MORTALITY OF QUEBEC CHRYSOTILE WORKERS

IN RELATION TO

RADIOLOGICAL FINDINGS WHILE STILL EMPLOYED

Francis Douglas Kelly Liddell

Thesis submitted for the degree of

PhD

TUC Centenary Institute of Occupational Health

London School of Hygiene and Tropical Medicine

July 1978

A B S T R A C T

Two cohorts of Quebec chrysotile miners and millers were selected in order to study how radiological changes in asbestos workers predict mortality. *Cohort "A"* comprised 988 men, with dust exposure, smoking history, respiratory symptoms and lung function recorded in 1967-68, and six independent readings of an earlier chest radiograph; 130 men had died before 1976. *Cohort "B"* comprised all 4,559 men not in Cohort "A" who were born 1891 through 1920, with at least a month's employment and an x-ray; dust exposure, smoking history and a single x-ray reading were obtained. By the end of 1975, there had been 1,453 deaths in Cohort "B".

A high Relative Risk (RR) of *total mortality* was related to each radiographic feature, cigarette smoking, excessive dust exposure, and, in Cohort "A", dyspnoea and poorer function.

Death from *pneumoconiosis* was associated with small irregular parenchymal opacities, of profusion usually greater than 1/0, and with heavy dust exposure, but not with smoking.

Almost all who died from *chest cancer* had smoked cigarettes (very high RR), had been heavily exposed to asbestos (high RR), or both. About half their x-rays showed pneumoconiotic change. There was insufficient evidence to determine whether chest cancer was a complication of asbestosis or an independent reaction to asbestos exposure. Five of the six *mesothelioma* cases had positive but varied radiographic appearances.

The contribution of asbestos dust to some deaths attributed to *heart disease* was substantiated by high RRs for severe exposure, and for small parenchymal opacities; smokers, and the breathless, also had high risks.

Other neoplasms showed no consistent dust or x-ray patterns. RRs of deaths from some other causes were high for certain radiographic features. Not all these results can yet be explained.

The main findings validated the UICC/Cincinnati classification convincingly. Studies to permit generalization are recommended.

C O N T E N T S

Chapter 3

RADIOLOGICAL CLASSIFICATION

Chapter 4

QUEBEC CHRYSOTILE STUDIES I:
POPULATIONS AND MEASURES OF EXPOSURE

Chapter 5

QUEBEC CHRYSOTILE STUDIES II: FINDINGS

Chapter 6

QUEBEC CHRYSOTILE FINDINGS AND OTHERS COMPARED

Chapter 7

THESIS OBJECTIVES AND MATERIALS

Chapter 8

METHODS

Chapter 9

DESCRIPTION OF THE STUDY COHORTS

Chapter 10

FINDINGS I

Chapter 11

FINDINGS II

Chapter 12

FINDINGS III

Chapter 13

SUMMARY OF FINDINGS

Chapter 14

DISCUSSION, SYNTHESIS AND RECOMMENDATIONS

L I S T O F T A B L E S

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 11 (continued)

Chapter 12

Chapter 14

LIST OF FIGURES

Chapter 1

I N T R O D U C T I O N

The uses of asbestos, the "magic mineral" are stated to be innumerable, and certainly more than three thousand have been identified by Rosato (1959). The President of the Quebec Asbestos Mining Association called asbestos "a unique product, a natural material of great value providing characteristics which are found in no other product and which are of inestimable service" (Messel, 1978). Although these views are not disinterested, they are largely endorsed by unbiased experts. Thus, Gilson (1965) commented on the surprisingly diverse and expanding uses of asbestos, and that it had much to its credit, for example such products as incombustible buildings, fire-resistant bulkheads, fire-proof clothing, brake shoes and clutch plates, all affecting safety and health. Further, it allowed great savings in energy through its use for insulation.

World production of asbestos has grown steadily from a few tons a year just a century ago (50 tons were produced in Quebec in 1878) to nearly six million short tons in 1977 (Quebec Asbestos Mining Association, 1978), at a value of almost 2,000 million dollars. Although the bulk comes from Russia (44.8 per cent in 1977, all chrysotile), Canada (27.4 per cent, chrysotile) and South Africa (13.0 per cent, chrysotile, crocidolite and amosite), all countries make use of it.

Undoubtedly, asbestos is a most important mineral; but equally certainly it can have adverse effects on health. It has been known since the turn of the century to lead to pulmonary fibrosis, which in those days of extremely severe exposure was often rapidly fatal. Before this and other health hazards were officially recognized (in the 1930s in Britain), environmental hygiene for both production and manufacture was poor in the extreme. After implementation of the Asbestos Regulations 1931, concentrations of airborne dust were much reduced, but remained very high, by modern standards, both here and in the mines and mills which produce asbestos. However, even in such conditions, the deleterious effects on the health of those exposed to asbestos dust are not usually manifest for many years. Thus, studies over the last quarter of a century, which have shown excess mortality and morbidity in asbestos workers, and which have aroused great concern about hygiene standards, have been examining responses to past doses which, in most parts of the world, would be unthinkably high today.

Nevertheless, it remains essential to make the most thorough possible epidemiological investigations of health in relation to asbestos exposure. These are, indeed, aided by knowledge of severe historical exposures, although interpolation of fitted dose-response relationships within the region of present day exposures is of great difficulty. Further, although concerns about the health of asbestos workers have led to attempts to develop substitutes, there is little likelihood of complete replacement of asbestos for many years. Nor are substitutes necessarily the answer; it may be that the properties needed to mimic those of asbestos are themselves fibrogenic or carci-

nogenic.

There are known to be interrelationships between all the responses to exposure, and many of the responses exhibit dose-response relationships, although these differ markedly from one fibre type to another. However, little is known as to the sequence in which the various signs and symptoms manifest themselves; nor has there been any reliable evidence on how any particular sign, symptom or combination can predict mortality. Radiological changes can, since 1967, be categorized into a classification of the pneumoconioses which was devised with particular reference to asbestos, the appearances of which could not be adequately recorded in earlier classifications. The irregular small opacities in the lung parenchyma and the pleural changes that are often observed in the x-ray films of asbestos workers, but comparatively seldom in others, can therefore be taken as reasonably specific to asbestos exposure, and thus might be expected to be better than other signs in indicating state of asbestos-related disease and so of predicting mortality in populations of asbestos workers.

The broad objective of this research was to determine the extent to which radiographic changes could predict mortality in persons who had been exposed to asbestos. Should prediction turn out to be good, it would serve as the best possible validation of the radiological classification. Further, light might be cast on the value of radiology in the surveillance of a working population. When the research reported here was already well advanced, a meeting of x-ray readers from six countries, at an important symposium on asbestos in Johannesburg (Glen, 1978), agreed that research on morbidity and mortality

associated with x-ray abnormality was "crucial", because "the importance of radiology depends on its ability to predict illness and death, rather than on its sensitivity to asbestos exposure" (Irwig, 1978).

This thesis is organized in a further thirteen chapters, of which the first considers the history, forms, uses and consumption of asbestos, and its health effects. Chapter 3 discusses radiological classification, tracing development from 1930 to the latest international classification, i.e. the ILO U/C (1971) international classification of radiographs of the pneumoconioses. Full details are given of the U/C classification agreed to in 1967; this, the basis of the ILO U/C (1971) classification, was used for the film reading essential to this research. The next two chapters are concerned with the health of Quebec chrysotile miners and millers, by far the largest group exposed to a single fibre to have been investigated: Chapter 4 describes the populations and measures of exposure defined and studied by Professor J. Corbett McDonald and his colleagues (including the author) at McGill University; the findings from these studies are reviewed in Chapter 5. The following chapter examines findings from many diverse investigations in the context of those from McGill; particular attention is paid to (a) the relationships between dose (exposure to asbestos dust) and response (lung cancer mortality) and (b) the interaction between asbestos and smoking in carcinogenesis.

Chapter 7 details the thesis objectives, and the materials used in the research, and Chapter 8 discusses methodology, in both general and specific terms. The study populations are described fully in

Chapter 9, and the findings are presented in the following chapters.

Discussion, synthesis and recommendations are in Chapter 14, followed by statements on originality and acknowledgements. The leading data are given in a 350-page Annex which is bound as Volume 2 of the thesis.

Chapter 2

A S B E S T O S : F O R M S , U S E S A N D H E A L T H E F F E C T S

2.1 Introduction

According to Friedrichsen (1963), the word *asbestos* is from the Latin *absestus* itself from the Greek *a-* (not) with *sbestos* (quenchable). It was certainly in English use by the early 18th Century, and has commonly been employed as a collective term for a wide variety of minerals composed of silicates of magnesium and iron.

The fire-resistant properties of asbestos were known to the ancient Romans, as is clear from the account by Herodotus, in 450 B.C. (quoted by Hunter, 1975, p. 972), of its use in the enshrouding of corpses before cremation to facilitate collection of ashes for burial. This may be the reason for another Latin word for the mineral, *amiant(h)us (cf.* the French *amiante),* literally without miasma, or undefiled, incorruptible. Several classical writers appeared to have been referring to one of the asbestiform minerals, particularly in its use for lamp wicks; the flames of ancient temple lamps were kept replenished with oil so that they would never be extinguished, and this is thought to be the origin of the term unquenchable. These early uses must have involved spinning and weaving, and there is some evidence that cloth made with a mixture of asbestos and vegetable fibre was

used to deaden the sounds of tree-felling in Roman times. Thereafter, there were occasional references to asbestos, for example by Marco Polo (around 1250 A.D.), by Dr. Robert Plot (in 1686) and by Benjamin Franklin (in 1725), this last probably being to asbestos from Quebec (*Asbestos*, 1970; Zussman, 1972). However, much the earliest reported use was in Finland, described by Dr. L. Noro and by Dr. R. Kiviluoto (quoted by Gilson, 1965); Seaton (1975) states that fibres of the indigenous Finnish type of asbestos have been found in the clay of pots made in Finland four thousand years ago, having been added presumably to strengthen the final article.

2.2 Forms and supplies of asbestos

Asbestos has been defined variously. Statements by Hendry and Gaze, at the 1964 Conference on Biological Effects of Asbestos held by the New York Academy of Sciences, that the word asbestos was "a broad term embracing a number of fibrous mineral silicates that differ in chemical composition" and that it was "used to describe any mineral that breaks down into fibres when it is crushed or processed" were echoed by Zussman (1972) who wrote that asbestos was the name for "a mineral which is made up of fine fibres and which is resistant to high temperatures". However, in a 1970 publication, *Asbestos* magazine stated that the term "is not the name of a distinct mineral species but is a commercial term applied to fibrous varieties of several minerals differing widely in chemical composition, the fibres being diverse in length, strength, flexibility and consequent usefulness". More recently, in a report (Ward, 1977) of the International Agency for Research on Cancer (IARC) Working Group on the Evaluation of the Carcinogenic Risks of Chemicals to Man: Asbestos, the use of asbestos

as a generic term is confirmed, but it is also stated that current usage of the term is restricted to six specific naturally-occurring mineral silicate fibres. In fact, commercial use is almost entirely of only four of these fibres: chrysotile, crocidolite, amosite and anthophyllite.

Asbestos is so invaluable because it is made up of fine fibres which are flexible, of great tensile strength, and resistant to high temperatures; they provide good accustic, electrical and thermal insulation and, to varying degrees, resist corrosion (Zussman, 1972). The three or four commercially important types of asbestos differ in physical properties and in chemical composition and in their health effects.

Chrysotile, or white asbestos, makes up the bulk of world production and use, about nine-tenths in 1977. The fibres are fine, highly flexible and have good heat resistance, while the long fibres can be spun easily into textiles (*Asbestos*, 1970); Hendry (1965) adds to these properties tensile strength, absorption and filtration, stating that in combination they place chrysotile in a class by itself as a mineral of "unparalleled properties". This form of asbestos is a mineral of the so-called serpentine group, and contains mainly magnesium oxide in addition to silica. Most of it is produced in Russia and Canada, but Ward (1977) mentions half-a-dozen other countries where comparatively small deposits are exploited.

Crocidolite, or blue asbestos, and *amosite* are both of the amphibole group of minerals, which are more brittle and of harsher texture

than serpentine fibres; their main chemical constituents in addition to silica are ferrous and ferric oxides. These forms of asbestos now come only from South Africa, although small amounts of crocidolite used to be mined in Australia and Bolivia, while India is about to produce a fibre very similar to amosite (which is a name based on the initial letters of the Asbestos Mine of South Africa where it was first mined) to be called "mysorite" (Ward, 1977). *Anthophyllite* is another amphibole, which used to be produced and used almost exclusively in Finland; according to Ward (1977), production in Finland ceased in 1974. In this form of asbestos there is more silica than in chrysotile, less magnesium oxide and more ferrous oxide.

The modern asbestos industry dates from the discovery in the 1870s of large deposits of fibre in Quebec and Russia (Bogovski *et al.*, 1973, p. xiii); the Canadian and Russian form of asbestos is chrysotile. Slightly later came the commercial exploitation of the three amphibole fibres, crocidolite, amosite and anthophyllite. The Quebec Asbestos Mining Association (QAMA, 1978a) has kindly provided annual figures of asbestos shipments from 1878 (50 short tons) to 1977 (1,289 thousand short tons). Production in Quebec for each decade of the hundred years' existence of this industry, in millions of short tons, was:-

1878-87	0.015	1928-37	2.345
1888-97	0.101	1938-47	4.492
1898-1907	0.490	1948-57	8.771
1908-17	1.267	1958-67	11.449
1918-27	2.075	1968-77	13.399

Quebec has always produced the vast bulk of Canadian asbestos (82.1 per cent of the total production in Canada of 16.311 million short tons in the decade 1968-77). The other provinces that produce asbestos, all chrysotile, are the Yukon territories (109.2 thousand short tons in 1977), British Columbia (103.5 thousand tons), Newfoundland (71.2 thousand tons) and Ontario (16.4 thousand tons). Until recently, Quebec also produced the bulk of the world's total supplies; according to the IARC Working Party on the Evaluation of the Carcinogenic Risk of Chemicals to Man: Asbestos (Ward, 1977), who had to assemble data from several sources, Canada's share of world production was 45 per cent in 1960. However, this share had fallen to 29 per cent in 1976 (Ward, 1977) and was 27.4 per cent in 1977; Quebec's share in 1977 was 22.3 per cent (QAMA, 1978b). The USSR is now the main producer of asbestos, having increased its share of world production from 29 per cent in 1960 to 44 per cent in 1976 (Ward, 1977); in 1977, Russia produced 2,596 thousand short tons, all chrysotile, 44.8 per cent of the total, 5,790 thousand short tons (QAMA, 1978b).

It is difficult to obtain a direct statement of how much of each fibre is produced, but it seems that crocidolite and amosite are nowadays mined only in South Africa, which in 1977 produced 750 thousand short tons of all forms of asbestos, while anthophyllite production in Finland ceased in 1974 (Ward, 1977; QAMA, 1978b). As about nine-tenths of the current South African labour force produce amphibole (Gibbs and DuToit, 1978), the proportion of chrysotile in the grand total must be close to ninety per cent. The countries that mined chrysotile in 1977 were, in addition to Russia and Canada, China (220 thousand short tons), Cyprus and Italy (a total of 330 thousand tons),

with the USA, South America, Australia and "other countries" accounting for 105, 80, 75 and 45 thousand short tons, respectively (QAMA, 1978b). Small amounts of fibre have been produced in the past in Corsica (chrysotile) and in Australia and Bolivia (crocidolite); some limited amounts of another asbestiform mineral, tremolite, have been mined in the USA and the Far East (Ward, 1977).

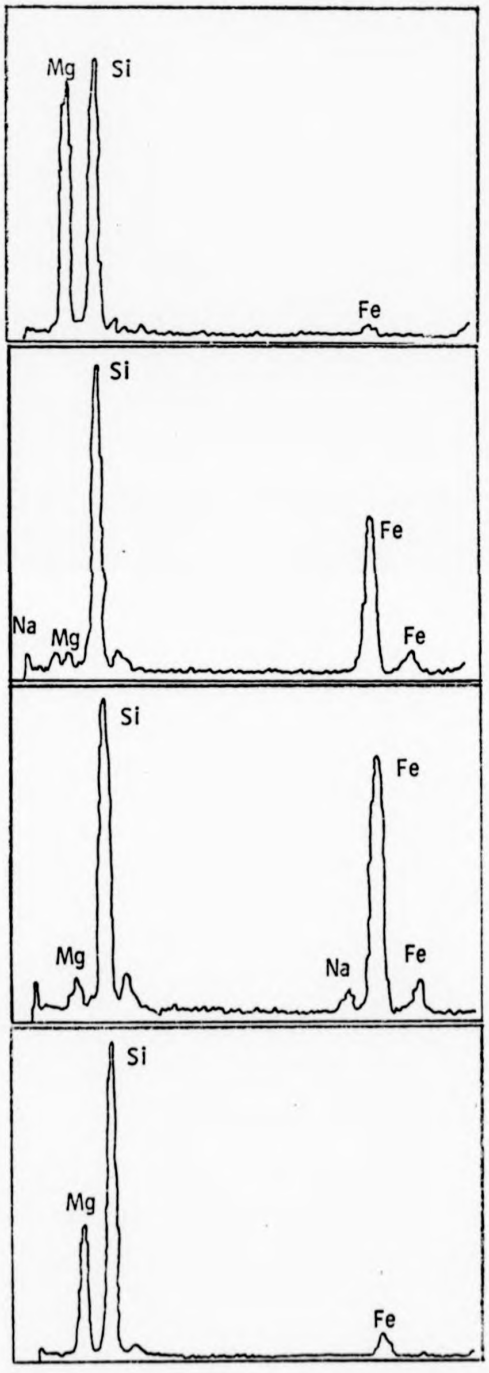
The four main types of asbestos fibre differ greatly in their chemical composition, as shown in the x-ray spectra (after Dr. Fred Pooley) in Figure 2.1, which are in close conformity with the analyses given by Gaze (1965). All types of fibre contain silica (Si), but there is less in chrysotile (40 per cent) than in the amphiboles (around 50 per cent in crocidolite and amosite; 57 per cent in anthophyllite). The main constituent of chrysotile is 42 per cent of magnesium oxide (MgO), but that forms only a small part of crocidolite (1 per cent) and amosite (6 per cent), although up to 29 per cent in anthophyllite. On the other hand, iron is scarce in chrysotile, ferrous oxide (FeO) and ferric oxide (Fe_2O_3) totalling less than 3 per cent, but common in the South African amphiboles (around 40 per cent) and intermediate in anthophyllite. Water of crystallization is 14 per cent of chrysotile but only 2 per cent of the amphiboles.

2.3 Uses of asbestos

At least three thousand uses of asbestos have been identified (Rosato, 1959); a short list of over 150 is given by *Asbestos* (1970). Raw asbestos is used for the "rovings" from which all spun and woven textiles are made; in felts, paper, millboard and wall board; for reinforcement of cement products; for thermal, electrical and acoustic

Figure 2.1

X-RAY SPECTRA



insulation; for friction materials and filtration media; for fire-proofing and other protective clothing. Asbestos yarn is used for cloth, electrical tape, brake linings, clutch facings, gaskets, rope, twine, sewing thread, wicks, etc. The cloth woven from asbestos has many uses, not least because of its strength - clothing, draperies, mailbags, ironing boards, for example. Asbestos millboard, being fireproof, has a large number of applications in industry and building; here, too, asbestos-cement sheets, flat and corrugated, and asbestos-cement wall boards are popular. Asbestos-cement pipe is used for flues and chimneys in the home and elsewhere, and for high and low pressure systems.

Since the introduction of asbestos into the Paris Mētro (1903) to prevent the repetition of a disastrous fire, and particularly in the interior of RMS Queen Mary (1932) to prevent the spread of any possible fire, its pre-eminence as a fire-resistant material has been recognized. It is used for firefighters' suits, helmets, ropes and sheets. With the introduction (1912) of a method of constructing seamless asbestos-cement pipes, such pipes have been very widely used for a multitude of purposes, and asbestos itself is used for jointing and lagging steam pipes, etc, and for many other forms of heat insulation. It can be exploited in the form of building materials such as tiles - for roof or floor - and even linoleum, for cements and cement sheets, and for fireproof panels, including theatre safety curtains. Because it is acid-resistant, asbestos is used for filter cloths, linings for certain chemical vessels, valve packings and gaskets. Re-inforced with wire threads, asbestos is the major ingredient of brake linings and clutch facings. On top of these largely industrial uses, asbestos

has many domestic applications, for example in ironing boards, oven cloths, cooking mats, and other kitchen materials. Finally, it has been a favourite material in the "Do-It-Yourself" market.

Although about ninety per cent of asbestos usage is of chrysotile, the other forms have often been specified for particular purposes. One set of examples is given in an important section of the doctoral thesis of Surgeon Commander P. G. Harries (1971). Until 1950, the Admiralty specified crocidolite for certain materials used in the insulation of machinery in steam-propelled warships. With higher steam temperatures after 1950, large pipe sections, almost wholly of amosite fibre, were tried but found less efficient than had been expected. More recently, pipe lagging has been with calcium silicate bound by amosite, the binder amounting to 12 per cent of the material. Further, until the late 1950s, insulation of steel decks and hull was mainly with crocidolite. One other specified use of crocidolite was for the filter pads in service gas masks in World War II, while chrysotile was used for civilian masks (Jones *et al.*, 1976; McDonald and McDonald, 1978; Dr. J. C. Gilson, personal communication).

Perhaps the most important present-day use of asbestos is in cement products, and particularly for asbestos-cement pipes. Here, fast drying is essential in manufacture, especially for the pipes of largest diameter, and this process is greatly accelerated by a mixture of about one-sixth of crocidolite; see below. Certain other processes have been devised for specific amphibole fibres and cannot easily be adapted to the exclusive use of chrysotile.

The IARC Working Group (Ward, 1977, quoting Clifton, 1974) gives the following distribution of asbestos use, by type, in the USA for 1974 *(sic)*:-

Chrysotile	720.8 million kg	94.5 per cent
Crocidolite	33.8 "	4.4 "
Amosite	8.4 "	1.1 "
Anthophyllite	1.0 "	0.1 "
	763	100

Most of the crocidolite (33 million kg) was used for asbestos-cement pipes, but accounted for only one sixth of the asbestos used for this product. The amosite was used mainly for asbestos-cement sheet (3.9 million kg), thermal insulation (1.6 million kg) and roofing products (1.5 million kg), but chrysotile was still the most commonly used fibre for these products, accounting for 95.3, 82.5 and 98.5 per cent, respectively, of the asbestos in each. QAMA (1978b) provide approximate fibre content in various products, as follows:-

Asbestos cloth and yarn	85-90	per cent by weight
Asbestos papers (felts)	80-90	" "
Asbestos water-proofing and anti-leak joints	50-70	" "
Woven friction material	70	" "
Moulded friction material	50-60	" "
Asbestos pipes	16	" "
Asbestos finished sheets	10-15	" "
Asbestos-vinyl tiles	8-14	" "

2.4 Geology and exploitation

Zussman (1972) concluded his article on the nature and history of asbestos with the statement that: "Even after many decades of research, the mode of growth of natural asbestos fibres remains largely a matter of conjecture". Certainly, the geology of the asbestos-bearing rocks and their overburden is too complex to fall within the scope of this thesis. However, a few facts are given below, taken from a 32-page guide to the geology of the mining region of South-Eastern Quebec, with more than a dozen maps, and many references (QAMA, 1972). The Quebec deposits of chrysotile lie in a belt a few miles wide and about 120 miles long. Chrysotile occurs mainly as cross fibre, but also as slip fibre and mass fibre. "Cross fibre occurs in veins with fibres occupying a position somewhere between normal and sharply oblique to the vein walls, whereas slip fibre is a stress mineral occurring as a coating on slip planes and orientated parallel to the direction of slip. Mass fibre is present in the ore of a few mines as aggregates of unoriented or semi-oriented leaves or bundles of chrysotile. At some locations the rocks have been completely or nearly converted into mass fibre." At Asbestos, Quebec, there is one mine (and a small factory), which has been in operation since 1881, producing mainly cross fibre but some mass fibre from rock that may contain as much as 50 per cent chrysotile. The present rating of this mine is 600 thousand tons of fibre a year. In the Thetford Mines area, there are presently four mines; deposits are made up principally of cross fibre, but an appreciable amount of slip fibre ore is being recovered. At one location, there were three deposits, one now worked out, one in production and the third not started. "Although difficult to explain, one interesting aspect of the fibre quality ... is the increasing

'softness' of the fibre with depth ... " Finally, much of the host rock is itself "serpentized".

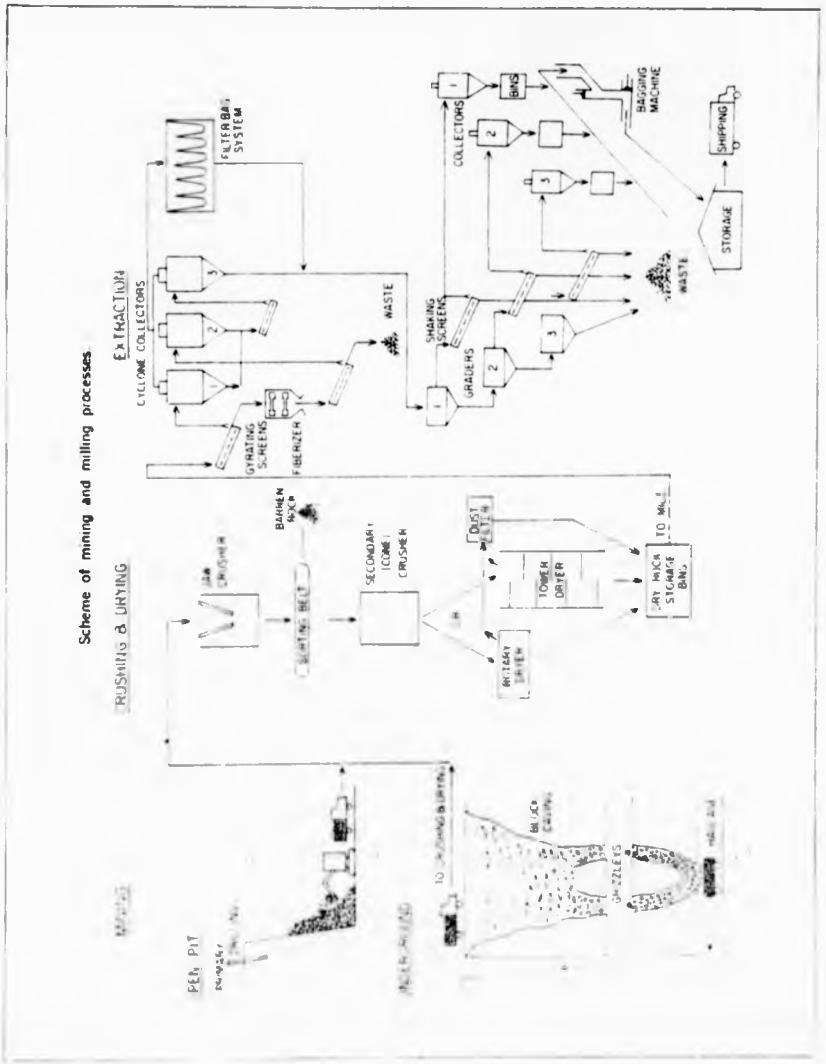
Ore, whether from an open pit or underground mine, often contains less than ten per cent asbestos, with ninety per cent or more waste rock. At the mine in Asbestos, Quebec, fifteen tons of ore are crushed to produce a ton of commercially disposable asbestos, but the total material moved is more than 60 tons (QAMA, 1972, p. 19). The ore is fed first to ore preparation plants, where it is crushed and separated. The larger fraction is further sorted by hand, but the smaller is first dried and then passed to mills in which operations are carried out in cycles of crushing, screening and then lifting by air (Lincoln, 1972). Figure 2.2, taken from Gibbs and Lachance (1972), gives a schematic illustration of the process, in principle.

2.5 Dust exposure and inhalation

Thus, milling is essentially a dusty operation, in which suppressive measures relying on wetting have not so far proved feasible. Mining, contrary to some expectations, is generally less dusty (Gibbs and Lachance, 1972). However, many jobs involving the handling of asbestos or asbestos products were, until quite recently, very dusty. Up to about 1950, baggers in the Quebec mills were exposed to concentrations of over 200 million (respirable) particles per cubic foot (of air), or 200 mpcf, and at that time the average concentration to which millers were exposed was approximately 75 mpcf (Gibbs and Lachance, 1972). In naval dockyards, many of the various processes involving asbestos were very dusty, and Harries (1971, p. 30) stated that "men are described as emerging from the compartments covered from head to

Figure 2.2

SCHEME OF MINING AND MILLING PROCESSES



foot in dust", and also that "although most of the fibre was blue, amosite fibre was used occasionally and was disliked because it was more dusty". In textile factories, carding has always been particularly dusty: Knox *et al.* (1968), reporting on a factory in Rochdale at which "steps [had been] taken to reduce exposure ... since the introduction of the Asbestos Industry Regulations in 1931", quoted yearly mean dust levels as high as 32 mpcf as late as 1952. Enterline *et al.* (1972b) reported historic dust levels (i.e. before 1947) in an American asbestos plant, in New Jersey, "in excess of 50 mpcf".

These figures of dust concentrations are, of course, meaningless in isolation - this matter is discussed in a later chapter - and, because they had been obtained by different technologies, they are not on a comparable basis. However, what is clear is that dust concentrations were, in each of the cases cited above, about two orders of magnitude worse than levels in the early 1970s, although these levels themselves were still much higher than today's "standards". The 1931 Regulations referred to by Knox and his colleagues will be mentioned later; at this point, it is only necessary to point out that they introduced dust suppressive measures in 1933. Thus, before that date dust concentrations were surely at least another order of magnitude worse than in the 1950s. Newhouse (1973a) cites anecdotal evidence to this effect in British factories, and Gibbs and Lachance (1972) corresponding evidence concerning Quebec mines and mills.

Such an insult to the lungs might well be expected to cause severe disease. Indeed, in *De Re Metallica*, published in 1556, Agricola (1494-1555) commented " ... the dust, which is stirred and

beaten up by digging, penetrates into the windpipe and lungs, and produces difficulty in breathing and the disease which the Greeks called asthma". Hunter (1975), who quotes this comment on p. 27, later (p. 918) added "It was here [Joachimsthal, in Bohemia] that Agricola strongly advocated the ventilation of mines, for he knew that dust entering the lungs caused disease associated with dyspnoea, and he spoke of corrosive dusts which ulcerated the lungs, producing consumption." Hunter (p. 27) considers Agricola's accounts of miners' ailments as rambling and without precision, and that the idea of diseases specifically caused by particular occupations had not in Agricola's day been conceived. Hunter believes that the conditions being described more than 400 years ago probably included silicosis, tuberculosis and lung cancer. Nevertheless, it would appear that Agricola was the first to recognize a "pneumoconiosis", albeit in hard-rock miners extracting gold and silver.

This term, coined as "pneumonokoniosis" by Zenker in 1876, is another collective noun, meaning literally lung-dust-condition, or better a health effect arising from the inhalation of dust. VanOrdstrand (1977) lists some 26 pneumoconioses, providing a personal classification into (A) the benign, (B) those that are usually reversible and (C) those which may be disabling and even fatal. It is unlikely that this grouping would be generally accepted by those working in this field, but there is little doubt that *asbestosis* may indeed be disabling and may lead to premature death; see below.

However, before reviewing the effects on health of the inhalation of dust, it is necessary to consider what happens to the dust itself.

This is a matter of great complexity, which has been the subject of theoretical and experimental investigations since the 1930s, but about which knowledge is still not complete. Reliance has to be placed on morphological and pathological evidence, which can, of course, be quite misleading. Experiments in man may be not only dangerous but unrewarding, because the present concern should be to examine in what *practical* circumstances particular amounts of fibre are retained in the lung and how these amounts differ and, even more difficult, why. For the present purposes, a very simplified statement must suffice: it is based on the following references:- McDonald, Gibbs *et al.* (1972); Muir (1972); Timbrell (1973); and Morgan (1975).

There appear to be two generally agreed facts. First, only those particles or fibres less than about ten micro-metres (μm) enter the respiratory system, and most of the larger even of this size are trapped in the nose or the upper regions of the main respiratory tract. It is also likely that the curly fibres of chrysotile have greater difficulty in penetrating deeply, because of interception in the branching respiratory passages, than the more rectilinear fibres of the amphiboles. Further, dust deposition is a complex process, involving sedimentation, inertial impaction and diffusion, each element of which depends on the sizes, shapes and density of the particulate matter, its concentration, electric charges and growth of hygroscopic particles due to humidity, and to ambient temperature and humidity which may reach extremes in some occupational environments, particularly mining. Thus only the very fine fibres penetrate to the alveoli, and the shortest of these to the periphery. The second fact is that a

high proportion of those fibres or particles that do penetrate to the small air cells is eliminated by cilial action and mucous escalation, to be swallowed and excreted *via* the gastro-intestinal tract. This process of elimination is usually highly efficient, and indeed is thought to be improved when heavily loaded. However, it may not be able to cope with truly massive quantities of retained particulate matter. Further, the macrophages, which have to engulf the fibres before they are eliminated are incapable of dealing with long straight fibres, common in crocidolite, and particularly in amosite.

The amount of fibre retained in the lung is an extremely small proportion of that inhaled, and that proportion may well vary, not only because of differences in factors already discussed, but also with factors of human variation. Such factors may be physiological or immunological; they may be altered by smoking habit or by respiratory disease, either acute or chronic; and they almost certainly include differences in breathing patterns, through nose or mouth, and in rate and depth of breathing dependent on physical effort.

Chrysotile fibres are more soluble than amphiboles and this plays an important part in determining what proportions are retained for long periods. Retained chrysotile fibres may break up into even smaller "fibrils", detected in the lung by electron microscopy *post mortem*. However, the fibres of crocidolite appear to retain their original form, and are often retained indefinitely, being easily recognized at autopsy. Retained fibres may migrate within the parenchyma, or to pleura or even peritoneum.

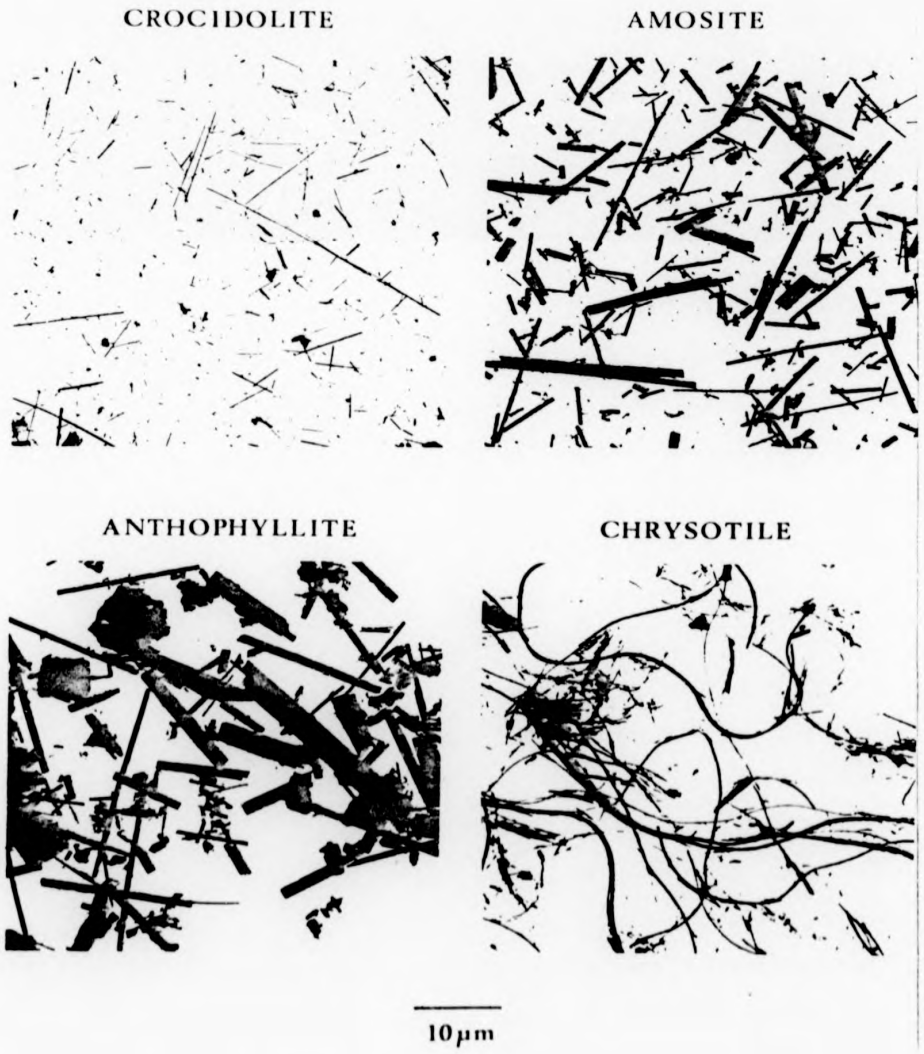
Figure 2.3 gives copies of electron micrographs of respirable fibres, taken from Timbrell (1973), who commented on the curly morphology of chrysotile fibres compared with the rectilinear shapes of the amphiboles, and that the diameters of crocidolite were of smaller order than those of anthophyllite, with amosite in between, and that this was a characteristic of such fibres from Cape Province, Finland and the Transvaal, i.e. whence all commercial supplies now come. He also emphasised the fragmentation of the chrysotile fibres, longitudinally, into fibrils of very small diameter, about 0.03 μm.

2.6 Pulmonary fibrosis; asbestosis

Those who have been heavily exposed to asbestos dust may develop asbestosis. Harries (1971, p. 11) reports Burton Wood's 1929 findings in 15 cases of asbestosis examined for symptoms, signs and x-ray changes. "The most important symptom was dyspnoea, which was progressive, and in the later stages of disease, extreme. Cough was often slight, and was a variable symptom. He noted a reduced chest expansion, cyanosis and finger clubbing often occurred. Dry crackling adventitious sounds were present, chiefly in the bases and superficially in the axillae. He thought the latter sound might have a pleural origin. The first patient described in the series is reported as having a vital capacity of 1,600 cc and this is the first report of a lung function test in asbestosis. The x-ray films were described, and Burton Wood mentioned that although some of the cases showed a 'ground glass' appearance over the lower zones, a fine mottling was seen on closer inspection. Basal pleurisy was seen in many films and also thickening of the apical pleural cap."

Figure 2.3

ELECTRON MICROGRAPHS OF ASBESTOS FIBRES



As a result of a report in 1928 of an asbestos worker with pulmonary fibrosis for which no occupational or infective cause, other than asbestos, could be found, Merewether and Price (1930) investigated, for the Factory Department of the Home Office, the effects of asbestos dust on the lungs (Harries, 1971, p. 11). They showed that, of 363 asbestos textile workers examined, 95 (over a quarter) had definite pulmonary fibrosis considered due to asbestos dust. These workers found a correlation between the incidence of fibrosis and the duration and intensity of dust exposure. Radiological examination of 133 workers revealed signs of diffuse fibrosis in 62 (nearly half), while radiological changes were suggestive in a further 25. Harries comments that radiographic technique was probably such as to lead to under-estimation of the prevalence of changes, but does not comment on how the workers subjected to x-ray examination were selected for this purpose. Merewether and Price found no particular tendency for respiratory tuberculosis to be present in the asbestos workers, with or without fibrosis.

The report of Merewether and Price suggested not only a dose-response relationship, but also that the interval between start of exposure and development of definite disease depended on the dust concentration. The latent period was as short as seven years in continuous high exposure, but could be as long as 25 years in lower concentrations. It was clear that dust suppression was needed if the disease was to be prevented. Merewether and Price further reviewed the dust concentrations in the various asbestos textile processes and made recommendations as to suitable methods of dust suppressive measures. It was these measures that formed the basis of the Asbestos Industry

Regulations 1931, in the United Kingdom. These were not implemented until 1933, but they included periodic medical supervision of persons working in certain prescribed asbestos occupations, while asbestosis was recognized as a condition covered by the Workmen's Compensation Acts.

The earliest studies of asbestos-related disease in the United States appear to have taken place in the mid-1930s, as described by Ayer *et al.* (1965), and a Threshold Limit Value was set "many years ago", according to Schall writing in 1964, by the American Conference of Government Industrial Hygienists, based on the findings of Dreessen *et al.* (1938). This standard was endorsed by the ACGIH in 1964, although Schall (1965) had some severe criticisms of it.

2.7 Diagnosis of asbestosis

Although it is nearly fifty years since these findings were presented, there is still no generally agreed definition of asbestosis. This is despite the introduction of a new international classification of radiographs of the pneumoconioses (to be discussed fully in a later chapter), which was prepared over the years 1966-71 with asbestosis well in mind; it had not been considered in the earlier ILO classifications. In 1971, Harries (p. 24) commented that there was disagreement over the presence and significance of the various symptoms and signs, including the radiological and lung function changes; in particular, the importance of pleural changes was not generally agreed. Harries felt that the most acceptable consensus of opinion was that asbestosis is a *progressive* pulmonary fibrosis resulting from exposure to asbestos dust, accompanied by fibrotic changes in the pleura which

may develop areas of calcification. He went on to state that little advance had been made in the matter of *early* diagnosis of asbestosis, pointing out that it still required intelligent assessment of all the relevant data. Lewinsohn (1977) stated that "asbestosis is still the *earliest* lung disease resulting from exposure to [asbestos] and its incidence in an exposed population is the most useful indicator of the degree of dust control exercised over a period of time". These views are not entirely compatible; the use of the terms "progressive" and "earliest" suggest different attitudes towards the condition. (The italics in this paragraph and the next are mine.)

Lewinsohn (1977) also stated that, for him, "the diagnosis [of asbestosis] depends upon: (1) An adequate occupational exposure history. (2) Physical signs of pulmonary fibrosis. (3) *Progressive* radiological changes. (4) Confirmatory measurements of altered lung function". The physical signs he was referring to were basal rales and finger clubbing, and he well recognized the subjectivity of their assessment. He made the point that the presence of asbestos bodies and fibres in sputum were of little importance in that they could only confirm exposure, which should already have been ascertained as part of the history. It was, of course, essential that the history should include all exposure, including any that may have occurred during, for example, home repairs. Lewinsohn did not explain what he meant by "progressive" x-ray changes. Further, his emphasis on the confirmatory nature of altered lung function is not echoed by all other workers. Thus, Keatinge (1973), reviewing the work of Ghezzi *et al.* (1972), stated that "even in the absence of radiographic changes, clinical examination and lung function tests will provide enough evidence to

demonstrate that the patient has been exposed to asbestos in the past". In this context, the evidence, concerning a specific patient, is required presumably for purposes such as compensation.

2.8 Is asbestosis progressive?

As to the presumed progressive nature of asbestosis, Gilson (1973) reported to the Working Conference held at the IARC, Lyon, that little progress had been achieved in the investigation of the effects of the removal from further exposure to asbestos dust. It had been one of the recommendations of the Union Internationale contre le Cancer (UICC) Working Group in 1964 that it was important to establish the subsequent morbidity and mortality from asbestosis, and the mortality from cancers associated with exposure to asbestos, in population groups no longer exposed to the dust. As a first step, Professor McDonald's team at McGill University assembled a group of 86 ex-employees of the Quebec chrysotile production industry; they were men born in the years 1901 through 1920 who had left the industry in the period 1950-61 and had been x-rayed before leaving. These men were x-rayed again in 1972, and seven separate assessments were made of the film pairs, all by experienced readers. Parenchymal change was recorded in at least four assessments for eight of the 66 men who had had substantial exposure before leaving, but for none of the 20 with only slight exposure. It was concluded (Becklake *et al.*, 1978) that the parenchymal changes observed after leaving the industry were attributable to the earlier occupational exposure to chrysotile; these changes were mainly in the nature of "attacks" rather than "progression". Pleural change was recorded for 15 of the 66 with heavier exposure and for 4 of the other 20, very similar proportions.

2.9 Asbestosis and mortality

Although there are still problems over definitions and whether or not asbestosis is essentially progressive, it remains clear that in those who have been heavily exposed to asbestos dust, there may be respiratory symptoms (usually breathlessness, first only on exercise, and later more severe, even seriously disabling), impaired lung function (particularly reduced Forced Vital Capacity, or FVC, and transfer factor), basal rales, finger clubbing, and changes on the chest roentgenogram; one, several or all of these signs and symptoms may be present, but there are also many heavily exposed workers who show none of them. X-ray changes include nowadays many that were incorporated into the international classification for the first time in 1968, and incorporated into the ILO U/C (1971) classification when this eventually appeared.

Asbestosis can undoubtedly lead to premature death. Indeed, the first description of the disease process, in 1906 by Dr. Montague Murray at the Charing Cross Hospital in London, was in an asbestos textile worker, with incapacitating breathlessness, but few other physical signs, who died at the age of 33; at autopsy, there was widespread pulmonary fibrosis, with no evidence of tuberculosis, together with marked pleuritic adhesions. "This patient was the sole survivor of 10 men working in the carding room when he commenced work [there]; the others had all died about the age of thirty" (Harries, 1971, p. 11). The second *post mortem* to direct attention to the possibility that silicates might cause extensive fibrosis was not until 1924, when Cooke demonstrated what have come to be called "asbestos bodies" in the lungs of a young tuberculous female textile worker (McVittie, 1965).

Three years later, according to McVittie, "a whole new literature relating to asbestos appeared in Britain", and in 1933, Merewether (cited by Harries, 1971, p. 13), while pointing out the difficulty of making the diagnosis of asbestosis, noted its insidiousness and reported the average age of death for men with asbestosis as 40.8 years, compared with 54.1 years for those with silicosis. Of the 100 men with asbestosis discovered in a Home Office enquiry in 1928, seventeen had died, ten with asbestosis, six from asbestosis with tuberculosis and one with asbestosis and carcinoma of the pancreas.

2.10 Lung cancer

Primary carcinoma of the lung has often been recorded in asbestos workers, frequently in association with pulmonary asbestosis. For example, Doll (1955) concluded that the average risk of cancer of the lung in workers who had been exposed to asbestos dust for twenty years or more was of the order of ten times that experienced by the general population. Although Braun and Truan (1958) criticised Doll's findings and "found no unusual risk to asbestos miners in the province of Quebec", their own conclusion was hardly justified; see below. Again, McCullogh in 1959 reported lung cancer in 65 out of 365 deaths (18 per cent) during 1924-55 in which *post mortem* had confirmed the presence of asbestosis (Harries, 1971).

McDonald (1973) reviewed cancer in chrysotile mines and mills, pointing out that Braun and Truan (1958; just referred to) had observed at least nine lung cancer deaths within a specified cohort, compared with six expected from Provincial rates. McDonald also referred to the findings of Kogan *et al.* (1966) in a ten-year study of

mine and mill workers from Sverdlovsk, a large Russian city on the eastern edge of the Ural mountains and fairly close to the world's most extensive chrysotile deposits, at Asbest: although materials and methods were not fully described, it was reported that mortality from lung cancer was increased by factors of 1.9, 2.3 and 3.1 for miners, factory workers and millers, respectively. The investigation of mortality in the Quebec chrysotile mines and mills carried out by McDonald and his colleagues has been reported *seriatim* (McDonald *et al.*, 1971; 1973; 1974; Liddell, McDonald and Thomas, 1977; McDonald and Liddell, 1978; and in preparation, but cited here as McDonald *et al.*, 1979). From the start, excess lung cancer mortality has been shown among the male workers. This study is particularly important because of its size (now 4,500 deaths in a defined cohort of nearly 11,000 men - and 440 women), because of the "purity" of the exposure, because it includes workers with very little exposure as well as those with heavy exposures, and because quantitative estimates of dust concentrations have been made. There appears to be a clear relationship between excess lung cancer mortality and total dust exposure.

An important co-carcinogen is, of course, cigarette smoke. The latest report by McDonald *et al.* (1979) will show that the data fit quite well a multiplicative model of risks, in which the two agents (asbestos dust and cigarette smoke) act in such a way that " ... addition of the second agent produces an effect which is proportional to the effect of the first. If smoking alone increases the natural incidence of lung cancer, say, 10 times (i.e. the relative risk due to smoking alone is 10) and asbestos alone increases it three times, the lung cancer incidence in those exposed to both asbestos and smoking

will be equal to 10 x 3 = 30 times the natural incidence". This quotation is from Saracci (1977), who was analysing the epidemiological evidence on the asbestos-smoking interaction, and concluded that this model stood as the most plausible interpretation of the interaction. The data from Quebec (not available to Saracci) suggest that exposure *for 50 years* to concentrations averaging one mpcf are roughly equivalent in their effect of generating lung cancer to the smoking of three cigarettes *a week* (McDonald and Liddell, 1978).

There have now been many investigations among other groups of workers, in all of which excess lung cancer mortality has been observed in comparison with expectations based on national, state or similar reference populations. There appears little doubt that all forms of asbestos can produce not only fibrosis but also lung cancer. However, Wagner *et al.* (1971), reviewing the epidemiology of asbestos cancers, stated that "The epidemiological evidence suggests that the use of chrysotile asbestos with efficient suppression carries only a small risk. The use of crocidolite should be avoided wherever possible. The position of amosite is probably intermediate, but dust control should be at at high standard". Enterline and Henderson (1973) were a little sceptical, although their own review tended to support the gradient in carcinogenicity indicated by Wagner and his colleagues. Further confirmation comes from a study by Weiss (1977).

Because the importance of fibre type cannot be overemphasised, an up-to-date review of the evidence on relationships between dose of asbestos dust and response in the form of lung cancer mortality is given in Chapter 6.

2.11 Mesothelioma

Although first suggested only in 1960, by Dr. J. C. Wagner and his colleagues, in South Africa, it is now generally accepted that asbestos dust can cause mesothelioma, i.e. malignant mesothelial tumours of pleura or peritoneum. This is an extremely rare tumour with an incidence around two per million population each year in many countries of the world (McDonald and McDonald, 1977). However, the incidence is often higher in cities with dockyards, and higher still in working populations exposed to asbestos. Important excesses occur in Turkey, particularly in two villages in central Anatolia, Karain and Tuzköy, where Baris *et al.* (1978) have reported extremely high incidence of mesothelioma, consistent with environmental exposure to a carcinogen since birth, although there are no asbestos deposits in the neighbourhood. Mineralogical studies have suggested that zeolite minerals may be the causative agents, and Pooley (1978) has shown that the zeolites near these villages, but not elsewhere in Anatolia, are of similar sizes and shapes as the fibres of crocidolite; see Figure 2.3.

McDonald and McDonald (1977) present proportional mortality rates for lung cancer and for mesothelioma from the main published cohort studies of male asbestos workers (Table 2.1). After allowance for differences in the general incidence of these diseases in the countries concerned, these authors commented as follows: "The findings for insulation workers, mainly obtained by Selikoff and his colleagues (1973), but supported by the studies of Elmes and Simpson (1971) in Belfast and Kleinfeld and others (1967) in New York State, were all very similar. Regardless of age, type of work or duration of observation period, about 20 per cent of deaths in insulation workers were

Occupational group	Location	Period	Deaths: all causes
Insulators			
All types	NY & NJ	1943-72	421
All types	US & Canada	1967-72	1,092
Construction	US & Canada	1967-72	446
Shipyards	US & Canada	1967-72	34
All types	NY	1945-65	46
All types	Belfast	1940-66	98
Asbestos factory			
Textiles	Rochdale	1916-67	125
Mixed products	London	1931-70	350
Mixed products	PA	1938-64	330
Mixed products	Cardiff	1936-62	133
Amosite insulation materials	NJ	1941-71	484
Mining and milling			
Chrysotile	Quebec	1936-73	3,749
Chrysotile	N. Italy	1932-70	270
Anthophyllite	Finland	1936-67	216
Talc & tremolite	NY	1940-65	91

Table 2.1

PROPORTIONAL MORTALITY FROM LUNG CANCER AND MESOTHELIOMA

(McDonald and McDonald, 1977, Table 12)

Per cent lung cancer	Per cent mesothelioma	Per cent pleural
20.0	7.6	25
19.5	7.1	34
17.7	5.2	43
26.5	8.8	66
21.7	6.5	33
24.5	7.1	57
17.6	3.2	100
20.6	6.9	38
10.6	2.4	0
8.3	0.8	100
15.1	1.4	43
5.7	0.2	100
2.2	0	-
9.7	0	-
9.9	2.2	50

caused by lung cancer and a third as many more by mesothelioma, predominantly of the peritoneum. The mortality of factory workers was more variable; the lung cancer ratios were generally lower and there were fewer mesotheliomas. The London factory investigated by Newhouse (1973b) which used chrysotile, crocidolite, and amosite seems to have fared worse than the predominantly chrysotile factories in Rochdale studied by Knox and others (1968), in Lancaster, Pennsylvania by Mancuso and El Attar (1967), and in Cardiff by Elwood and Cochrane (1964). The amosite plant in Paterson, New Jersey surveyed by Selikoff *et al.* (1973) occupied an intermediate position. In the asbestos production industry, experience was quite different, as shown by our own studies in Quebec and those of Ghezzi *et al.* (1972) in Northern Italy and also those of anthophyllite workers by Meurman *et al.* (1974) in Finland. In all these groups, lung cancer was a less frequent cause of death, and there were few pleural mesotheliomas and none of the peritoneum. This was in line with reports from Kogan *et al.* (1972) in the USSR of a similar moderate increase in lung cancer in the many thousand Russian chrysotile miners and millers, but no evidence of mesothelioma, though cases might have been missed."

Some more recent information follows. McDonald and his colleagues have discovered only eleven deaths due to mesothelioma among over 4,500 deaths in the years 1911-1975 in a defined cohort of more than 11,000 workers in the Quebec chrysotile production industry, some of whom were exposed very severely, with accumulated dust exposures amounting to over 4,000 mpcf.years, the equivalent of fifty years employment in dust concentrations averaging 80 mpcf. Of the eleven cases, one was a female known to have worked in a gas mask process -

see below - and a second was male employed only for a short time in the same factory at the relevant period. Of the other cases, all male, two were workers at Asbestos and seven at Thetford Mines, where dust concentrations were generally considerably higher that at Asbestos, and where men tended to be employed for longer periods. None of the cases had accumulated exposure greater than 1,000 mpcf.y, but there was some evidence of a dose-response relationship at Thetford Mines. Even here, the proportional mortality ratio (PMR), i.e. seven deaths from mesothelioma among a total of 2,284 deaths, was only 3.1 per thousand.

Selikoff and Hammond (1975) have recently updated three important series: 17,800 insulation workers in the USA and Canada, followed after at least twenty years since first exposure; 623 asbestos insulation workers in New York and New Jersey, followed similarly; and 933 amosite factory workers first employed 1941-45, followed after at least twelve years since first exposure. Deaths from mesothelioma in relation to those from all causes for the three populations were:- 87 in 1,109 (PMR = 78.3 per thousand); 35 in 444 (PMR = 78.8); and 10 in 429 (PMR = 23.3).

Peto *et al.* (1977) and Peto (1978) reported that, in all the workers studied at the factory in Rochdale, there had been some 34 deaths from mesothelioma. Five of these occurred among the 186 deaths (all causes) of workers with at least 10 years exposure, a PMR of 26.9 per thousand. Although most of the fibre used in this factory was chrysotile, some crocidolite has been processed; the amount is reported to be low, but there is considerable evidence (for example from a

former Medical Inspector of Factories) that "blue" asbestos was commonly used there in the 1950s.

Jones *et al.* (1976) and McDonald and McDonald (1978) have demonstrated enormous risks of deaths due to mesothelioma in workers exposed during World War II to crocidolite used in the filters of military gas masks, in England and Eastern Canada, respectively. In the Canadian study, a total of 199 persons had been employed in this process for a maximum of about two years, several at the factory in Asbestos, Quebec. Of the total, 56 were known to have died by the end of 1975; nine of the deaths were from mesothelioma, a PMR of 160.7 per thousand. Seven of the nine mesotheliomas were peritoneal.

All the mesotheliomas among miners and millers in Quebec and among factory workers in Rochdale were pleural, whereas the majority of those in other asbestos employment involved the peritoneum. Peto (1978) developed an argument based on these differences, which leads to incrimination of chrysotile. Undoubtedly, the PMR among Quebec miners and millers is rather higher than in the general population of Quebec, but it is very much less than in those known to have been exposed to amphiboles. Although no great reliance can be placed on the exact values of the PMRs, they do appear to give the order of magnitude of the risks, i.e. 3 per thousand for miners and millers at Thetford Mines; 23 for amosite workers; 27 for Rochdale factory workers; 78 for American and Canadian insulation workers; 104 for Barking factory workers; and 161 for Canadian crocidolite gas mask filter workers. These differences cannot be denied, despite the dismissal by Selikoff and Hammond (1975) of the proposal that "the

specificity for mesothelioma is greater for some kinds of asbestos than for others".

Thus it is difficult not to agree with McDonald and McDonald (1977) that the incidence of mesothelioma in insulation workers may be 100-200 times greater than in the general population, whereas in those engaged in chrysotile production it is perhaps three to six times greater. Indeed, it seems likely, as these workers suggested, that the potential for causing mesothelioma follows a gradient similar to that for lung cancer, *viz.* crocidolite is the worst hazard, chrysotile the least.

2.12 Cancer of the gastro-intestinal tract

Harries (1971, p. 231), in a review of evidence, remarked that several studies of asbestos workers had shown an increased risk of cancer of the gastro-intestinal tract. Bonser and colleagues had reported (1955) four abdominal cancers in 72 cases of asbestosis, and Keal, in 1960, one death from peritoneal neoplasm in 15 male deaths with asbestosis, and 9 female deaths from ovarian or peritoneal cancer in 15 similar female deaths. Mancuso and Coulter (1963) found an excess of peritoneal neoplasms, and Selikoff *et al.* (1964) excesses of the stomach, colon or rectum. Doll, in 1955, and with Knox and coworkers in 1968, showed no excess of cancers other than of the lung, while Meurman *et al.* (1974), studying anthophyllite workers in Finland, reported excesses of lung cancer and asbestosis, but not of cancers of the digestive system.

McDonald (1973), concerned with gastro-intestinal cancer in chry-

sotile miners and millers, reported no excess in Italy, but a slight excess, not always at the same sites, in each of his serial reports from Quebec. The excesses appeared only in those with exposures greater than 400 mpcf.y. In the latest Quebec material (McDonald *et al.*, 1979), case-control studies of all 154 deaths from cancer of the stomach or oesophagus and 88 deaths of cancer of the colon or rectum, each with two controls matched for age and mining district, have revealed that the relative risk for cancer of the stomach or oesophagus was normal for exposures up to 1,000 mpcf.y, but much enhanced at higher exposures. For cancer of the colon and rectum, relative risk was normal in men with exposures up to 300 mpcf.y, and then increased.

It would therefore appear that heavy exposure to asbestos may indeed lead to cancer at various sites in the gastro-intestinal tract. This is despite the statement by Gross (1974) that, because several laboratories in several countries had failed to induce cancer in experimental animals using fibres less than five μm in length, the concept that mesotheliomas and gastro-intestinal cancers arise from the ingestion of asbestos dust cleared from the lungs, should be abandoned.

2.13 Cancer of the larynx

From the patterns already discussed, it might seem likely that asbestos dust could also cause laryngeal cancer. However, there seems to be little reliable evidence in the recent literature. Shettigara and Morgan (1975) carried out a case-control study on 43 patients in Toronto, eliciting occupational and smoking histories. Both asbestos

exposure and cigarette smoking were considered "potent factors", with the "strength of association" higher for asbestos. Type of fibre was not considered, and the comment on relative potency is unwarranted in the light of the very small numbers on which it was based. Although their findings are claimed to be similar to those of Still and McGill (1973) in a hospital series, experience in the Quebec chrysotile industry was rather different. Here, McDonald and Liddell (1978) found no trace of a relationship between laryngeal cancer mortality and dust exposure, but a clear and convincing relationship with cigarette smoking. Only a small excess of deaths from laryngeal cancer was observed in the large series of asbestos insulation workers previously mentioned with regard to mesothelioma. Selikoff and Hammond (1975) considered deaths from this cause in those 11,656, nearly two-thirds of the complete cohort of 17,800, for whom smoking histories were available; four deaths due to larynx cancer were observed in the years 1967 through 1972, compared with 1.87 expected on the basis of US mortality rates for white males. The numbers were too small for the ratio of observed to expected (2.14) to be considered more than suggestive; all the cases had been smokers, the ratio being higher for those with a history of pipe and cigar smoking than for those who had smoked cigarettes.

2.14 Other health hazards

In their study of deaths to the end of 1975 in nearly 11,000 male Quebec asbestos workers, McDonald *et al.* (1979) used *inter alia* comparative composite cohort analysis (Case and Lea, 1955), sometimes called the man-years or the modified life-table method, to obtain numbers of deaths to be expected, for specific causes, on the basis of

rates for males in the Province of Quebec. The ratio of observed deaths to those expected can be seen to be a Standardized Mortality Ratio (SMR), adjusted for both age and era. The SMR for all causes was 1.1, and those for causes mentioned above were as follows:- Pneumoconiosis (asbestosis): 13.4; Lung cancer: 1.2; Cancer of oesophagus or stomach: 1.2; Cancer of colon or rectum: 0.7; Other abdominal cancers: 0.9; Laryngeal cancer: 1.0. The only unexpected finding is the low SMR for cancer of colon and rectum, despite the dose-response relationship mentioned above.

Other causes that produced SMRs noticeably above unity were Respiratory tuberculosis (1.3) and Accidents (1.2). The former has been eliminated as an effect of asbestos and appears to reflect the prevalence of the condition in the mining areas of Quebec, particularly Thetford Mines; the latter, although including work accidents, embraces all traumatic deaths and is clearly not a consequence of dust exposure. The SMRs for "Other" cancers, i.e. those not mentioned above, and for Cerebro-vascular diseases were both 1.1, but the usual test of statistical significance (Liddell, 1960) gave χ^2 values of only 0.8 and 0.7, respectively, despite the fairly large numbers involved (over 250 deaths from either cause). Thus, there would appear to be no additional health effect that could lead to premature death, at least in chrysotile mines and mills.

One minor effect is that asbestos corns may arise in those who get fibres into small open wounds (Harries, 1971). Finally, asbestos and asbestos products are mentioned several times in the index to the US Public Health Service's Guide to the Recognition of Occupational

Diseases (Gafafer, 1964), but in each instance not covered above it is a material with which the asbestos is mixed that is incriminated, e.g. benzene, cement or coal tar, not asbestos itself.

2.15 Summary; gaps in knowledge; thesis objective

It has been generally accepted for some years that inhalation of asbestos dust could lead to pulmonary fibrosis, carcinoma of the lung and the development of diffuse mesothelioma of the pleura and peritoneum (Bogovski *et al.*, 1973, p. xiii). There have also been several reports that asbestos exposure can lead to excess mortality from cancers of the gastro-intestinal tract and certain other sites, but the findings are not completely consistent.

There now seems little doubt that the different fibre types are associated with different risks. Risks of fibrosis, of lung cancer and of mesothelioma after exposure to crocidolite appear to be substantially higher than after corresponding exposure to chrysotile. The position of amosite may be intermediate, but too little information is available to place it accurately. There may also be differences in risk according to size of fibre, which may depend on the process.

The manifestations of pulmonary fibrosis include changes on the chest x-ray, respiratory symptoms, particularly breathlessness but sometimes also cough, increased sputum, or chest pain, impaired lung function, clubbing of the fingers, cyanosis and rales at the base of the chest (i.e. the adventitious dry crackling sounds described by Burton Wood, 1929). It is not clearly determined whether the fibrosis

is progressive after exposure has ceased.

The lapse period between the start of exposure and first signs or symptoms, some of which are also associated with cigarette smoking, is highly variable. The fibrosis, often called asbestosis but without consistent definition, can lead to premature death, which may not be coded, on death certification, to "pneumoconiosis" (codes 523-524 in the Seventh Revision of the International Classificaton of Diseases).

Lung cancers and mesotheliomas generally occur after long lapse periods. The former are also associated with cigarette smoking, and the risks appear to be multiplicative. The lapse period may be related to dose, age at first exposure, and amount smoked. An examination is in hand in the 245 lung cancer deaths within the 4,463 deaths up to the end of 1975 among the nearly 11,000 male Quebec chrysotile miners and millers being investigated by Professor McDonald and his colleagues; first results, in Table 2.2, provide no evidence of consistent variation in lapse period associated with dust exposure accumulated to age 45 or with smoking habit, but more detailed study is still required. The latent period between exposure to asbestos and appearance of mesothelioma is usually greater than 25 years, and even longer when the exposure was to chrysotile only (McDonald and Liddell, 1978).

The 1964 recommendations of the UICC Working Group (1965b) were for investigation of:- (1) fibre type; (2) dose-response relations; (3) effects of removal from further exposure; (4) all cases of mesothelioma; and (5) asbestos-exposed populations not so far studied. With regard to methods, the Working Group also recommended:- 1(a) col-

Table 2.2

LATENT PERIODS IN 245 DEATHS FROM CANCER OF THE CHEST

(Years from first asbestos exposure to death)

Smoking habit	Dust exposure accumulated to age 45 years (mpcf.y)					
	<30	30, <100	100, <300	300, <1,000	1,000 or more	All
Non-smoker	44.9 *(5)* *	42.8 *(2)*	40.5 *(3)*	33.8 *(5)*	45.9 *(5)*	41.5 *(20)*
"Undiff-erentiated"	38.6 *(43)*	35.9 *(12)*	35.0 *(11)*	41.2 *(22)*	43.2 *(12)*	39.0 *(100)*
15-25 cigarettes a day	35.7 *(28)*	38.0 *(19)*	40.8 *(16)*	39.5 *(22)*	40.8 *(7)*	38.4 *(92)*
26-50 cigarettes a day	36.4 *(13)*	40.6 *(7)*	38.2 *(3)*	39.6 *(7)*	44.9 *(3)*	38.9 *(33)*
All	37.7 *(89)*	38.1 *(40)*	38.6 *(33)*	39.7 *(56)*	43.2 *(27)*	39.0 *(245)*

* *Italic figures in brackets indicate number of deaths*

lection of full histories; 1(b) study of mortality and morbidity from *all* causes as well as from specific causes; and 1(c) consultation with statisticians at all stages from planning to analysis. 2 In all surveys:- (a) a standardized questionnaire should elicit symptoms (cough, sputum, dyspnoea and chest pain, as a minimum); and (b) when physical examination was possible, clubbing of the fingers, cyanosis and basal rales should be recorded. 3 A classification of chest radiographs should be developed. 4 Lung function tests should include FVC and Forced Expiratory Volume over 1 second ($FEV_{1.0}$).

By 1972, progress had been made on many of these recommendations. In a report to the Director of the IARC, the Advisory Committee on Asbestos Cancer could now make more specific epidemiological recommendations (Bogovski *et al.*, 1973, p. 341). A few of these were:-
(i) the need for investigation, within type of fibre, of differences in size of fibre, and past exposure, in the risk of excess cancers of the lung and of other sites; (ii) investigation of possibilities and efficacy of early detection of disease; and (iii) study of differences between the effects of low continuous exposure and intermittent high exposure. Others concerned such matters as *post mortem* studies of mesotheliomas, secular trends in the general population, talc, pleural plaques, and cost-benefit analysis.

One other recommendation is of particular interest in the present context. It was "to interrelate radiographic appearances, lung pathology, respiratory function, dust content and type, in asbestos workers".

Although the various symptoms and signs of asbestos-related disease are undoubtedly important, excess mortality is the outcome of prime epidemiological interest. In the Quebec studies, and elsewhere, radiographic appearances have been related to dust exposure; respiratory symptoms and lung function have been related to dust exposure and smoking habit; and x-ray changes have been related to function. There have been many studies of mortality in relation to exposure, but few have included quantitative assessment of both duration and dust concentration; smoking is an important concomitant variable.

However, the outcome of greatest interest has also to be related to the symptoms and signs, and to exposure and smoking. A limited study of mortality in relation to x-ray change was reported in McDonald *et al.* (1974), but the interrelationships of all these variables do not appear to have been studied, although of great potential importance. Investigation of these relationships in Quebec chrysotile miners and millers forms the general objective of this thesis; specific objectives are given in Chapter 7.

Chapter 3

RADIOLOGICAL CLASSIFICATION

3.1 Introduction

In describing the development of the classification of chest radiographs of the pneumoconioses sponsored by the International Labour Office (ILO) in 1958, Van Mechelen and McLaughlin (1962) stated that "The abnormal x-ray shadows seen in the pneumoconioses constitute various combinations of linear, reticular, nodular and massive shadows, and none of them is specific in the sense that similar shadows may not be found in other non-industrial pulmonary conditions". The first classifications appear to have been those drawn up in South Africa and America, in 1916 and 1917, respectively. The ILO have sponsored five, i.e. in 1930 at Johannesburg, in 1950 at Sydney, in 1958 at Geneva, in 1968 at Geneva again, and finally the ILO U/C (1971) classification (Gardner *et al.*, 1930; ILO, 1953; 1959; 1970; 1972).

3.2 International classifications up to 1958

The first international classification was adopted in Johannesburg in 1930. Its concern was, for all practical purposes, with silicosis only and it was based as firmly on clinical symptoms as on radiological abnormality; three stages of disease were recognized. Although there was a meeting sponsored by the ILO in 1939, no new classification was adopted. However, note was taken of an American classifica-

tion which included radiological changes, histological appearances, clinical findings, both objective and subjective, and degree of incapacity for work.

Meanwhile Irvine, in South Africa, had in 1934 produced what appears to have been the first attempt to classify in purely radiological terms. Ten years later, Eck and Hanaut put forward a strictly radiographic classification, which has clear reference to silicosis; four stages of abnormality were distinguished - linear, micronodular, nodular and pseudo-tumoral - with three grades in each. In 1948, Van Mechelen and Belayew used this as the basis of what was called the Hasselt classification.

An important change in development came in 1949, when the Medical Research Council's Pneumoconiosis Research Unit (PRU) published a classification of coalworkers' pneumoconiosis (Fletcher *et al.*, 1949). This distinguished simple and complicated pneumoconiosis, and introduced four quantitative grades of either. In Sydney in 1950, the ILO followed PRU closely, although the number of grades of simple pneumoconiosis was reduced to three (ILO, 1953). Also, a category was added for discrete opacities not falling into the quantitative grades. Quite soon, this was found unsatisfactory for most purposes, and at a meeting of British and French experts in 1951 a compromise between Eck and Hanaut (1944), PRU (Fletcher *et al.*, 1949) and ILO, Sydney, 1950, was introduced; this was called the Cardiff-Douai classification (Cochrane, *et al.*, 1951). It allowed for small opacities in simple pneumoconiosis to be categorized by both their size (p, m, n) and their number (grades 1, 2, 3).

In 1958, Van Mechelen and McLaughlin (as they reported in 1962) had been asked to find out how far the Sydney classification was being used, and discovered that it was employed in only two countries, and that for specific purposes. The Cardiff-Douai classification was used throughout Europe in coalworkers' pneumoconiosis, but for no other occupation. They found, nevertheless, a clear desire for an international agreement, and the ILO called experts together in Geneva. The conference decided on limitation to "persistent radiological opacities in the lung fields provoked by the inhalation of mineral dusts". Van Mechelen and McLaughlin commented that these opacities constituted the majority of pneumoconioses, but that asbestosis (and berylliosis) "are said to present features different from other pneumoconioses". The ILO, Geneva, 1958, classification (ILO, 1959) retained most of the Sydney and Cardiff-Douai features. Suspect pneumoconiosis was to be recorded as "Z", which related to "increased lung markings", small opacities had sizes p, m, n defined, with three grades of profusion, while the grading of large opacities (or complicated pneumoconiosis) was reduced to A, B, C. An interesting development was the introduction, or better re-introduction, of a class, "L", for linear opacities, i.e. "numerous linear or reticular opacities, the lung pattern being normal, accentuated or obscured". Meanwhile Van Mechelen and McLaughlin made the important point that "the number of small rounded opacities is relatively difficult to establish, because there is always a desire to combine two different aspects, i.e. their distribution in the pulmonary fields and their profusion".

This classification did allow for the optional recording of "the main complications of the pneumoconioses" by what were called "addi-

tional symbols"; these were as follows:-

(co) Abnormalities of the cardiac outline. To be replaced by (cp): cor pulmonale, if this condition is strongly suspected.
(cv) Cavity.
(di) Significant distortion of the intra-thoracic organs.
(em) Marked emphysema.
(hi) Marked abnormalities of the hilar shadows.
(pl) significant pleural abnormalities.
(px) pneumothorax.
(tb) opacities suggestive of active tuberculosis.

3.3 Classifications of asbestosis

As seen in the preceding section, asbestosis had been ignored in all the international classifications before 1958, and even in that could only be recorded in terms of "L" or certain "symbols". The remark that this condition was "said" to present radiological shadows differing from those in the other pneumoconioses appears rather naive in the light of Merewether's description, in 1930, of changes (Harries, 1971, p. 12) occurring in four stages:

I. increased linear striations
II. fairly definite fine dusty stippling
III. coarser mottling with increased linear striations
IV. grosser lesions with pleural changes and displacements due to the pull of fibrosing lesions.

In an important review, Bohlig (1965) pointed out that asbestosis did not present the same characteristics and uniform features as silicosis, and that several attempts had been made, from 1932 through 1956, to develop a classification, but always without international recognition. A three-stage scheme, originated by Saupe in 1938, had

been widely used but had the major drawback that the stages overlapped. Bohlig reported that he had tried to use the ILO classifications in asbestosis, and expressed the strong view that what was needed was development rather than a special, unrelated, scheme. The main difficulty lay in that most asbestoses (at least in Europe) showed linear marking and there was need to differentiate as to extent and density. He therefore proposed that the one class "L" be replaced by three grades of profusion (as for p, m, or n shadows), differentiated by the code "f" (for filamentum or fibra).

Sluis-Cremer and Theron (1965), at the same conference, pointed out the deficiencies of the ILO, Geneva, 1958, classification for use in asbestos workers, and also suggested three grades of profusion. They felt, however, that the linear markings could be classified as "fine" or "coarse" according as they were less or greater than 1 mm in width, and suggested the codes "Lf" and "Lc", respectively. These workers also proposed that pleural plaques should be recorded, and perhaps also pleural thickening, distinguishing whether diaphragm, mediastinum, walls or fissures were involved. They considered, too, that "symbols" should be added for bronchial carcinoma (Ca), mesothelioma (Me) and cystic changes (Cy).

3.4 The UICC/Cincinnati (or U/C) classification

These two proposals were modified into a system that was evaluated by a working group set up by the UICC (Union Internationale Contre le Cancer) Committee on Asbestos and Cancer in 1965. Meanwhile Professor Corbett McDonald and his colleagues working from McGill University had urgent need of a means of classifying several thousand

films from Quebec and had prepared proposals, and the US Public Health Service had expressed interest. The three groups met for four days in Cincinnati at the end of 1967, reviewed the results of the trials that each group had carried out, and eventually came to unanimous agreement on a new scheme designated as the UICC/Cincinnati (or U/C) classification. Its aims and principles were (Bohlig *et al.*, 1970):-

Aim 1. To provide a scheme for the systematic recording of the various radiographic appearances associated with exposure to asbestos and other dusts.

Aim 2. To provide a system in which the qualitatively different features of the film can be recorded separately and graded.

Aim 3. To provide a code that permits a brief description of the important radiographic features of the pneumoconioses.

Principle 1. As far as possible it is purely descriptive of radiographic appearances and does not use interpretive words such as "fibrosis" or "infection" which already have definitions in pathology.

Principle 2. It describes the natural history of the changes produced by asbestos and other dusts as far as is known, but it avoids the use of terms such as "early stages", "progressive" or "final".

Principle 3. It provides a system of recording semiquantitatively (with the help of verbal descriptions and standard films) features of the film which can be separately assessed with a reasonable degree of certainty.

Principle 4. It provides a means of describing the appearances seen in workers known to have been exposed to asbestos dust as well as to other dusts.

The U/C classification was an extension in several dimensions of the ILO, Geneva, 1958, scheme, and seems to have achieved most of its

intentions; however, Principle 1 (see above) was unfortunately not followed in its entirety. There is still a need to decide whether any radiographic changes are due to pneumoconiosis or not, and hence an element of diagnosis has been retained even in the latest developments; see page 6 of the present ILO U/C (1971) classification (ILO, 1972).

In the U/C classification, small opacities were subdivided into rounded and irregular; for rounded opacities, the "types" (or sizes) p, m, n, were replaced by p, q, r to reduce errors of transcription but without change of definition; for irregular opacities (replacing "L"), three "types" (or widths) s, t, u were introduced; each lung was divided into three zones, and a record was to be made of those in which the opacities appeared. Large opacities were subdivided into well-defined and ill-defined.

Perhaps the most important change was in what were called "other features". The "symbol" (pl) was replaced by (1) a record of whether either costophrenic angle was obliterated; (2) the grading of pleural thickening (or diffuse, uncalcified, plaques); and (3) the recognition of pleural calcification by site (diaphragm, walls or other), and by extent. In addition, when a diaphragm was ill-defined, this was to be indicated, as was the extent to which cardiac outline was ill-defined.

The number of "symbols", even excluding (pl), was increased to 18, of which six were obligatory, the rest optional.

Another major innovation was of the 12-point scale of profusion, developed within the National Coal Board by the present author and his

colleagues (Liddell, 1963; Liddell and May, 1966; Liddell and Lindars, 1969).

It had been agreed that, before the U/C classification was published, it should be subjected to tests of practicability and observer variation, both intra- and inter-observer. These tests, described briefly by Rossiter (1972a), were considered to show that the proposed scheme had reached a stage where it was likely to be a useful tool for epidemiological studies and it was therefore published (Bohlig *et al.*, 1970). It is fully described in the Appenidix to this thesis, bound at the end of Volume 1.

3.5 The ILO U/C (1971) classification

Shortly after the decision to publish the U/C classification, the ILO adopted it as the "extended" ILO, 1968, classification (ILO, 1970); this was expected to be particularly useful for epidemiological studies in which the radiographic features were to be related to other measurements, such as indices of dust exposure or lung function changes (Jacobson and Lainhart, 1972). At the same time, a "short" classification was authorised for clinical use and for purposes, such as compensation, to which the earlier (1950 and 1958) international classifications had been put. This 1968 short classification was very similar to that of the ILO in 1958, except that pleural thickening of the chest wall and diaphragm was to be recorded by means of the "symbol" (pl) and pleural calcification by (plc). Five further "symbols" were made obligatory, with twelve "optional extras".

The US Public Health Service and others, particularly the

group working from McGill University, conducted several studies using the U/C classification in asbestos workers, beryllium workers, coal-miners, dockyard workers, etc. Much varied experience was gained in a short time, and a meeting to exchange information was held at the MRC's Pneumoconiosis Unit at Penarth, in April 1971. Several changes were adopted, and the recommendation made that the ILO and U/C classifications should be identical. At the Fourth ILO International Pneumoconiosis Conference, at Bucharest in September 1971, these proposals were approved, and the classification became known as the "ILO U/C (1971) international classification of radiographs of the pneumoconioses" (ILO, 1972; Jacobson and Lainhart, 1972). (The Penarth meeting had not resolved all difficulties in the use of the U/C classification, as discussed by Jacobson and Gilson, 1972.)

As three years previously, there were two versions, this time called "complete" and "short". In the complete classification, the lung zones were defined more exactly than before, and there was a strong recommendation that the combined profusion of both rounded and irregular small opacities should be recorded - but without any guidance as to how this should be done. In the U/C, 1968, classification, the extent of pleural thickening had been coded on a four-point scale; in 1971, both width and extent were to be coded, each on to a three-point scale. The number of "symbols" was increased to twenty, and their use was made obligatory.

The short classification of 1971 made allowance for the recording of small irregular opacities, distinguishing type (width), s, t, u, but retaining the older four-point scales (0, 1, 2, 3) for profusion

of both forms of small opacity, and for "combined" profusion, again strongly recommended. Pleural thickening was to be recorded as in the 1968 short classification, but "symbols" were to be treated as in the complete 1971 classification.

In 1975, I carried out a trial, on behalf of the Royal Commission on the Health and Safety of Workers in Mines (Ontario), to evaluate the x-ray classification still in use at that time in Ontario; it had been based on the one adopted nearly forty years previously by the South African Miners' Phthisis Medical Bureau for use in cases of silicosis. Three experienced readers assessed 269 films, most of claimants for workmen's compensation but including a fair proportion of unexposed men. The report (Liddell, 1975a) recommended the adoption in Ontario of the latest international classification, not only for the obvious reasons, but also because a substantial proportion of films in the trial revealed irregular small opacities which could not be recorded in the Ontario scheme.

A further benefit of the trial was that it allowed a study of the use of the ILO U/C (1971) classification for films of men with varied exposures. Some of the difficulties in the recording of small opacities were discussed in a recent report (Liddell, 1977). The most serious were in the averaging of profusion over the affected zones of the lung, and, as expected, in the recording of combined profusion.

Jacobson and Lainhart (1972) emphasised that periodic reappraisal and further changes might be required, but that eventually a classification might be developed encompassing all diseases of the chest. In

the last few years, a group of experts in the USA, working under the auspices of the American Thoracic Society, has been examining ways of using or adapting the ILO U/C (1971) classification for radiographs of persons not occupationally exposed to mineral dusts. The American College of Radiology, in co-operation with the National Institute of Occupational Safety and Health and the ILO, is to hold a symposium in Washington in September 1978, to make a further appraisal of the present classification, and the ILO is calling experts to a meeting in Caracas to be held the following month.

3.6 Standard radiographs

As Van Mechelen and McLaughlin (1962) wrote, "it is generally accepted that it is practically impossible to use a radiographic classification accurately without a set of standard reference films". They discussed problems of finding a single set of films representing the various pneumoconioses, and then of making copies for use as reference. However, the final set was complete by May 1961, when these authors submitted their report.

These same standard films for small rounded opacities and for well-defined large opacities were also used in the U/C classification, but new films had to be provided as standards of small irregular opacities, of obliterated costophrenic angle, pleural thickening of the chest wall, irregular diaphragm and irregular cardiac border.

A reference set of films for use with the ILO U/C (1971) classification had to be considerably larger than ten years previously, in order to cover all the features, and Dr. J. C. Gilson in a paper

entitled "Choice of Standard Films, with particular reference to those for small rounded opacities", privately circulated in 1971, commented that, even for small rounded opacities, the factors to be taken into account on choosing standards had changed considerably from what they had been in 1958-61, but that there were strong grounds for maintaining the levels of standards of this radiographic feature. However, the methods of averaging profusion, when not evenly distributed over the lung fields, were changed in an important fashion in 1971; this is one of the problems referred to in Section 3.5 above, and can be seen to create further difficulties in the selection of standard films. Nevertheless, by the end of 1972, the ILO was announcing that standard films were available.

The set consists of 21 plates, approximately 350 mm square. Most are radiographs of both lungs in one person, but three show two or three portions of the lungs of different subjects. One full film is normal in all features, and each of the mid-category profusions 1/1, 2/2, 3/3 are illustrated for each type of small opacity (p, q, r; s, t, u). However, in none of the reference films for profusion 1/1 do the opacities affect all six lung zones, and the same is true for half the films for profusion 2/2 and even for the 3/3 of type u. Well-defined large opacities of each category (A, B, C) are shown, but only category B of ill-defined large opacities. Pleural thickening and diaphragmatic pleural plaques are illustrated on one plate (with parts of the radiographs from three persons), and all other features of the classification are seen in films chosen as reference for small opacities. About half the "symbols" are also illustrated in like manner. Rounded and irregular small opacities are stated to co-exist in one of

the films, but the details give no guidance on how the assessment of combined profusion was made (rounded: q, 1/1 with no zones marked as affected; irregular: t, 3/3 in all six zones; combined 3/3).

There is little difficulty in accepting Gilson's comment that levels of standards should not be changed unnecessarily, and the U/C, 1968, classification had of course made use of the existing standard films wherever possible. However, the principle on which the 12-point scales of profusion of small opacities were based ought to have been better served by the introduction of reference films on the borderlines between categories in the short classification. A reader might then have been able to decide, in direct comparison, whether a specific film showed less or more profusion than the standard, thus facilitating differentiation between, say, 1/2 and 2/1. It also seems likely that the "middling tendency" (Morgan *et al.*, 1974) – placing the majority of films in the middle of the short categories, i.e. at 1/1, 2/2 or 3/3, reducing the numbers placed close to but on one side or other of the category borderlines – observed in most studies of the use of the 12-point scales would be reduced, because there would not be a mid-category film against which to make direct reference.

3.7 Radiographic technique

No discussion of the classification of x-ray films of the pneumoconioses could be complete without at least a mention of radiographic technique. Despite many attempts at some degree of standardization, there is little agreement among experts on the criteria of film quality. Indeed, in one trial of the U/C, 1968, classification, it was reported by Rossiter (1972a) that agreement about technique was

worse than for any other radiographic feature: the complete range of assessments (from acceptable to very poor) was recorded by different observers on a quarter of the films in the trial. The effects of film quality on the actual readings are complex, as has previously been discussed by, for example, Liddell (1961). It seems likely that some, perhaps all, readers adjust their readings of films they consider of poor quality to what they believe would be seen in an acceptable film. Further complication arises because in recent years a new type of technique has been developed; this uses kilovoltages in the range 110 to 140 kV, with short exposure times, one thirtieth or one sixtieth of a second, whereas the earlier techniques had used 60 to 80 kV with longer exposures (0.05 to 0.08 s) in order to get adequate penetration. While good radiographs are possible from each method, with careful attention to detail (ILO, 1972), the films are not necessarily comparable, as has been appreciated recently in one particular study (Becklake *et al.*, 1978) where film pairs were assembled consisting of one film by each technique.

Further discussion of this subject is outside the scope of this thesis.

3.8 Summary

Although international classifications of radiographs of the pneumoconioses had been sponsored by the ILO since 1930, those up to and including that adopted in Geneva in 1958 had been concerned primarily with silicosis and coalworkers' pneumoconiosis. Even in 1930, Merewether had described the radiological appearances of asbestosis in rather different terms, and at the New York Academy of

Sciences conference in 1964 on the biological effects of asbestos strong dissatisfaction was expressed with the ILO classification for use in asbestos-exposed populations. The UICC Working Group agreed proposals in 1967, which with minor modifications were adopted by the ILO in 1968, and confirmed, after several more international meetings of experts in all the pneumoconioses, as the ILO U/C (1971) international classification of radiographs of the pneumoconioses (ILO, 1972).

One of the main driving forces behind the 1967 UICC Working Group meetings had been the need for a classification into which to assess many thousands of films of Quebec chrysotile miners and millers. The earliest agreed version of the U/C classification was adopted for that purpose (Rossiter *et al.*, 1972), and as these readings were used in the research reported here, full details of that classification are given in the Appendix to this thesis.

Chapter 4

QUEBEC CHRYSOTILE STUDIES I: POPULATIONS AND MEASURES OF EXPOSURE

4.1 Introduction

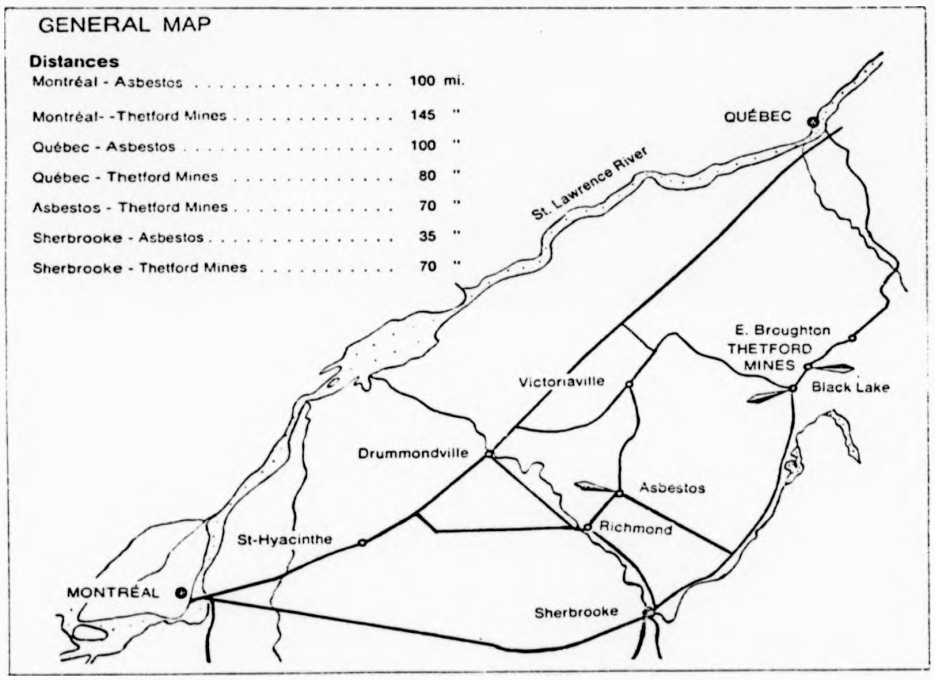
Although Quebec's share of the world market of asbestos has been falling in recent years, annual production of chrysotile during the 1970s has been fairly steady around 1.3 million short tons, and the labour force has numbered about six thousand. Mining is carried out in two neighbouring areas of the region known as les cantons de l'est (the Eastern Townships) of Quebec; see the map in Figure 4.1. The first workings, opened in 1878, were at Thetford Mines and work still continues in that town and in the nearby Black Lake and East Broughton. In 1881, one man opened a mine at Asbestos; the company has continued since, also operating a small factory in the town for the manufacture of mixed asbestos products. After mining, the rock containing asbestos is processed in adjacent mills, which crush the rock, extracting the fibre and preparing it for commercial disposal.

Those who have worked in the mines and mills of Quebec are, as mentioned in Chapter 2, of particular interest for several reasons. First, their exposure has been purely to chrysotile. In most industrial applications, different fibres are used, mixed in the one pro-

Figure 4.1

MAP OF THE ASBESTOS-MINING REGION

OF SOUTH-EASTERN QUEBEC



cess, or separately but within the same factory. Thus, although chrysotile dominates greatly, it is difficult to find other populations who have been exposed to a single fibre. Even where such a population has been found, it has been quite small; *cf.* Elwood and Cochrane (1964) and Weiss (1977). The second reason for the importance of the Quebec workers is that there have been so many of them - nearly thirty thousand by the end of 1966. Thirdly, many of these persons (predominantly male) worked for a very short period only and so had minimal exposure; on the other hand, there were substantial numbers who had had many years of employment often in the extremely severe dust conditions of the past. Thus, there are possibilities for comparison between heavily and lightly exposed.

Following the 1964 recommendations of the UICC Working Group (1965b) on problems requiring epidemiological study, Professor J. C. McDonald and his team based on McGill University started their investigations of the health effects of asbestos in this population, in 1966, at the request of the Canadian government and with encouragement from the Quebec government. There have been many facets of the investigation, which is still continuing, and some sixty reports. This multidisciplinary approach to such a large population exposed to a single fibre, with estimates of the dust concentrations to which they were exposed, has led Enterline (1976) to write: "Except for McDonald's study of asbestos miners, however, no really 'grand' studies of asbestos exposed workers have ever been undertaken in which exposure and response are related".

The remaining sections of this chapter concern the setting up of

the project with its many sub-projects, and findings are outlined and discussed in the following chapter.

4.2 Principles

The principles of this investigation, although never so far stated explicitly, can be summarized as follows:- (a) to identify each person who had ever been employed by an asbestos mining company in the Eastern Townships; (b) to obtain certain basic information about each such person - sex, date of birth and history of employment in the industry; (c) to formulate precise questions for study; (d) to select the appropriate sub-population on which each question could best be answered; (e) to collect the necessary additional information about each defined sub-population; and (f) to analyse the full data with the best available methods.

Principles (a) and (b) were attacked by getting the personnel department of each mining company to compile a register of all persons currently or previously employed, as at 1 November 1966. A "buff card" was made out for each such employee. On the face, a record was made of his or her name, date of birth and address (at the time of employment), and on the reverse a detailed work history was provided; see below. There were 44 mining companies in this enumeration, but records for several, all but one very small, had been destroyed. This meant that no buff card could be made out for 500 or more persons, and that the history was incomplete for some others, mainly older men, who had worked in one of the mines concerned but been transferred to another when it closed. For a small proportion of persons, again mainly older men, dates of birth were incomplete and in a few instances

missing.

Because of the inevitable movement of labour between companies or from asbestos work to another occupation and back, there was need to bring together all the buff cards for each individual who had more than one. In many instances, there was agreement in every particular of name and date of birth on more than one buff card, and there could be considerable confidence that the cards referred to the same person. However, in some personnel departments, names had been recorded by a clerk unfamiliar with the mother tongue of the workers concerned, often an English-speaking clerk entering the names of French Canadians, or of immigrants from central Europe; further, age at the time of first entry on the books was often recorded, rather than date of birth. Inevitably, therefore, there were cases where the probability was that more than one card referred to one person, but confidence could not be complete. In every individual case, the evidence was reviewed on at least three occasions before a final decision was made; a small investigation of the quality of matching is reported in Chapter 7. At a comparatively early stage, McDonald *et al.* (1971) reported that they had registered 27,669 men and women, of whom 6,415 were in employment on 1 November 1966. Of the total, a little over 1,000 had been employed by more than one company.

The broad aims of the study are to relate dust exposure assessments for each worker, from the start of the industry, to mortality, radiographic appearances, pulmonary function and respiratory symptoms (McDonald *et al.*, 1974). Specific aims will be introduced in relation to the findings discussed in the following chapter. However, it seems appropriate to mention here the basic selection of chest radio-

graphs for use in several sub-projects.

At both Asbestos and Thetford Mines, chest x-rays are used for two main purposes, pre-employment medical examination and annual medical examination. The procedures started in 1936 at Asbestos, but at Thetford Mines were not introduced until 1946 and were not universal until several years later. The interval between medical examinations, and hence between successive radiographs, naturally varied somewhat depending on each individual's circumstances.

Following the same principles as for the identification of all employees, it was decided to select a radiograph for everyone who had had one. The most recent, before November 1966, was identified, and those of 15,689 persons in all were collected from the two medical clinics.

4.3 Work histories

The work histories, on the reverse of the buff cards, contained a list of every job the employee had ever had in the company, with date of start, and, from the next succeeding record, date of termination. Any time employment ceased, a record of the date was provided. Where there was more than one card for any person, they were brought together and the work histories were combined; in a very few instances, discrepancies appeared between histories given by different companies, and had to be resolved.

The reliability of these histories has to be considered. There are two aspects: are the dates of starting and ending employment

correct? and are all the jobs listed for each man? The former has been checked in a current study that will not otherwise be reported here. For over 1,200 men selected for this study, the work histories were "edited" by computer program, written to my specification, and a Work History Verification form was printed out. This form listed all identifying information and also the recorded date of first employment, and by which company, dates of leaving any company, dates of rejoining or of starting employment at another company, and date of last recorded employment. Field enquiries have been made to determine whether (a) those concerned worked in the industry before the first recorded date or after that last recorded; (b) any gap in recorded history was, in fact, spent, wholly or partly, in the industry; and (c) during any recorded spell of employment the man was in fact working elsewhere. Enquiries are not yet complete, but it is known that for about two thirds of the men the enquiries were "negative", i.e. have validated the recorded work history. For a considerable further proportion, the only "positive" response was about employment after 1 November 1966, i.e. without casting doubt on the validity of the record up to that point. Most of the remaining discrepancies were to be expected: light has been cast on some doubtful cases where buff cards had been assumed to refer to the same man; some spells of long-term absence from employment, particularly in the armed services during World War II, had not been recorded at Asbestos, because such men were kept on the books until their return; the records destroyed at one mine can now be at least partially filled; etc. In general, the enquiries have indicated that the buff cards were of high reliability in regard to dates of starting and ending employment.

No means of checking the second aspect (specific jobs) has been found. Their importance is for the calculation of exposure (see below) and the clear-cut dose-response relationships that have been determined in various sub-projects suggests that this aspect, *together with* assessments of dust concentrations (also see below), has been satisfactory.

4.4 Dust measurements

The jobs entered on the reverse of the buff cards were listed, within each company, or mine within company, and a total of 13,346 names distinguished. However, in many cases, several names were used for the same work and exposure, and the number of distinct jobs was reduced to 5,783. Dust concentrations were required for each job as they may have fluctuated throughout its existence. The following account relies heavily on two reports by Gibbs and Lachance (1972; 1974).

Since 1949, Maurice Lachance, Ingénieur, had made annual measurements of dust concentrations at working places in the dryers, crushers and mills in all companies. From 1946, various investigators had made similar measurements in the small factory at Asbestos. All Mr. Lachance's measurements were made with a midget impinger, the others using a similar instrument and also several others. Records of concentrations were in millions of particles per cubic foot (mpcf). Well over 4,000 dust counts had been made by the end of 1966.

In mining and maintenance, and in certain other jobs, no dust assessments had been made by direct measurement, but dust levels were

estimated by investigating levels in the late 1960s and adjusting according to changes in operating procedures which had been reported by mining and maintenance personnel. Before 1949, few dust measurements had been recorded, and corresponding estimates were made, usually after interviews with employees of long service and in consultation with foremen, etc. In this way comparisons could be made with more recent conditions. All these estimates are necessarily approximate, but there was substantial agreement among those questioned. Nevertheless, for one reason or another, there is at least the possibility of some degree of overestimation (Gibbs and Lachance, 1972, p. 195).

The method of measurement used by Mr. Lachance was essentially that later approved by the Asbestos Textile Institute (1963). The count, sometimes referred to as "total dust" included both fibres and particles, and was carried out at a hundred-fold magnification. The dust counted was mostly below 7 μm in diameter (and so far from "total"); as fibre bundles exceeding 3 μm in width were rare, most of the dust counted was probably respirable.

Great variation was found between work places in dust levels, which were particularly high in certain areas of drying, milling, maintenance and waste disposal, and comparatively low in mining; differences were also found between mines, not only in different companies but also between those owned by the same organisation. Over the years 1949-66, when measurements had been taken, there was steady improvement in dust levels: the mean annual concentration in the mills fell from around 75 mpcf to about one-tenth that level. The mill at

Asbestos had the lowest concentrations throughout this period, reducing from about 30 mpcf in 1949 to a low level in 1956, which was fairly consistently maintained thereafter. In 1949-51, the mill with the worst experience each year had annual average concentrations above 200 mpcf, but in 1966, the average at the worst mill was below 15 mpcf.

Dust counts would probably have been substantially higher in the years before measurements were instituted. Thus they appear rather worse than in other historical studies (Knox *et al.*, 1968; Enterline *et al.*, 1972b) reported in Chapter 2.

Conversion to fibre counts would be desirable but has proved of doubtful value. Side-by-side sampling, using the midget impinger and a membrane filter device, has shown a poor degree of correlation between the two counts and shed little light on a means of conversion. The Quebec government's Comité d'étude, set up under Judge René Beaudry to study the health of asbestos workers in the Province, analysed up-to-date data supplied by Dr. G. W. Gibbs, and suggested that the relation: $(\text{fibres/ml}) = 10.97(\text{mpcf})^{0.68}$ would allow conversion (Dagbert, 1976). However, there was enormous variation in the ratio of the two counts: low counts on one instrument were, of course, often associated with low or medium counts on the other, but also occasionally with high values. Some extremes, estimated by eye from the figure in Gibbs and Lachance (1974), are:-

Midget impinger count (mpcf)	33	23	13	2
Membrane filter count (fibres/ml)	5	58	135	98
Ratio	0.2	2.5	10.4	49.0

This hundred-fold variation in ratios is mirrored in the very wide 95 per cent confidence limits provided by Dagbert on his conversion formula, i.e. $55.7(\text{mpcf})^{0.68}$ and $0.58(\text{mpcf})^{0.68}$; their ratio is $(55.7)/(0.58) = 96.0$

Over a realistic range of particle counts, i.e. at high levels, Dagbert's formula would suggest converting on the basis of five or so fibres/ml to unit mpcf, but Gibbs and DuToit (1978) stated that Dagbert had not adequately edited the data provided by Dr. Gibbs, and that the factor to convert historical particle counts should lie between one and five fibres/ml to unit mpcf. Converting on the basis of three fibres/ml to unit mpcf, the 1949 annual average concentration in the mills of Quebec, measured as 75 mpcf, may have been roughly equivalent to about 225 fibres/ml. Clearly, no great reliance can be placed on this figure, but there can be little doubt that dust levels were very much higher, by two orders of magnitude, than any modern "Threshold Limit Value" such as 5 or 2 or particularly 0.5 fibres/ml. Even in 1966, when the annual average concentration had fallen to around 7 mpcf, the fibre "equivalent" would appear to have been of the order of 20 fibres/ml, still unconscionably higher than today's standards.

4.5 Exposure calculations

When the National Coal Board's Pneumoconiosis Field Research (PFR) was set up in 1952 (Fay and Rae, 1959), a major concern was the calculation of indices of exposure to coalmine dust of each of the 35,000 miners under study. In the event, no attempt was made to assess historical exposures by more than a statement of the years worked at the coalface, elsewhere underground and on the surface, either at the

colliery where the man was questioned during a radiological survey or at any other mine. However, for the periods between surveys, detailed records were maintained of each man's work, job by job, day by day, taking account of overtime - which might be worked in another job - and absence. Dust measurements were made for each job and, thereafter, the length of time spent in each job was multiplied by the dust concentration there in the relevant period, and the cross-products were summed to obtain a single measure of exposure over the inter-survey period (usually about five years). The method of maintaining current histories was virtually identical to that introduced earlier for another purpose by Liddell and Finch (1958).

The Quebec studies required indices assessed over much longer periods, dating back to 1878. The method of obtaining them was similar to that of PFR, just described, taking the work histories on the buff cards as base; dates had been entered in terms of month and year only. However, the lack of the daily detail that had consumed such an enormous data processing commitment in PFR was much more than compensated for in Quebec by the vitally important estimates of early exposure.

For each of the 5,783 jobs, defined as above, and for each year of operation, an average dust concentration was estimated from the available dust measurements and approximations. The concentration was recorded on a 13-point scale, corresponding to:- 0.5, 2, 7, 12, 17, 22, 27, 32, 37, 42, 47, 70, and 140 mpcf. *Accumulated dust exposure*, or dust index, was originally calculated, as mpcf x years (or mpcf.y), by an adaptation of the method described above. An example

will illustrate the process:- consider a man who started in the industry during February 1965 in job 1 (dust code 3 in that year), moved to job 2 in September (code 5 in 1965, code 4 in 1966) and left in February 1966; the calculations are as follows.

Job	Year	Duration	Fraction of year	Concentration *	Cross-product
1	1965	Feb–Sep	7/12 = 0.58	(3) 7	7 x 0.58 = 4.06
2	1965	Sep–Dec	3½/12 = 0.29	(5) 17	17 x 0.29 = 4.93
2	1966	Jan–Feb	1½/12 = 0.13	(4) 12	12 x 0.13 = 1.56
				Accumulated dust exposure	=10.55

* The figures are (code) and corresponding concentration (mpcf).

For more recent studies, many of the exposure indices have been recalculated on an annual basis, and the proportion of each year worked has been recorded, a double-field being included on the computer record separately for each of the 63 years from 1904 (when the first employment of any of those involved in these particular studies started) through 1966. In the example above, the first 61 fields would be blank, and the entries for 1965 and 1966 would be:- 8.99 and 0.87; 1.56 and 0.13; respectively.

Several other indices of exposure were included in early studies. They were: accumulated dust exposure weighted for physical effort; accumulated dust exposure weighted for physical application; time-weighted dust exposure. This last is highly correlated with the first described (accumulated dust exposure, unweighted), and so little additional information can be gained from it. The others must be expected to have even higher correlations with the first, and have not in the event been found useful.

A fifth indication of exposure, useful because it does not take dust concentration into account, and so allows some form of comparison with other studies, is *years of exposure*. This can be expressed on a gross basis, counting from first employment to final departure from the industry, or on a net basis, omitting gaps in service from the index. These two measures have recently been termed gross and net service, respectively.

A correction to the accumulated dust exposure took account of variations in the length of the working week, which was generally 66 hours before World War II, but has been 40 hours in recent years. If the accumulated dust exposure is divided by length of service, the quotient will be only a rough indicator of average concentration, if the periods over which the averaging is done embrace changes in the length of the working week. To find true average concentrations, it would be necessary to re-calculate service, adjusting in such a way that the unit becomes a working year based on 40 hours a week, before finding the quotient. This would, however, mean that the working year could be as "long" as 66/40 = 1.65 years on the present basis.

Despite the shortcomings discussed above, the estimated exposures are of very great value. While it may be impossible to place each individual subject precisely on a continuum of dust exposure, the great width of the continuum means that it is possible to distinguish workers who have had varying degrees of exposure. For example, a ten-point scale of dust exposure accumulated by age 45 has been found useful in the most recent study of mortality (McDonald *et al.*, 1979); the boundaries between the classes were drawn at 1, 3, 10, 30, 60,

100, 200, 300 and 600 mpcf.y, and of 10,939 men so grouped the class size was never less than 573, nor more than 1,607. While one cannot be completely confident that every individual has been placed into the correct class, employees with short service (less than one year, say) were most unlikely to be correctly in any but the lowest classes of dust exposure, while those with long service (twenty years or more, say) could not be at the lower end of the scale of exposure. This is illustrated by the two-way distributions in Tables 9.2 and 9.13, below. Indeed, because the accumulated exposure for a man with long service, probably having had many jobs, is a sum of more-or-less independent terms, the coefficient of variation of his estimated exposure is certainly small, by virtue of the Central Limit Theorem, compared with the variation of exposures between subjects. There may remain certain biases, but they can have little effect on any internal comparisons; see the discussion by Fay and Ashford (1964) on corresponding problems in British coal mines.

4.6 The "main mortality cohort"

Because excess mortality is undoubtedly the most important health effect of asbestos exposure, the mortality study will be outlined first. It was based on employees thought likely to yield the most valuable information, i.e. those born in the years 1891 through 1920, who had been employed for one calendar month or more (McDonald *et al.*, 1971). Those born before 1891 would have been even more difficult to trace; those born after 1920 would, even by 1978, be less than 60 years old and would not have completed their working life-times, still not having reached an age of high mortality. The cohort defined in these ways is here called the "main mortality cohort".

A substantial proportion of this cohort had had less than a year's service, and many of these together with some others of longer service had not been exposed to appreciable quantities of dust. In their first report on mortality, McDonald *et al.* (1971) stated that the selected cohort comprised 11,788 persons who met the criteria.

Attempts were made, under the supervision of Professor Alison D. McDonald, to trace every person in the cohort, to establish whether he or she was alive or dead, and if dead to seek details of exact date and place of death, so that a copy of the death certificate could be obtained. The search for ex-employees was initiated in the mining towns, through relatives and friends, and was extended to parish registers, provincial death records, the Canadian Unemployment Insurance Commission (UIC) and eventually to many other areas and organisations. Many deaths were reported as having occurred in other provinces, in the United States, and overseas. Careful examination was made of the field information, and many additional enquiries were undertaken to ensure that the tracing was reliable. In particular, it was sometimes found necessary to alter an earlier decision, previously made in terms of information on the buff cards only, as to whether these cards referred to one or more persons. The quality of tracing is discussed briefly in Chapter 7.

Tracing was carried out to four points in time: 1 November 1966 (McDonald *et al.*, 1971); 31 December 1969 (McDonald *et al.*, 1973; 1974); 31 December 1973 (Liddell, McDonald and Thomas, 1977); and 31 December 1975 (McDonald *et al.*, 1979). The numbers reported were as follows:-

	Total cohort	Traced	Traced as per cent of total	Reported dead	Deaths as per cent of traced
1966	11,788	10,421 *	*88.4*	2,457	*23.6*
1969	11,572	10,120	*87.5*	3,270	*33.7*
1973	11,391	10,245	*89.9*	4,110	*40.1*
1975	11,379	10,257	*90.1*	4,547	*44.3*

* including 598 registered with the UIC between 1964 and 1 November 1966, and presumed alive.

The "loss" of 400 persons (3.5 per cent) from the originally defined cohort was for several reasons: buff cards thought to refer to different persons were in fact found to concern only one, in more instances than the reverse occurred; and stricter application of the criteria for selection revealed some originally included who should not have been. More stringent definitions for acceptability of tracing reduced the number reported as traced at end-1969 compared with three years earlier, but unceasing efforts have now improved the trace rate to over 90 per cent; see also below.

Cause of death, from the death certificate in the vast majority of cases, was coded according to the Seventh Revision of the International Classification of Diseases by a senior coder recently retired from the Department of Demography of Quebec. Some death certificates could not be obtained, because the death had occurred before registration was introduced in Quebec in 1926 or because it had taken place outside Quebec in regions where authorities would not provide copies. In some of these cases an acceptable cause of death was elicited from relatives.

A smoking history was sought from those alive and from relatives and friends of those who died after 1950. The information was coded in

four categories:- number of cigarettes smoked a day, age when started smoking, and if appropriate when quit smoking, and whether a pipe smoker or not. Unfortunately, the coding was found to have been carried out inexpertly, and care is needed in interpretation; see Liddell, McDonald and Thomas (1977, p. 477). In preliminary work for this last cited paper, I studied the records to the end of 1973, for males, and found that 84.2 per cent of losses, i.e. those not traced, were before 1936. Of 9,723 men known to be alive in that year, 5,797 were traced alive, 3,750 were known to have died, and only 176 were untraced (59.6 per cent, 38.6 per cent and 1.8 per cent, respectively). Of the 8,672 known to be alive in 1956, smoking questionnaires had been completed for 5,771 still alive in 1974, for 2,600 who died 1956 through 1973 and four who were alive in 1965 but were subsequently lost to view, i.e. for a total of 8,375 (or 96.6 per cent). Another way of expressing these findings is that for the 9,834 men traced to the end of 1973, smoking history was not known for 1,090, all but 26 of whom had died, mainly before 1950 so that smoking histories had not been sought.

4.7 The "physiology cross-section"

This name is given to an age-stratified sample of current male employees who were examined, in 1967 and 1968, using (a) a respiratory symptom (and smoking) questionnaire, (b) lung function measurements, and (c) the chest radiograph. The study was carried out primarily to determine the relationships between exposure to dust on the one hand and the various signs and symptoms that could be assessed by the tools listed above on the other hand. Because there were so few women in the industry, most of whom had been employed in low dust

concentrations, the study was confined to men; it was decided to include higher than representative proportions of older men.

From the register of persons ever employed in the industry up to 1 November 1966, it was determined that there were 6,415 current employees, of whom 6,180 were males. The 102 who were less than 21 at the time to which the register referred and the 37 who were 65 or more were excluded. A random sample was taken from each remaining five-year age group to yield a total of 1,027; the sampling fraction varied from 14 per cent in those of ages 21 through 25, to 47 per cent of those 61 through 65. The examinations took place in the summer of 1967, but only 885 men were seen and tested: 85 had died or left and 57 refused to participate. These losses were mainly among older men, and in the following summer all 241 men still at work and aged 61 through 65 but not already examined were called; a further 185 sets of tests were carried out.

A total of 1,069 men were tested, and included in a study of lung function in relation to radiographic changes (Becklake *et al.*, 1970). However, a serious deficiency in the questionnaire or the records of the lung function tests, or in the work history, led to the exclusion of 54 men, so that studies of respiratory symptoms and lung function in relation to dust exposure were confined to 1,015 men (McDonald, Becklake *et al.*, 1972; Becklake *et al.*, 1972).

The British Medical Research Council Questionnaire on Respiratory Symptoms (1966) was used with slight modifications and after translation into French, so that each man could be intereviewed in the lan-

guage of his choice. One fluently bilingual interviewer administered the questionnaire to all but 16 men (among the 54 excluded as noted above). Smoking history was recorded in the usual way during these interviews, and ages were verified; many required correction compared with the information on the buff cards.

In each of the two mining towns, a field laboratory was set up and the two technicians each tested eight men a day. Becklake *et al.* (1972) reported as follows: "The following tests of lung function were carried out in the order listed, using methods described fully elsewhere: (1) carboxyhemoglobin level measured by an oxygen rebreathing technique; (2) functional residual capacity (FRC) using a helium dilution technique; (3) vital capacity (VC) followed by three tests of forced vital capacity (FVC), the largest of which was also analyzed for the forced expiratory volume expired in 0.75 second ($FEV_{0.75}$) and in 1.0 second ($FEV_{1.0}$), for the $FEV_{1.0}$/FVC ratio expressed as a percent, and for the maximal midexpiratory flow (MMF); (4) diffusing capacity for carbon monoxide at rest measured by the single breath method ($D_{CO}[SB]$) as the product of Krogh's diffusion constant (K) and alveolar volume (TLC[SB]) calculated from helium dilution by the single breath; and (5) diffusing capacity for CO ($D_{CO}[SS]$) and the CO extraction rate (%) measured by the steady-state method at rest and at two levels of exercise (200 and 400 kg.meters/min) on a bicycle ergometer. Minute ventilation ($\dot{V}_1$) and oxygen consumption ($\dot{V}_{O_2}$) were also measured at the same time."

4.8 Procedures for reading 15,689 radiographs

As previously mentioned, the most recent radiographs of 15,689

guage of his choice. One fluently bilingual interviewer administered the questionnaire to all but 16 men (among the 54 excluded as noted above). Smoking history was recorded in the usual way during these interviews, and ages were verified; many required correction compared with the information on the buff cards.

In each of the two mining towns, a field laboratory was set up and the two technicians each tested eight men a day. Becklake *et al.* (1972) reported as follows: "The following tests of lung function were carried out in the order listed, using methods described fully elsewhere: (1) carboxyhemoglobin level measured by an oxygen rebreathing technique; (2) functional residual capacity (FRC) using a helium dilution technique; (3) vital capacity (VC) followed by three tests of forced vital capacity (FVC), the largest of which was also analyzed for the forced expiratory volume expired in 0.75 second ($FEV_{0.75}$) and in 1.0 second ($FEV_{1.0}$), for the $FEV_{1.0}$/FVC ratio expressed as a percent, and for the maximal midexpiratory flow (MMF); (4) diffusing capacity for carbon monoxide at rest measured by the single breath method ($D_{CO}[SB]$) as the product of Krogh's diffusion constant (K) and alveolar volume (TLC[SB]) calculated from helium dilution by the single breath; and (5) diffusing capacity for CO ($D_{CO}[SS]$) and the CO extraction rate (%) measured by the steady-state method at rest and at two levels of exercise (200 and 400 kg.meters/min) on a bicycle ergometer. Minute ventilation ($\dot{V}_1$) and oxygen consumption ($\dot{V}_{O_2}$) were also measured at the same time."

4.8 Procedures for reading 15,689 radiographs

As previously mentioned, the most recent radiographs of 15,689

persons had been collected (Rossiter *et al.*, 1972). They were to be used for several purposes, *viz:* (a) an examination of the U/C classification; (b) for relating to respiratory symptoms and lung function in the physiology cross-section; and (c) for relating to dust exposure measures. Six readers, all of whom had helped in the development of the U/C classification, participated in the reading which took place in three stages. First, a random sample of 600 films was read once each by all six readers, working independently, to allow an examination of inter-observer variation; so also were the films of the subjects in the physiology cross-section, to provide the most reliable basis for relating radiological findings to function measurements. All the films were then reassembled into thirty batches, by a quasi-random procedure of shuffling, and each reader read five batches. This second stage permitted some study of intra-observer variation, for each reader had now read a considerable number of films on two occasions. Finally, a complex procedure was adopted whereby all films which at the second stage had been recorded as in any way abnormal (by a single reader) were read by three others, and a sample of those assessed as normal at stage two were read by at least one other reader. The total number of assessments (excluding those on films considered unreadable) was 42,022; we have recently found that there were 1,868 sets of six readings, one per reader, from the first stage (a total of 11,208 assessments), 15,570 readings at the second stage (almost equal numbers by each reader, varying only between 2,553 and 2,611), and a further 15,244 at the third stage.

As a preliminary to the study of the relationships between radiographic findings and indices of dust exposure, the following films

were excluded: those of students employed in the summer only; those of applicants examined but not employed; those for men whose personnel records had been destroyed; a few for subjects with otherwise incomplete work histories; and a few films of very poor quality. This left 13,021 (or 83 per cent), of whom 12,174 were of males. Of these, 967 were listed as past or present employees of the small factory at Asbestos, leaving 11,207 production workers. In the report by Rossiter *et al.* (1972), relationships between radiological changes and indices of exposure were examined in the males aged 36 through 65 at the time of last recorded job in the industry (to November 1966); there were 6,129 production workers and 398 factory workers.

4.9 The "radiographic progression cohort"

In 1975, Eyssen reported on a study which had had the objectives: (1) to determine the most suitable method of assessing radiographic progression in the individual to allow the changes to be related to measures of his exposure; (2) to make a first examination of the relationship between radiographic progression and asbestos exposure; and (3) to describe changes over the years in the prevalence of radiographic change in the Quebec chrysotile producing industry. Eyssen stratified the 12,174 male subjects defined by Rossiter *et al.* (1972) - see previous section - by place of work (Asbestos or Thetford Mines), length of employment and whether they showed evidence on the latest film to 1966 of radiographic abnormality or not. Random samples were drawn from each stratum, with high sampling fractions for strata containing abnormal films and low fractions for strata with only normal films. In this way, 283 men were selected; for each man five radiographs were collected, including the latest available at that time,

i.e. up to 1971, and four previous films at roughly five year intervals spanning about 20 years.

Two methods of assessment were adopted by five readers, all of whom had been concerned in the main reading described in the last section. One method was side-by-side reading of the films in known temporal order, using the ILO U/C (1971) classification with further fourfold elaboration of the scales of (i) profusion of small opacities, both rounded and irregular; (ii) both width and extent of pleural thickening; and (iii) ill-defined cardiac outline. The other method was independent reading of all the films in randomized sequence into the (unmodified) complete ILO U/C (1971) classification (ILO, 1972).

This work was carried out before the mortality analysis to the end of 1973, and so the revised dust exposure calculations on an annual basis were not available even for those men in the present study who were in the "main mortality cohort". Calculations were carried out *ad hoc* of exposures in the quinquennia up to the earliest film for each man included in the study, and for the three periods between that film and the next three succeeding films included. Smoking histories were available for the men also in the "main mortality cohort" but not for the others. The two medical clinics, at Asbestos and Thetford Mines, provided what information they could from the subjects' medical histories on the smoking habits of these men, and so it was possible to classify all but three subjects as smoker or not; the three with unknown history were treated as smokers as the more likely habit.

For a more detailed examination of radiographic changes in relation to dust exposure, and other factors (Liddell, Eyssen *et al.*, 1977), closer study of the work histories revealed discrepancies, or employment outside the Quebec asbestos industry in work that involved exposure to asbestos or other dusts, in twelve men; these and four for whom there were important gaps in the radiological findings were excluded from the analyses, which were based on the side-by-side readings of four readers only, because one had not completed assessments on all films.

4.10 Summary

In 1967, Professor McDonald's team registered all workers, nearly thirty thousand, who had been employed in the Quebec chrysotile producing industry some time since its inception, in 1878, and November 1966. For various studies, the following populations were defined:-

(a) The "main mortality cohort" of those born in the years 1891 through 1920 who had been employed for one calendar month or more. Improving information over the years and stricter application of the criteria for inclusion in the cohort have reduced the numbers slightly from those first reported, and there are now 11,379 persons in the cohort, including 440 females (McDonald and Liddell, 1978).

(b) The "physiology cross-section", a sample of males at work in November 1966, weighted heavily towards the older age groups. A total of 1,069 men were interviewed, but data from respiratory symptoms questionnaires and lung function tests were complete for only 1,015 (McDonald, Becklake *et al.*, 1972;

Becklake *et al.*, 1972).

(c) The "radiographic progression cohort", a sample of 283 men for whom five chest radiographs were available spanning an average of twenty years. Because of some doubts about work histories, including exposure to possible airborne health hazards outside the Quebec industry, the cohort was reduced to 267 for further analysis (Eyssen, 1975; Liddell, Eyssen *et al.*, 1977).

(d) All persons, totalling 15,689, who had had a routine chest radiograph at one of the medical clinics in the Eastern Townships before November 1966. Exclusion of students employed in the summer only, applicants for work not taken on, some for whom personnel records had been destroyed and a few whose films were of very poor quality reduced the effective study population group to 13,021. However, the latest film for all 15,689 was collected and assessed.

As the main aims of the investigation were to relate dust exposure assessments for each worker to mortality and other biological responses to asbestos exposure, calculations were made of accumulated dust exposures, through work histories and estimates of dust concentrations, for all persons included in the various facets of the enquiries (Gibbs and Lachance, 1972; Liddell, McDonald and Thomas, 1977). Other indices of exposure were also obtained for certain specific purposes.

Chapter 5

QUEBEC CHRYSOTILE STUDIES II: FINDINGS

5.1 Introduction

In this chapter, I review the main findings from the studies by Professor J. C. McDonald and his colleagues of the health effects of asbestos exposure in the miners and millers of Quebec chrysotile. Sections 5.2 and 5.3 deal with radiological changes, respiratory symptoms and lung function, each in relation to asbestos dust exposure, and the next section with the interrelationships of signs and symptoms. Sections 5.5 and 5.6 concern mortality in relation first to dust exposure and then to radiographic changes. A brief summary follows, and in Chapter 6, the findings from other studies, both in chrysotile and in relation to other fibres, are discussed.

5.2 Radiological changes in relation to dust exposure

Of the two earliest reports relating radiographic appearances to exposure to asbestos dust (Rossiter *et al.*, 1971; 1972), the first was of a preliminary nature, concerning only 809 employees of one company at Thetford Mines. The authors' own summary (Rossiter *et al.*, 1971, p. 206) states that: "Small rounded opacities were related to total dust, but not to the other two indices, and ill-defined cardiac outline to total dust weighted by physical effort. Pleural thickening

and pleural calcification were related to age, but not to any dust index ... The distribution of pleural plaques in the Quebec asbestos mining areas was not uniform, the greatest concentration being in those who have worked in or near this mine." Their conclusion that their findings justified the use of the U/C classification could be accepted, but the results themselves needed generalization.

The main study (Rossiter *et al.*, 1972; also summarized by McDonald *et al.*, 1974) provided that generalization. The main concern was with all male production workers aged 36 through 65 who had ever had a chest radiograph; they numbered over six thousand. A further 398 male factory workers in the same age range were also considered. In each case, the radiographs examined were the latest available to 1966, and the workers' ages used in these reports were at 1 November 1966 for current employees, and at the end of employment for ex-employees. As radiographs were supposed to be taken annually, it might be expected that the age at x-ray was on average six months less than the reported age; it seems likely, however, that the average interval between x-rays was greater than a year, because of missed appointments and similar reasons, and the age at x-ray may have been on average rather more than six months younger than reported. However, the bias thus introduced into an individual's age is likely to balance out in the cross-sectional study reported here.

The men were classified by mining area, Asbestos or Thetford Mines, by five-year age-groups and separately by the five dust exposure indices outlined in section 4.5 above.

The procedures for reading the radiographs have also been described above; see section 4.8. Although it would have been simplest to derive an assessment for each film by averaging the category for each feature for the readers involved, up to six, it was thought that more information would be obtained by taking account of the distributions of categories for the individual readers in the random series of 600 films all had assessed, and that this would allow for inter-observer variability. To this end, radiological indices were calculated on scales whereon, for each factor, the change from the lower to the upper end of category (or grade) 1 was taken as the unit; these ends of the category were labelled 1 and 2 respectively. The distribution of categories for individual readers in the series of 600 films they had all read were used to "adjust" for differences between readers in their levels of reading. Thereafter, the scores were averaged for use directly in regression analyses; for prevalence statements however, the average scores were "discretized" and also often standardized for factors of less than immediate concern. Further, this scoring process was only possible for the graded features of the U/C classification; other features were taken as present if at least half the readers who had assessed a particular film thought so. Despite the unequal number of readers to a film, the authors considered that the reading pattern would have led to only small biases (Rossiter *et al.*, 1972); however, without full details of the adjustment procedure, it is not possible to examine its justification. At the worst, however, it could have affected only slightly the general patterns revealed in the analysis.

The main findings of this study illustrated in Figure 5.1 (taken from Rossiter *et al.*, 1972), can best be quoted from McDonald *et al.*

Figure 5.1

RADIOLOGICAL SCORES

Variation in the average score from cohort to cohort, with and without standardizing for exposure differences.

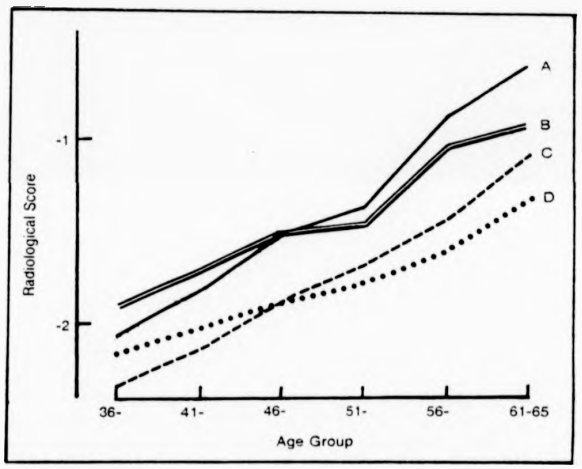
A Thetford Mines

B Thetford Mines, standardized for exposure

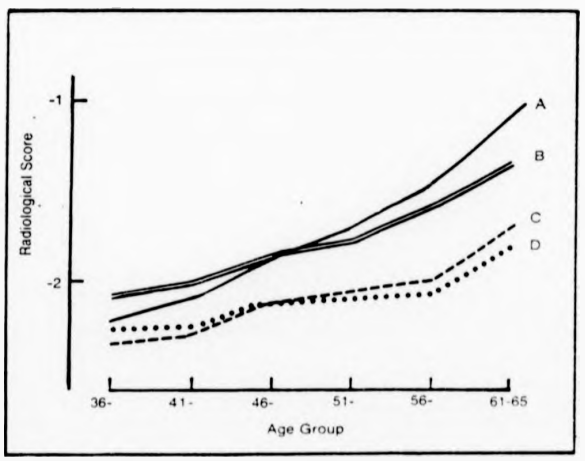
C Asbestos

D Asbestos, standardized for exposure

Irregular small opacities



Pleural thickening



(1974), *viz:* "The two main roentgenographic indices of response to asbestos exposure are irregular small opacities and pleural thickening. The prevalence of these, and of all other roentgenographic changes, were higher in the Thetford Mines area than in the Asbestos area of Quebec, although the two areas are only 80 km apart and the asbestos mined is geologically similar. The association of the changes with dust exposure was also stronger at Thetford Mines than at Asbestos. ... At Thetford Mines the prevalence of irregular small opacities of category 1 or more rose steadily with increasing dust exposure, whereas for category 2 or more the relation to dust exposure was less marked, except for the considerable rise in the most exposed workers. Even with allowance for differences in dust exposure, the prevalence of category 1 or more was markedly age-related, rising to 14.8% for those 61 to 65 years old. This age effect was much lower for category 2 or more, and amounted to only about one third of the change associated with dust exposure. At Asbestos, the prevalence of irregular small opacities of category 1 or more rose to 9.2% for those aged 61 to 65, and there was virtually no relation to dust exposure. With respect to only category 2 or more, the relation to age was much lower and prevalence increased among those with the highest dust exposure. For pleural thickening, the effect of age was slightly greater than the effect of exposure on the prevalence of grade 1 or more, and of grade 2 or more, for both mining areas.

"The biggest difference among all the roentgenographic features was in pleural calcification, for which the prevalence of grade 1 or more was 0.4% at Asbestos and 5.2% at Thetford Mines. In spite of the relationship to dust exposure, no correlation exceeded 0.3. This

is largely a reflection of the very high proportion of men who showed no roentgenographic change. Some of the differences between the two areas were not surprising, as overall dust exposure levels at Asbestos were considerably lower than at Thetford Mines, but others cannot be explained in terms of dust exposure or geology. If variation in fibre content of dust were an important factor, the results in mine workers, for whom the fibre proportion would be low, should differ from those for mill workers, in whom the fibre proportion would be higher. Altogether, there were 506 persons who had worked for ten or more years entirely in mining or entirely in milling. Analysis of roentgenographic changes in these men showed that mill workers had slightly higher prevalence of irregular small opacities, but the differences between Asbestos and Thetford Mines remained. No other consistent differences could be detected between the mine and mill workers.

Two further reports on radiological changes in relation to dust exposure were based on the "radiological progression cohort"; see section 4.9. The first of these (Eyssen, 1975) was concerned mainly with a choice between methods of assessing radiographic change in serial films. Correlations between measures of exposure and of radiographic progression had the first objective of determining whether either side-by-side reading of all five films in known temporal sequence into fine scales of profusion produced consistently higher correlations than independent randomized reading into the ILO U/C (1971) classification, without amendment; only a secondary objective was to elucidate any readily available epidemiological findings (Eyssen, 1975, p. 102). In the event, the correlations between radiographic progression, however assessed, and levels of dust exposure whether before the first

film or in the intervals between films were not substantial.

The other study (Liddell, Eyssen *et al.*, 1977) of the radiological progression cohort related to 267 men, excluding several from the complete cohort who had had exposure in the intervals between films or whose work histories were in considerable doubt. The analysis took place in three phases. Phase 1 was a "cross-sectional" study of all 267 men, to relate the x-ray status of the earliest selected film to potential stimuli. The men were then classified into two cohorts. The first cohort consisted of 150 men whose earliest film in the study contained no evidence of abnormality according to all four readers using both side-by-side and independent reading; Phase 2 was a study of "attacks" in this cohort. The remaining men formed the second cohort, and Phase 3 was a study of the progression of radiographic changes in these men from their first film which could be treated as "less-than-normal" over the rest of the period, averaging twenty years in total, covered by the available x-rays.

Phase 1 showed that abnormality in the earliest film was related mainly to the time since first employment, in close conformity with the findings earlier of Rossiter *et al.* (1972). Phase 2 revealed that, in 45 of the 150 men completely normal at first film, some radiological abnormality developed during the period of observation: incidence was weakly related to age; at Asbestos, the risk of developing small opacities was lower in smokers than in non-smokers. In Phase 3, there was an irregular pattern of correlation, more evident in Thetford Mines than in Asbestos, between radiological progression and various stimulus variables.

Liddell, Eyssen *et al.* (1977) concluded that associations between radiological responses and measures of asbestos exposure were, as always, weak, despite powerful methodology. They felt this indicated that effects were obscured by other factors (including susceptibility) uncorrelated with exposure. Several possibilities required consideration. First, the variables - response, stimulus or disturbing - chosen for analysis may not have been the most appropriate; or they may have been inaccurate. The x-ray shadows are only indirect signs of disease, and their assessment is seriously hampered by observer variation (despite attempts to minimise it by taking all four readings into account) and by the inevitable changes of radiographic technique over such a long period of study (again perhaps better allowed for in side-by-side reading than when films were read independently). The dust measurements were, of course, at best with imperfect instruments, sometimes only educated guesses, and not necessarily bearing much relationship to dust retention in the lung. Secondly, if asbestosis is progressive, radiographic change will be observed in men with long service, irrespective of recent exposure. Thirdly, there may well be differences in factors of social, psychological, behavioural, physiological or immunological nature that modify the amounts of dust inhaled, the proportion and constitution of what is retained, and the nature of the pathological response. In this study, 80 per cent of the men exposed for over 30 years, often to heavy concentrations, remained completely unaffected as far as their chest x-rays were concerned, whereas others were attacked after quite short periods of employment in the more recent eras when dust concentrations were comparatively low.

5.3 Respiratory symptoms and lung function in relation to dust exposure

As explained in the previous chapter, an age-stratified sample of 1,015 current male employees was examined, mainly in 1967, to explore the relationships between respiratory symptoms and lung function, on the one hand, and, on the other, dust exposure, taking age and smoking habit into account. There are two reports, which deal with symptoms (McDonald, Becklake *et al.*, 1972) and function tests (Becklake *et al.*, 1972) separately.

The symptoms studied were: winter cough; winter cough for three months of the year; phlegm in winter; phlegm in winter for three months of the year; cough and phlegm for three months of the year; wheezing most days; nasal catarrh for three months of the year; breathlessness compared with others of the same age; and disabling chest illness in the last three years. As far as possible, terms were used in the same way as others had used them, to allow comparison between studies. Smokers were classified in two ways, by current habits and in terms of cumulative numbers of cigarettes (or equivalent) smoked. The index of exposure to asbestos was the accumulated dust exposure.

The distributions of cough, phlegm and wheezing all followed a similar pattern: prevalence increased with age, and rates were much higher for smokers than for non-smokers or ex-smokers. However, they did not appear to be associated with dust exposure, except perhaps in men over 50. On the other hand, breathlessness, although increasing with age, was not clearly related to smoking but showed a definite, positive, association with dust exposure; this finding was not sensi-

tive to the degree of breathlessness being considered. Disabling chest illnesses were associated with age only, and nasal catarrh showed no important or consistent trends.

Attempts to disentangle the effects of the three factors (dust, smoking and age) were not entirely successful. However, the authors concluded that the prevalence of persistent cough and phlegm (bronchitis) was related to age and smoking habits and *perhaps* (my emphasis), in non-smokers and light smokers, also to dust exposure. Breathlessness on excercise was related to age and dust exposure but not to smoking. The age-corrected prevalences of breathlessness given by McDonald, Becklake *et al.* (1972, Table 4) have been further adjusted for smoking habit by the "equivalent average" method (Yule, 1934) in Table 5.1.

For the examination of lung function tests, the men were divided into only two groups according to their smoking habits, non-smokers being those who had never smoked even one cigarette a day for as long as a year. Thereafter, each group was divided into six classes according to accumulated dust exposure, and mean values of the various test measurements were calculated for each class, after "standardization" for age, height and weight, by means of a series of regression analyses. Many of the function measurements were associated with dust exposure; see Figure 5.2. The following paragraph is quoted from Becklake *et al.* (1972).

"*Lung volumes.* - In both non-smokers and smokers the standardized mean value for total lung capacity (TLC) fell with increasing dust ex-

Table 5.1

PREVALENCE OF BREATHLESSNESS
BY DUST EXPOSURE

1,015 men in the "physiology cross-section"

(Age-corrected prevalence percentages,
further adjusted for smoking habit)

Dust exposure accumulated to November 1966 (mpcf.y)	Prevalence of breathlessness (%)
Less than 10	5.0
10, less than 100	16.4
100, less than 200	23.8
200, less than 400	24.4
400, less than 800	28.8
800 or greater	38.0

Figure 5.2

LUNG FUNCTION, SMOKING AND DUST EXPOSURE

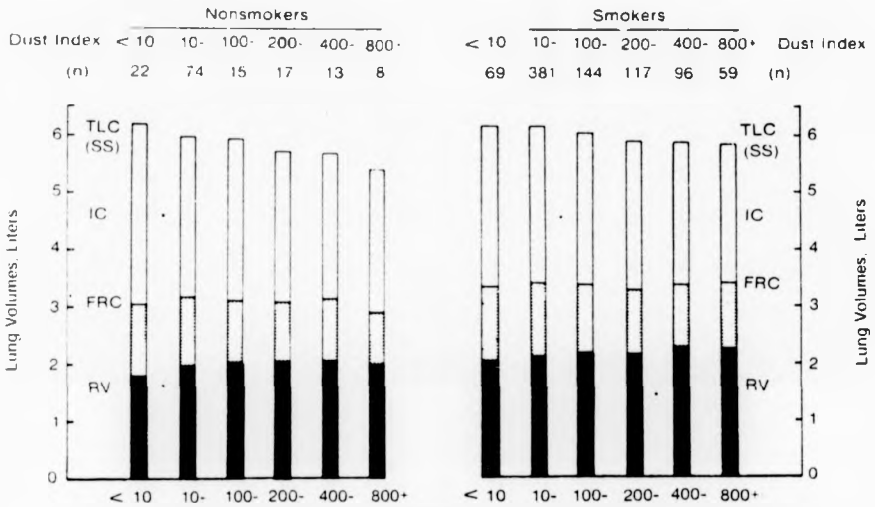
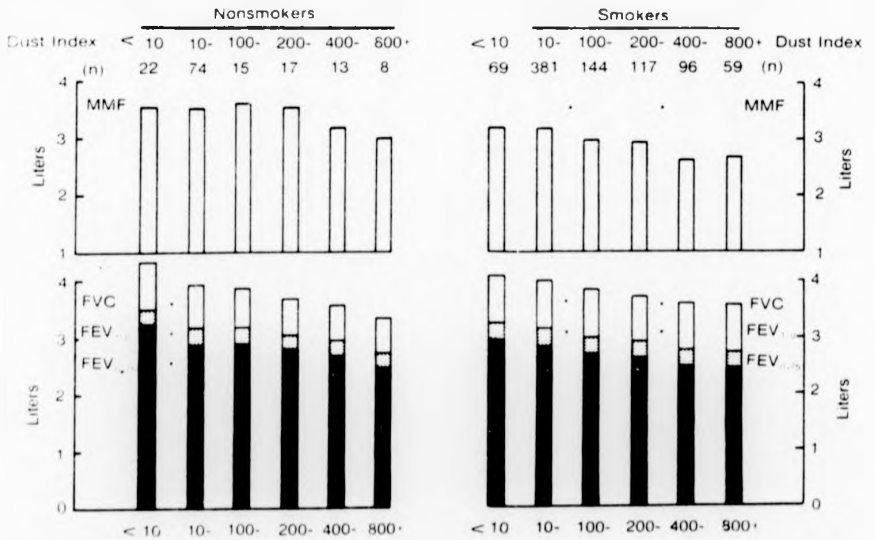


Fig 1.—Standardized mean values for subdivisions of lung volume (TLC[SS], IC, FRC, and RV) in nonsmokers and smokers divided by dust index. Number (n) of individuals in each subgroup is indicated.

Fig 2.—Standardized mean values for flow rates (MMF, $FEV_{.75}$, $FEV_{1.0}$ and FVC) in nonsmokers and smokers divided by dust index. Number (n) of individuals in each subgroup is indicated.



posure, due primarily to reduction in the inspiratory capacity (IC = TLC - FRC). Since IC is one of the components of VC, a fall in relation to increasing dust exposure was also seen in the FVC. In non-smokers the other subdivisions of lung volume, in particular FRC and residual volume (RV), did not show any evident trend with increasing dust exposure. In smokers, however, there was a progressive increase in RV. *Flow rates.* - Both in non-smokers and smokers, there was a progressive fall in FEV with time ... These decreases were probably attributable in part to diminished VC (or FVC) with increasing dust exposure. In contrast, MMF and $FEV_{1.0}$/FVC were reduced only in the higher dust index groups in non-smokers. Results of both tests were lower on average in smokers than non-smokers but were only reduced substantially in men with high dust exposure. *Diffusing capacity.* - Neither of the standardized measurements of diffusing capacity at rest ... showed any consistent trend in relation to increasing dust exposure in non-smokers or smokers. There was a fall in diffusing capacity on exercise ... with increasing dust exposure in the non-smokers, though because of the small numbers in five of the six non-smoker dust-exposure subgroups, this conclusion is tentative. However, the highest standardized values for D_{CO}(SS) both at 200 kg.meters/min and at 400 kg.meters/min were seen in the non-smokers with insignificant dust exposure [less than 10; and 10, but less than 100 mpcf.y]. Among the smokers, there was a fall in diffusing capacity on exercise ... but much less than that seen in non-smokers."

An important objective of the complete research programme was reported by Becklake *et al.* (1972) to be to determine methods of surveillance of workers exposed to asbestos but as yet unaffected accord-

ing to any clinical test. The authors gave their opinion that IC, FVC and FEV, which were sensitive to even low levels of exposure in non-smokers, and related to dust exposure over the full range in both non-smokers and smokers, would be suitable for health surveillance. However, the effects of dust exposure in smokers, although doubtless of statistical significance, were no larger than the standard errors of the variation about the regression lines, and even in non-smokers were not more than about half as large again as the corresponding standard errors. Thus, the mean standardized ICs for non-smokers exposed to less than 10 and more than 800 mpcf.y were 3.12 litres and 2.47 litres respectively, a difference of 0.65 litres, whereas the standard error was 0.58 litres. For smokers, the corresponding figures were: 2.81 and 2.43, with a difference of 0.38 litres and standard error 0.53.

5.4 Interrelationships of signs and symptoms

In the two foregoing sections, we have considered how various signs and symptoms were related to dust exposure. In this section, we examine their interrelationships. There seems to have been no study of how respiratory symptoms and lung function measurements were related in Quebec asbestos workers, and publications concerned with radiographic signs relate them only to function. A first report was made by Dr. M. R. Becklake and her colleagues to the 1968 Dresden conference; it was based on those members of the age-stratified sample for the physiology cross-section who were fully tested in 1967 (before its extension in 1968). This was superseded first by a summary report and then by a much fuller account with the same authorship (Becklake *et al.*, 1970).

The population studied consisted of all 1,069 men tested in 1967 and 1968. In other words, 54 men for whom data were incomplete were included, where possible, although they reduced the "physiology cross-section" to 1,015. This meant that the analyses were based on different numbers according to the function tests under review. The numbers of men included were as follows:- 1,062 for lung volumes; 1,059 for expiratory flows; and for diffusing capacities 840 (single breath), 1,049 (steady state), 932 (exercising at 200 kgm/min), 413 (at 400 kgm/min) and 149 (at 600 kgm/min).

It is implied (Becklake *et al.*, 1970, p. 641) that all 1,069 films for the complete population had been evaluated by each of the six readers, into the U/C classification. The subjects were themselves classified according to "the second highest reading" of small irregular opacities, the only parenchymal change of any importance because small rounded opacities were rarely recorded. Pleural change was taken as present if reported by at least two of the six readers.

As in the already discussed study of lung function measurements, these were "standardized" for age, height and weight by a complex regression procedure. The adjusted mean of each function measurement for the radiological group showing no parenchymal change (profusion of small irregular opacities 0/0; with six readers it would hardly occur that the second highest reading was 0/-) was taken as reference, and the mean for each other radiological group was expressed as a deviation from the reference. The effects of pleural changes were similarly assessed.

In those workers whose x-rays showed no sign of parenchymal disease, i.e. in the reference group, comparison with other populations suggested that VC and FVC might be slightly lower than "normal". In the presence of definite though minimal changes in the pulmonary parenchyma, VC and FVC were the only measurements to show "significant" reduction. Once more the word "significant" is being used in its statistical sense; for example, in those men whose profusion of small irregular opacities was, on the criteria given, 0/1, VC was over 95 per cent of that for the reference group. The authors write about function changes being "indicators of the progress of radiological disease" (Becklake *et al.*, 1970). The meaning is obscure, and what they are reporting is simply a matter of associations. Undoubtedly, VC was lower the higher the profusion of small irregular opacities, and there were several other tests which were similarly related, although they probably had substantially higher standard errors so that significance, in the statistical sense, was lower. Minute ventilation on exercise was selected by the authors as the most "sensitive" of the "indicators" other than VC. For any given grade of profusion of small irregular opacities, function was somewhat reduced when pleural thickening or calcification was also present.

5.5 Mortality in relation to asbestos exposure

Probably the most valuable of the Quebec chrysotile studies is the continuing evaluation of the effects of asbestos exposure on mortality. Tracing has been carried out to four points in time, and results have been presented in five reports, while one is in the final stages of preparation, *viz.*

Deaths to 31 October 1966	McDonald *et al.* (1971)
Deaths to the end of 1969	McDonald *et al.* (1973; 1974)
Deaths to the end of 1973	Liddell, McDonald and Thomas (1977)
Deaths to the end of 1975	McDonald and Liddell (1978); McDonald *et al.* (1979)

In a summary of the health of chrysotile mine and mill workers of Quebec, McDonald *et al.* (1974) wrote: "By the end of December 1969, 87.5 per cent of the 11,572 persons in the cohort [i.e. the "main mortality cohort"] and 99 per cent of those who had worked ten years or more had been traced. Of these, 3,270 had died, comprising 65.4 per cent of those born 1891 to 1895, but only 9.8 per cent of those born 1916 to 1920. The age-standardized mortality [i.e. deaths accumulated over the complete period of observation] per 1,000 men for certain causes of death are given in Table 3 [reproduced here as Table 5.2]. Cancer of the lung showed a rising rate with increasing dust exposure, particularly in the two highest dust exposure groups. Cancers of the gastro-intestinal tract also showed a rise in the two highest, and pneumoconiosis in the highest categories of dust exposure. Of 134 deaths in men from respiratory cancer, five were from pleural mesothelioma. These cases showed no clear relationship with dust exposure. There were no peritoneal mesotheliomas. Mortality from all causes fell with increasing dust exposure up to the highest dust group, probably because those who died young could not attain a high dust exposure. On the basis of Quebec death rates, the expected number of respiratory cancer deaths in the cohort was 139, or about 93 on the basis of estimated rates in the mining region. This suggests that mortality from respiratory cancer in the Quebec chrysotile industry as a whole has been at most 50 per cent above expectation and probably about

Table 5.2

MORTALITY TO END-1969
OF QUEBEC MINERS AND MILLERS

9,692 men in the "main mortality cohort"

(Cumulative mortality rates, per thousand men, standarized for era of birth)

Accumulated dust exposure (mpcf.y)	Cause of death			
	ALL CAUSES	Respiratory cancers *	Abdominal cancers	Pneumo-coniosis
Less than 10	365	10.3	18.0	1.6
10, less than 100	355	13.1	13.6	1.5
100, less than 200	354	13.4	18.7	0.8
200, less than 400	313	15.5	11.6	4.9
400, less than 800	323	21.4	26.3	4.9
800 or greater	395	32.1	28.7	23.6

* includes malignant pleural mesothelioma

25 per cent."

The earliest methods of analysis were known, from the start, not to have been ideal, and some improvements had already been incorporated in the reports of deaths to the end of 1969. In 1974, McDonald *et al.* stated that the first main weakness was that length of exposure might well have been related to length of survival - only those who survived say 30 years from first employment could have had 30 years of employment. The second lay in the use of deaths accumulated over many years (from 1910 to 1966) for a single calculation of mortality. An attempt had been made to overcome the first by use of a parametric approach due to Berry (1970), but this had not been entirely successful. One reason was that the two measures of exposure on which the analysis was based, i.e. years of employment and accumulated dust exposure, were so highly correlated that many of the 144 cells in the 4 x 6 x 6 array (four lengths of service, six groups of total exposure, six quinquennia of birth) were void or contained few men and hence no or very few deaths. The second weakness had been examined in 1973, by studying deaths 1967-69 separately - and finding essentially similar patterns. Nevertheless, an analysis based on man-years of exposure, what Case and Lea (1955) called "comparative composite cohort analysis", was planned. Meanwhile, a case-control analysis had already been adopted (Eyssen and Liddell, 1974), which, although only privately circulated because certain shortcomings were appreciated, suggested an important change in the approach to analysis.

So much importance was placed on finding the best methods of

analysis that it was felt desirable to seek advice from experts. This was done in two stages. First, a group met at McGill University in June 1974 to spend two days discussing methods of analysis. A full report (Liddell, 1974) was circulated; after it had been approved by all concerned, a brief summary was published (Liddell, 1975b). The second stage was to prepare an appraisal of methods of cohort analysis, using the Quebec mortality cohort data for applications, and to have this presented to a meeting of the Royal Statistical Society (RSS) where it could be discussed, and where paper, discussion and reply would be published (Liddell, McDonald and Thomas, 1977). Meanwhile, tracing was continued to the end of 1975, and what follows is a summary of these latest findings (McDonald and Liddell, 1978; McDonald *et al.*, 1979). They have been obtained using the methods discussed before the RSS, which appeared to find favour among the discussants who included several experts of impeccable reputation. There were two approaches, using argument *a priori*, from cause to effect, and *a posteriori*, from effect to cause. For the first, the cohort was divided into mutually exclusive sub-cohorts each subjected to Case and Lea's (1955) comparative composite cohort analysis, slightly amended in a Fortran program (PGM1A) written by Mario Rodrigues to my specification. This analysis accumulates man-years in view in each five-year square of the Lexis (1875) space, and calculates deaths expected on the basis of a reference population (here Quebec males) against which observed deaths can be compared. The ratio: (Observed deaths)/(Expected deaths) can be seen to be a Standardized Mortality Ratio (indirect method), or SMR (Liddell, 1960; Liddell, McDonald and Thomas, 1977). The second approach follows Miettinen (1969) in selecting a fixed small number of controls

for each case; this has been shown to have high efficiency (Ury, 1975) and the material can be used for analysis by regression models (Cox, 1972) if required.

According to McDonald *et al.* (1974) the "primary aim has been to define as accurately as possible the quantitative relationship between exposure to chrysotile asbestos and the incidence of lung cancer"; this aim will be examined first. Thereafter, we will consider the evidence on mortality from all causes, pneumoconiosis, other exposure-related diseases, and mesothelioma. The classification of causes of death, coded in the Seventh Revision of the International Classification of Diseases, used throughout our recent studies is given below, in Table 7.1.

For the *a priori* approach, we adopted two classifications of sub-cohorts. In the first, four classes were created according to length of service: less than 1 year (3,007 men); 1 year, but less than 5 years (2,324 men); 5 years but less than 20 years (2,503 men); 20 or more years (3,105 men). Each class was then divided into four (giving 16 subcohorts in all) according to total exposure accumulated up to a maximum of 20 years, and all men who had survived 20 years from first entry to the industry were followed thereafter to the end of 1975. The reasons for these definitions are fully discussed by Liddell, McDonald and Thomas (1977).

In the second *a priori* classification, ten sub-cohorts were formed according to dust exposure accumulated to 45 years of age, and follow-up was from that age onwards. In order to investigate the

interaction with smoking, the ten sub-cohorts were subsequently re-grouped into three, each subdivided by four levels of smoking.

In both uses of comparative composite cohort analysis the reference population was Quebec males. Full details of deaths annually by cause were available only from 1951 through 1973. The 1973 populations and deaths were reproduced as though they had occurred in 1974 and 1975 as well.

For the *a posteriori* approach, we chose four controls for each death from lung cancer. To be eligible, the control (a) had to be born in the same year as the case and to have survived into the year following the death of the case, and (b) had to have worked in the same mining area (Asbestos or Thetford Mines). One control for each case was selected as having similar smoking habit; three other controls without such restriction. Wherever choice was possible, it was made by strict application of a randomization procedure. Controls were found for all 245 lung cancer deaths (after excluding five mesothelioma deaths which had been coded 162-164 on the death certificate), the only relaxation in the criteria being that the first control was not always matched perfectly for smoking. The measure of exposure used in this analysis was dust accumulated up to nine years before the death of the case.

The findings from the three approaches to lung cancer mortality were in close conformity; they were also in very reasonable agreement with those reported earlier, even although those were on fewer deaths and by rather different methods. The Relative Risks in Table 5.3

Table 5.3

RELATIVE RISKS FOR RESPIRATORY CANCER AND ASBESTOS EXPOSURE AT FOUR STAGES OF ENQUIRY

Accumulated dust exposure (mpcf.y)	1966 *	1969	1973 †	1975	Accumulated dust exposure (mpcf.y)
less than 10	1.0	1.0	1.0	1.0	less than 10
10, less than 100	1.1	1.3	1.2	1.1	10, less than 100
100, less than 200	1.5	1.3	1.0	1.2	100, less than 200
200, less than 300	1.2	1.5			200, less than 300
300, less than 400			1.8	1.8	300, less than 400
400, less than 600	2.1	2.1			400, less than 600
600, less than 800			3.0	2.9	600, less than 800
800 or greater	3.2	3.1			800 or greater

* Relative Risks for 1966 and 1969 were derived from cumulative mortality rates, standardized for era of birth.

† Relative Risks for 1973 and 1975 were derived from SMRs. There were differences also in the definitions of exposure.

were all obtained by *a priori* analysis, but with differences in definitions of sub-cohorts and in methods of calculation, as already explained. However, a very similar dose-response relationship was demonstrated at each analysis (McDonald and Liddell, 1978).

Analysis of the case-control material, whether or not the matching was taken into account, indicated that a multiplicative model of the risk associated with smoking and with dust exposure fitted quite adequately. The corresponding *a priori* results are not open to such sophisticated methods of analysis, but do not suggest any alternative explanation.

The relationship of the response of lung cancer mortality by the end of 1975 to the accumulated dust dose in the 245 cases and their controls has kindly been examined by Mr. Geoffrey Berry, of the MRC Pneumoconiosis Unit. It is well fitted by the straight line:-

$$\text{Relative Risk} = 1 + 0.0012(\text{mpcf.y}).$$

The χ^2 statistic of 23.05 with nine degrees of freedom for differences between dust groups can be partitioned into a component of 19.61, with one degree of freedom, for the linear fit, leaving 3.43, with eight degrees of freedom, for departures from linearity. This last component is very small; further, there was no suggestion that any polynomial would improve the fit. Nevertheless, if only exposures up to 300 mpcf.y are considered, it is difficult to detect any excess lung cancer. The results from the 16 sub-cohorts, defined by length of service and average dust concentration, are compatible with either of these interpretations. Further analysis attempting to distinguish between possible models is in hand, but has so far produced no defini-

tive answer.

The exact form of dose-response relationship cannot be determined, but a linear relation is biologically plausible enough for malignant disease. Taking excess risk from respiratory cancer as linearly related to dust exposure in men who vary in their smoking habits, and to amount smoked in men from the same population who vary in their dust exposure, allowed McDonald and Liddell (1978) a rough comparison of the two hazards, by superimposing the relationships. This indicated that the Relative Risk of exposure to 1 mpcf for fifty years might be roughly equivalent to that from smoking three cigarettes a week during a similar period of life.

Relative Risks for a specific cause must, of course, be weighed in the light of overall mortality, otherwise they can be most misleading, as discussed by Liddell (1975c) in terms of a study by Sutherland (1959) of mortality from sinus cancer and lung cancer at a refinery in Port Colborne, Ontario. Sutherland's cohort was of 2,355 men employed for at least five years between 1930 and 1957, and he used the man-years approach of Case and Lea (1955), basing expectations on Ontario age- and cause-specific male death rates. He found Relative Risks of 36.8 for sinus cancer and 2.2 for lung cancer. However, the total number of deaths from these causes was only 26; the excess over expectation was 19. Meanwhile for all causes of death, the Relative Risk was 0.8; the cohort suffered in sum 63 fewer deaths than expected (245 compared with 308). On the more common causes of death (i.e. excluding those specifically studied) the Relative Risk was 0.7: the cohort suffered 80 fewer deaths than expected from these causes (219

compared with 299). The sinus and lung cancer deaths reduced this desirable shortfall by less than a quarter.

In the Quebec cohort, from 1951 to 1975, the number of deaths (all causes) expected, on the basis of provincial rates, was 3,328.2, almost equally divided between Asbestos (1690.2) and Thetford Mines (1638.0). There was a small excess, of about 39 deaths from all causes, at Asbestos and a rather larger one (of 182) at Thetford Mines. Respiratory cancer, in addition to showing the dose-response relationship discussed above, was also in excess of expectation, slightly at Asbestos and substantially at Thetford Mines (7 and 40, respectively). There was a total of 45 deaths from pneumoconiosis, among the 3,549 for all causes, and these are, at least in some senses, always an excess; 11 occurred at Asbestos and 34 at Thetford Mines.

The patterns with cancers of the abdomen were rather more complex. Those of the oesophagus and stomach were close to normal at Asbestos but in substantial excess at Thetford Mines (84 observed, compared with 54.41 expected). Cancers of the colon and rectum were only about three quarters of those expected, in both mining areas, but those of the organs in the abdomen were below expectation at Asbestos and above at Thetford Mines, although neither difference from expectation was very great. Other cancers were slightly above expectation in both places. Heart disease caused mortality very close to expectation in both places; so did stroke at Asbestos, although there was an excess of deaths from cerebro-vascular diseases at Thetford Mines. Tuberculosis deaths were close to expectation at Asbestos, but high at Thetford Mines (41 compared with 25.55 expected) while the deaths from

respiratory conditions not otherwise mentioned were slightly below expectation at Asbestos and slightly above in the other area. Accidental deaths were rather high at Asbestos and slightly above average at Thetford Mines; and deaths from other known causes below expectation at Asbestos and exactly as expected at Thetford Mines.

It was well known that dust concentrations had been considerably higher at Thetford Mines than at Asbestos and that service there had generally been longer. It was, therefore, to be expected that asbestos-related disease would be more common at Thetford Mines than at Asbestos. The dose-response relationship for lung cancer was very similar at the two places, and there were signs of dust relationships for cancer of the oesophagus and stomach, for respiratory tuberculosis and for other respiratory conditions, as well, as was to have been expected, for pneumoconiosis, these last being particularly clear.

Considerable effort has been given to the recognition of malignant mesothelial tumours not only in the cohort, but also in the population of the mining communities, either employees who did not meet the cohort criteria or those never employed by the mining companies. Ten male deaths in the cohort up to end-1975 were thought to be associated with malignant mesothelioma: only in three of these was it so stated on the death certificate; four were certified as "mesothelioma" and coded as benign; and three more were only discovered by study of autopsy findings. There is no easy way of arriving at an expected figure against which the ten can be compared, but from data obtained by McDonald and McDonald (1977), it was estimated to be about 2. In addition, there was one case in a female and, during 1976 and 1977,

four more cases in males. Thus, in all, we now know of 15 cases (all but one male) in the cohort, distributed as follows:- mine and mill workers: 10 at Thetford Mines and 2 at Asbestos; factory workers at Asbestos: 2 males and 1 female (McDonald and Liddell, 1978).

A final comment is required on female mortality. There were 440 women in the cohort; most had had short service, mainly in fairly low dust concentrations, so that very few had accumulated high dust exposures. Trace rates were higher even than for men, and there were fewer deaths than expected on the basis of provincial rates, i.e. 75 deaths from all causes in the years 1936-75 compared with 83.5 expected. By 1975, there had been two deaths ascribed to lung cancer (compared with one expected), but the excess was in fact a death due to pleural mesothelioma in a factory worker employed on the assembly of gas masks using crocidolite. Thus, there is no evidence of any excess mortality among female chrysotile workers, and they will not be discussed further in this thesis.

5.6 Mortality in relation to radiographic changes

A limited study was reported by McDonald *et al.* (1974). Among those traced up to the end of 1969 in the mortality study, nearly 10,000 were men; chest x-rays were available for a little over 5,000 of them, of whom 785 had died. Death rates were calculated by date of birth, accumulated dust exposure and the presence or absence of parenchymal or pleural radiographic changes.

For all causes combined, the death rate at Thetford Mines was increased in the highest dust exposure group but, after allowance for

exposure and date of birth, those whose radiographs showed parenchymal changes had higher mortality (220 deaths per thousand men traced) than those with normal x-rays (131 per thousand) or with pleural changes only (126 per thousand). A comparison was also made of deaths from respiratory disease, including tuberculosis and cancer. Similar methods of calculation showed 32 deaths in those with parenchymal change compared with only 8 expected, an excess of 24. Thus, 97 deaths in those with parenchymal changes on x-ray (with or without pleural changes) were observed, compared with 64 expected, an excess of 33, two thirds of them being attributed to respiratory causes. At Asbestos, the difference between the mortality of those with and without x-ray changes was less. There was a total of 431 deaths (all causes) but only 7 were associated with parenchymal change.

Further analysis of this material was not justified at that stage, because the number of deaths in those with chest x-rays was so small (785 out of 5,082, or only 15 per cent) and even at Thetford Mines, where dust exposure levels had been much higher than at Asbestos so that radiographic changes were to be expected more frequently, only 132 deaths were associated with x-ray change.

5.7 Summary

In male workers aged 36 to 65, the prevalence of radiographic changes rose with increasing dust exposure: of irregular small opacities (profusion 1/0 or more), from 2.2 per cent to 17.0 per cent; and of pleural thickening (grade 1 or more) from 1.4 per cent to 12.3 per cent. Small opacities or pleural changes were seen in 17 per cent of men; 3.2 per cent had both. Despite adjustment for higher dust

concentrations, the prevalence of radiologic changes was higher in the Thetford Mines area than in the Asbestos area. This was shown least by parenchymal changes, but was extreme with pleural calcification, which was common at Thetford Mines but virtually absent in Asbestos.

In 267 male miners and millers, each with five chest films spanning an average of 20 years, abnormality in the earliest film was related mainly to the time since first employment. In 30 per cent of the 150 men completely normal at earliest film, some radiological abnormality developed during the period of observation; in Asbestos, the risk of developing small opacities was lower in smokers than in non-smokers. There was an irregular pattern of correlation, more evident in Thetford Mines than in Asbestos, between radiological progression and various stimulus variables. The weak associations between radiological responses and measures of asbestos exposure indicated that effects were obscured by other factors (including susceptibility) uncorrelated with exposure.

An age-stratified random sample of 1,015 current male employees in the Quebec chrysotile mines and mills was subjected to a standard questionnaire and to lung function tests. The prevalence of persistent cough and phlegm (bronchitis) was related to age and smoking habits; in non-smokers and light smokers, it was perhaps also related to dust exposure. Breathlessness on exercise was related to age and dust exposure but not to smoking. In non-smokers, inspiratory capacity (IC), forced vital capacity (FVC) and forced expiratory volume ($FEV_{1.0}$) distinguished the lower two dust-exposure groups. In smokers, these tests were less sensitive.

The relationship between chest x-ray changes and pulmonary function was examined in basically the same sample. In workers whose x-rays showed no evidence of parenchymal disease, vital capacity (VC) and FVC may have been slightly reduced; in the presence of slight parenchymal changes, these measurements showed "significant" reduction. In addition, VC and exercise minute ventilation were related to radiological disease. For any given grade of parenchymal disease, function was somewhat more impaired when pleural thickening and/or calcification was also present.

Of 11,788 persons born between 1891 and 1920 employed in the Quebec asbestos mining industry, 88.4 per cent had been traced by the end of 1969, and 2,457 (23.6 per cent) had died. In the highest dust category, comprising 5 per cent of the cohort, the age-standardized rate was 20 per cent higher than in the other groups. Respiratory, cardiovascular and malignant disease accounted in equal proportions for the excess. There were 101 deaths from respiratory cancer (including three from mesothelioma), an estimated excess of about 15 deaths. The difference in rates of respiratory cancer between those maximally and minimally exposed was thought to be fivefold.

These patterns of mortality, exposure-response in particular, were essentially the same as those observed up to the end of 1975 (McDonald and Liddell, 1978). With almost half the men now dead and the survivors aged 55 to 84 years, it seems unlikely that further study will seriously modify the basic findings. As the latent period for malignant mesothelioma appears to be very long in these workers, we may expect the proportional mortality to rise somewhat from present

levels of 2.2 per 1,000 overall and 8.2 per 1,000 for men with 20 years or more exposure. However, the risk appears likely to remain very much lower than with crocidolite.

The major occupational hazards of chrysotile asbestos exposure are respiratory cancer and the complications of pulmonary fibrosis. Excess mortality from respiratory cancer has been shown to be directly related to accumulated dust exposure. The relationship may well be linear and a line also appears to describe the data for pneumoconiosis mortality and, indeed, for all causes.

Chapter 6

QUEBEC CHRYSOTILE FINDINGS AND OTHERS COMPARED

6.1 Introduction

The two other attempts to investigate health effects in Quebec chrysotile miners and millers are dealt with in section 6.2, followed by descriptions of other studies of workers in chrysotile only. Then we consider, in section 6.4, the relationships between dose (of exposure to asbestos of varying types) and response (of lung cancer mortality) and, in section 6.5, the interaction of asbestos dust and cigarette smoking. After a short discussion of mesothelioma, there are some summarizing comments on the health effects of asbestos exposure.

6.2 Other investigations in Quebec

In 1958, Braun and Truan published "An epidemiological study of lung cancer in asbestos miners". They attempted to collect data concerning all workers who had been "processed" through the clinic at Thetford Mines since its inception in 1947, and "similar" information at Asbestos. Because development of asbestosis in less than five years was considered rare, the cohort was defined as including every *miner* (my emphasis) who had a total exposure (? net service) of five or more years and was on the employment rolls in 1950; non-exposed

workers were excluded. Follow-up was over six years. The original cohort embraced 6,091 men, but 133 (2.2 per cent) were lost to view and "deducted". Of the 5,958 traced to presumably the end of 1955, a total of 187 had died (3.1 per cent), nine definitely and three possibly from cancer of the lung. After many tabulations and much discussion, the observed numbers of lung cancer deaths were compared with those expected from provincial rates on two bases, one ignoring age distributions but the other taking them into account and yielding an expectation of six deaths. Thus, the SMR was at least 9/6, or 1.5, and it is difficult to accept the statement of the authors that "it seems fair to conclude that the asbestos miners in the Province of Quebec do not have a significantly higher death rate from lung cancer than do comparable segments of the general population".

In 1974-75, a group from Mount Sinai Hospital, New York, made a study among long-term employees of some of the mining companies at Thetford Mines. The findings were presented by Dr.W. J. Nicholson, on 27 February 1976, to the Quebec Government's Comité d'étude sur la salubrité dans l'industrie de l'amiante (Président: René Beaudry, j.e.p.) and recently to the New York Academy of Sciences conference on Health Hazards of Asbestos Exposure (Nicholson *et al.*, 1978). As results had been provided to the unions who commissioned the study, and had been published by the media, they were available for comparison with his own team's findings by Professor J. C. McDonald, at an International Conference on Lung Diseases in Montreal, on 18 May 1975.

The Mount Sinai study was much more limited than the McGill investigation. It was concerned, primarily, with 1,214 men at Thetford

Mines (much the dustier of the two mining areas of Quebec) who, with a few exceptions, had worked there for at least twenty years. Table 6.1 compares the radiological findings by Mount Sinai and in the two McGill studies (Rossiter *et al.*, 1972; Eyssen, 1975) of men with long service. Although the three studies presented here are not strictly comparable, the findings are fairly similar except in the estimated prevalence of minor degrees of parenchymal change. The Mount Sinai readers clearly placed many films into category 1 of the profusion of small opacities which the McGill group would have considered normal or doubtful. Differences of this magnitude in the difficult area of the boundary between categories 0 and 1 are not surprising when research methods are not identical. The Mount Sinai rates were based on the *consensus* of four readers who were *aware* that the films were all from men with at least 20 years of employment, some having been first exposed up to 65 years previously. These two aspects of design were contrary to the recommendations of a 1973 National Heart and Lung Institute Workshop on the chest x-ray as an epidemiologic tool (Weill and Jones, 1975). In the McGill studies, on the other hand, both series of films included a high proportion from men with little or no exposure; the readers knew only that the subjects had been employed at some time in the Quebec industry and they recorded their individual findings independently.

The Mount Sinai group also carried out a small mortality study, following 544 mine and mill employees from 1961 through 1973. The workers were divided (without definition) into "low" and "high" dust exposure groups, and for all causes of death the two groups had observed and expected deaths, and ratios, as follows:-

Table 6.1

FINDINGS IN THREE RADIOLOGICAL SURVEYS
OF QUEBEC CHRYSOTILE MINERS AND MILLERS

Survey	Mount Sinai	McGill	McGill
Year	1974	1968	1974
Number of men	885	744	283
Mean years since first exposure	33	33	29
Prevalence (%) of:-			
small opacities			
profusion 1/0 or more	*52*	*18*	*26*
profusion 2/1 or more	*5*	*6*	*8*
pleural thickening			
grade 1 or more	*20*	*12*	*21*
pleural calcification			
grade 1 or more	*10*	*12*	*10*

Low dust exposure: 65 observed, 68.29 expected, SMR = 0.95

High dust exposure: 67 observed, 44.56 expected, SMR = 1.50

Deaths from specific causes are summarized in Table 6.2. One death from mesothelioma occurred - in the low exposure group - and has been included in "all other causes". The seven deaths from asbestosis in the "low" exposure group suggest that exposure was nevertheless substantial; a comparison of the expectations of deaths from all causes in relation to other material might indicate that the borderline between the two groups was taken somewhere around 1,000 (fibres/ml) × years. Whatever the exact borderline, many of those in the "low" exposure group had had severe exposure by present-day standards, as indeed must have been true because of the length of employment and the high historical dust concentrations. Thus, that the SMR for all causes was less than unity in this group is of at least as much interest as the Relative Risks, comparing the higher exposure group with the lower, of 4.33/1.55 = 2.79 from lung cancer, 1.11/0.72 = 1.54 for gastro-intestinal cancer and 4.24/2.09 = 2.03 for other respiratory conditions.

In Table 6.3, the Mount Sinai mortality findings are placed in context with those from the McGill investigation, where the latter figures relate to all men in the "main mortality cohort" with gross service of at least twenty years, divided into two sub-cohorts by average concentration (below and above 300 mpcf) over the first twenty years of employment. The larger numbers of the McGill investigation lead to much more reliable rates, and the Mount Sinai figures are seen to be in close conformity. This was only to be expected as the smaller study was essentially only a part of the McGill whole.

Table 6.2

MORTALITY AMONG 544 QUEBEC ASBESTOS
MINE AND MILL EMPLOYEES, 1961-73

Findings of Nicholson (1976)

(O = Observed deaths; E = Expected deaths; SMR = O/E)

	Low dust exposure			High dust exposure		
	O	E	SMR	O	E	SMR
Cancer:						
lung	7	4.52	*1.55*	13	3.00	*4.33*
gastro-intestinal	3	4.18	*.72*	3	2.71	*1.11*
other	4	6.75	*.59*	2	4.40	*.45*
Respiratory disease:						
asbestosis	7	*	*	11	*	*
pneumonia	1	2.01	*.50*	1	1.27	*.78*
other	2	2.79	*.72*	3	1.76	*1.70*
All other causes	41	48.05	*.85*	34	31.43	*1.08*

* Expectations low; SMRs high

Table 6.3

MORTALITY AMONG QUEBEC ASBESTOS
MINERS AND MILLERS

A: McGill study, 1910-75: 3,105 men with at least 20 years service
B: Mount Sinai study, 1961-73: 544 men

(O = Observed deaths; E = Expected deaths; SMR = O/E)

		Low dust exposure			High dust exposure		
		O	E	SMR	O	E	SMR
Cancer:							
lung	A	48	41.57	*1.15*	56	22.96	*2.44*
	B	7	4.52	*1.55*	13	3.00	*4.33*
gastro-intestinal	A	47	58.89	*.80*	45	33.02	*1.36*
	B	3	4.18	*.72*	3	2.71	*1.11*
Pneumoconiosis	A	11	*	*	25	*	*
	B	7	*	*	11	*	*
ALL CAUSES	A	620	657.88	*.94*	478	368.09	*1.30*
	B	65	68.29	*.95*	67	44.56	*1.50*

* Expectations low; SMRs high

6.3 Other studies of workers in chrysotile

In addition to the earlier reports from Russia, Cyprus, etc., there have been three recent accounts of mortality among workers exposed to chrysotile alone. The first discussed here concerns miners at Balengero, Piedmont, Italy, and was presented by Professor Giovanni Rubino and his colleagues at a meeting organised by the Royal Society of Medicine on 28 April 1977. The main concern was with 1,217 chrysotile miners followed from 1946 through 1975. All but 19 were traced (trace rate 98.5 per cent) and 336 were found to have died. The distribution of causes of death was similar to that in Quebec, except for excesses due to cirrhosis of the liver and cancer of the larynx, both comparatively common in Piedmont, and ascribed to heavy drinking of grappa. There had been one death due to mesothelioma.

Elwood and Cochrane (1964) described a follow-up study of workers from an asbestos factory near Cardiff, making mainly asbestos sheeting and pipe lagging, and using only chrysotile since 1935, although some crocidolite may have been used during 1933-35 in the manufacture of high-pressure pipes. Follow-up was of those alive fifteen years after exposure to asbestos dust. Deaths from all causes numbered 46 and those expected on the basis of mortality data for South-Eastern Wales were 47.87 (SMR = 0.96). For specific causes, the findings were:- neoplasm of lung, bronchus and pleura: 7 compared with 3.02 (SMR = 2.32); other neoplasms: 3 against 6.08 (SMR = 0.49); circulatory system 21 compared with 17.54 (SMR = 1.20); all other causes 15 when 21.23 were expected (SMR = 0.71). One death from mesothelioma was observed, but in a man who had probably worked with crocidolite. The authors concluded that chrysotile did not appear to be a

serious hazard as far as mesothelioma or abdominal tumours were concerned, though there was some evidence of an excess in the numbers of deaths from carcinoma of the lung and bronchus.

Weiss (1977) reported a thirty-year study of 264 men hired during 1939-45 who worked in a chrysotile products factory for at least a year and were alive at the start of 1945; follow-up was complete on 94 per cent. For all causes of death, the SMR was 0.61; for lung cancer and gastro-intestinal cancer it was 0.93 and 1.05, respectively. Although the SMR for all causes was higher for men who had worked at least five years in the factory compared with those who had had only one to four years employment, the difference in work duration had no effect on mortality from asbestos-related disease. Weiss concluded that men exposed to chrysotile alone showed a favourable mortality experience, but some caution in interpretation is necessary because of the very small numbers involved.

6.4 Asbestos dose related to the response of lung cancer

Although Schneiderman reviewed this subject in 1974, more data are now available, and this section attempts a synthesis.

Liddell, McDonald and Thomas (1977) published two analyses of the dose-response relationship of asbestos dose and lung cancer mortality in Quebec chrysotile workers. In certain ways, the most reliable estimate of the relationship was considered to be from an analysis in which each lung cancer death in the cohort was matched with five controls born in the same year as the case but who were alive at the end of the year in which the case died; dust exposures for cases and con-

trols were accumulated up to seven years before the death of the relevant case. Berry (1977a), using a minimum χ^2, iterative, program of his own, obtained the equation of the line of best fit as:

$$\text{Relative Risk} = 1 + 0.001869(\text{mpcf.y}) \qquad (1)$$

shown in the figure on p. 44 of Berry (1977b); a fit by eye had been made previously by the present author for other purposes, and this gave the regression coefficient as 0.001875. The χ^2 of 38.76 with nine degrees of freedom (Table 7 of Liddell, McDonald and Thomas, 1977) was partitioned by the fit of the line into 38.00 with one degree of freedom representing the linear trend and 0.76 with eight degrees of freedom for deviations from linearity; as Berry pointed out, this was almost too good to be true.

Because the dust exposure measures in these analyses were accumulated to seven years before the death of each case (and to the same age for his controls), there are some problems over treating the relations fitted in these terms as the most reliable. A more conventional approach, using *a priori* reasoning, i.e. arguing from cause to effect, grouped men according to their exposure and examined the SMRs of the groups. In Liddell, McDonald and Thomas (1977), 80 sub-cohorts had been defined in terms of length and place of service, accumulated dust exposure over twenty years, age at start of service and whether there had been substantial gaps in service. The SMRs for these 80 sub-cohorts clustered about the line given by (1), but the highest mean accumulated exposure in any sub-cohort was rather less than in the case-control approach so that the fit well away from the origin*

* The term "origin" is used as though the ordinate was excess risk, rather than relative risk.

could not be investigated.

McDonald *et al.* (1979) have used two definitions of sub-cohorts, allowing study of the corresponding relationships. The first grouping was into only 16 sub-cohorts, but using definitions exactly as previously for length of service and accumulated exposure; as was to be expected, the basic findings were closely similar to those found earlier. This time, however, the mean values of the accumulated dust exposures for each of the 16 sub-cohorts were obtained and it became possible to fit a line (by unweighted least squares)* to the SMRs, yielding the equation: SMR = 0.9262 + 0.001343(mpcf.y) or, expressed in terms of relative risk (RR),

$$RR = 1 + 0.001450(mpcf.y) \qquad (2)$$

and the coefficient of correlation was + 0.87.

As already discussed in section 5.5, the minimum χ^2 fit by Mr. Berry to the latest case-control data yielded the line:

$$RR = 1 + 0.001193(mpcf.y) \qquad (3)$$

and the χ^2 statistic with one degree of freedom for the linear fit was 19.61, leaving 3.43, with eight degrees of freedom, for departures from linearity. This last component is so small that it does not suggest any better non-linear fit, but it is now not "too good to be

---

* Although weighted least squares would have been theoretically more suitable, the complications were not considered justified as the differences would arise far from the origin, whereas the region of particular concern nowadays is close to the origin.

true". The slopes of lines (2) and (3) are in good agreement, when the errors of estimation, particularly of (2), are taken into account. It is not possible to "prove" that the relationship is truly linear, but the goodness of the fits (low residual χ^2 values, and high coefficients of correlation) and inspection of the data provide no justification for a curve approaching the origin at a more shallow angle.

The use of accumulated dust exposure as the only factor studied can be criticised, for it would appear to require the assumption that the risk of lung cancer did not depend on how the dust was accumulated: 500 mpcf.y could mean 50 years of exposure to a steady average of 10 mpcf, or 10 years to widely fluctuating concentrations averaging 50 mpcf, or indeed an infinite variety of patterns of exposure. However, there are several indications that it is a satisfactory choice. First, of those measures discussed by Liddell, McDonald and Thomas (1977, p. 478), this yielded the closest relationship with excess lung cancer mortality. Secondly, a comprehensive study by Dr. D. C. Thomas (personal cummunication) has failed to reveal any improvement in relationships by consideration of other factors describing how the exposure was accumulated. Thirdly, although there was some early evidence (Merewether and Price, 1930) and some recent speculation, for example by Enterline (1978 and earlier), that the more severe the exposure in terms of concentration, the shorter the latent period, recent evidence provides no confirmation; see Table 2.2 above.

Other studies of workers for whom measures of the dose of asbestos dust are available are rare. Berry (1977b) quotes the work of Enterline and colleagues (1972a; 1972b; 1973) among retired asbestos

factory workers in the United States, but there are two problems only one of which Berry attacked. This first was that even those retirees who had virtually no asbestos exposure produced a lung cancer SMR well above unity; Enterline's group also gave information about men who had retired from a factory nearby where there had been no exposure to asbestos, and the SMR here for lung cancer was similarly high. Berry (1977b, p. 45) related the lung cancer SMRs for exposed workers, taking account of accumulated dose, to those unexposed, and found a satisfactorily linear relationship; further the slope of that fitted line, when the relative risk at zero dose was taken as unity, was quite similar to that of line (1) above. The second problem is more difficult: in one of their reports, Enterline *et al.* (1972b) stated that 1,026 of the retirees from the asbestos factory had been production workers, three-quarters of whom had been exposed only to chrysotile, whereas 438 had been maintenance or service workers and a fairly high proportion of these had been exposed to crocidolite. The dose-response relationships in the two groups were quite dissimilar, being virtually non-existent for the production workers when the device was adopted of comparing against unexposed workers from the non-asbestos plant. However, the other group showed a *curve* which was always much above the line fitted to the whole cohort, undoubtedly significantly so despite small numbers. Publication of a more detailed breakdown of the cohort according to the type of fibre to which they had been exposed (Enterline and Henderson 1973) confirmed differences between fibre type in the risks of lung cancer but did not provide information on dose to allow adequate investigation of the shapes and slopes of the relationships.

A recent mortality study of workers engaged in the manufacture of asbestos-cement products in Louisiana has so far been published by abstract only (Hughes *et al.*, 1978) and full detail is not yet available. However, 5,654 males with at least one month employment were followed for a minimum of twenty years. Tracing, through the Social Security Administration, was complete for only 76 per cent, and only 90 per cent of death certificates were obtained. It was reported that SMRs for total mortality were less than in the State of Louisiana, and that the only cause of death found to be dose-related was respiratory malignant neoplasms "with significantly increased SMRs (225, 187) in the two highest exposure categories (> 100 mpcf.y)". Men with service less than two years had no excess mortality, those with from two to ten years service had increased mortality only when average dust concentrations were greater than 20 mpcf, and those with ten or more years service had increased mortality when concentrations were greater than 5 mpcf. It is not stated in the abstract to which fibre(s) the cohort had been exposed.

There have been several reports on a factory at Rochdale (Knox *et al.*, 1965; 1968; Howard *et al.*, 1975; Peto *et al.*, 1977) but, although some environmental evidence has been given, it does not allow full examination of dose-response relationships. From the 1975 paper, it was possible to gain the impression that working conditions in this factory had been more-or-less in accord with present day standards for many years. The facts are far different, as could have been inferred from the 1968 paper and as now given in the latest (1977) paper. Men and women first exposed in 1951 or later numbered 347; of these six men died from lung cancer when only 3.2 such deaths were to have been

expected from national mortality rates; the SMR was thus 1.9. However, we are also told (Howard *et al.*, 1975) that five of the six lung cancer deaths were in men who had been working in areas where dust levels were high in 1952. Equal allocation of the man-years to higher and lower dust conditions provides the following:- lower dust concentrations: one death against 1.6 expected (SMR = 0.63); higher dust concentrations: five deaths against 1.6 expected (SMR = 3.13). Further all six cases were smokers.

Dr. M. L. Newhouse, in a series of papers with various colleagues, has reported *seriatim* on mortality of workers at the Cape Asbestos factory in Barking. Although dust concentrations were only classified in two ways (low-moderate; severe) and service likewise (less than two years; longer), there were large differences in SMRs among 1,414 men followed from twenty years after start of service (Newhouse, 1973a), *viz:-*

	Dust concentration	
	Low-moderate	Severe
Less than 2 years in the job	4/2.4 = 1.67	11/3.3 = 3.33
Longer in the job	5/1.6 = 3.13	17/2.3 = 7.39

Comparison with other experience is impossible without estimated concentrations, but the excess risks appear much higher than in Quebec. There can be no doubt that substantial amounts of crocidolite were used at this factory.

6.5 The interaction of asbestos dust and cigarette smoking

Saracci (1977) has reviewed the epidemiological evidence on the asbestos-smoking interaction, considering three models. In the first,

the excess incidence of lung cancer independently due to asbestos and to smoking add together when both agents are present (additive model). In the second model, the addition of each one of the two agents produces an increase in lung cancer incidence which is proportional to the effect of the other agent (multiplicative model). In the third, asbestos can increase lung cancer incidence only in the presence of smoking. Saracci did not have available at the time of writing the data from Quebec, but he reviews the rest carefully. As found by other investigators, he feels the additive model the least plausible of the three, and the multiplicative the most plausible.

The evidence from Quebec also supports the multiplicative model, and here the amount of data make the plausibility the greater. In studies based on *a priori* reasoning, there appeared little to suggest deviation from the multiplicative model. Thomas (1977) reported on his preliminary studies of the shapes and forms of relationships and interactions on lung cancer deaths to the end of 1973. His more recent work (Dr. D. C. Thomas, personal communication), using two methods of analysis, showed no evidence against the multiplicative model: in unmatched analysis of the case-control data (cases to end-1975 with four controls per case, one chosen matched for smoking habit, the other three not so matched), using multidimensional contingency table analysis, he found no significant improvement to the fit by varying the model from the simple multiplicative. In a matched analysis based on his own extensions of methods, following Cox (1972) and others, to be published (Thomas, 1978), he once more demonstrated a good fit of the multiplicative model to the data.

An important finding from Quebec is that of the 245 male lung cancer deaths, 20 were among non-smokers. While there remain some doubts about the quality of some of the smoking information obtained from the questionnaires, they relate mainly to the coding, the lack of information about men who died before 1950, and the inevitable problems about deciding who is an ex-smoker when the respondent may revert to smoking after being questioned. The exact amounts smoked may also be in doubt, but perhaps the most reliable piece of information is the statement that a man never smoked. In the non-smokers, the observed relationship between dose of asbestos and excess lung cancer was similar to that in smokers. This would seem to dispose of the third of Saracci's models.

Figure 6.1, following McDonald and Liddell (1978), takes excess risk from respiratory cancer as linearly related (a) to asbestos dust exposure in men who vary in their smoking habits and (b) to smoking in men from the same population who vary in their dust exposure, and superimposes the relationships, to allow a *rough* comparison of hazards.

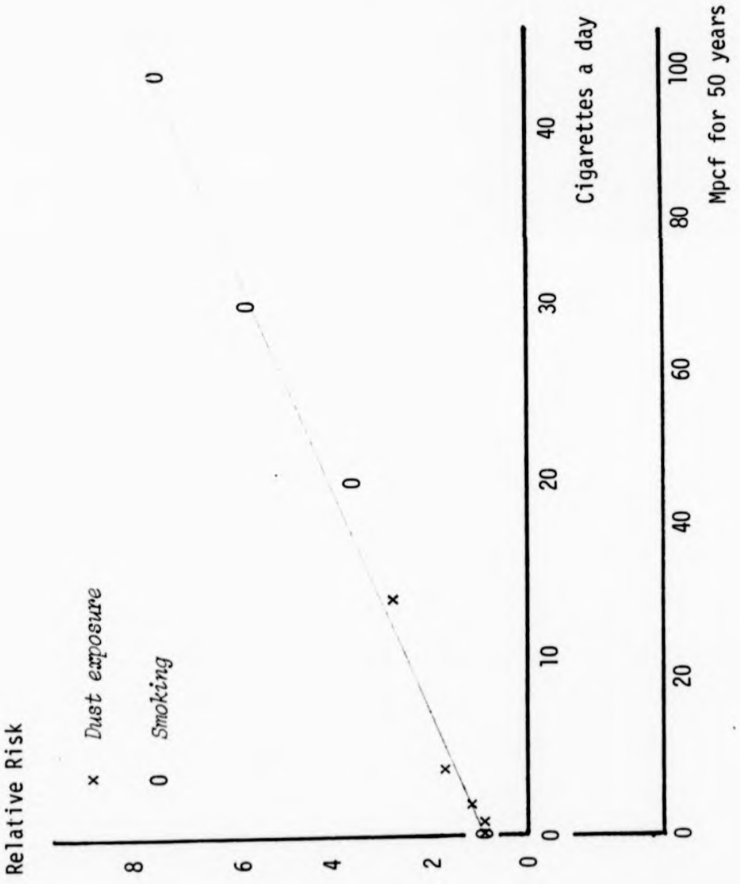
6.6 Mesothelioma

This thesis is not primarily concerned with mesothelioma, and there is a good review of the whole subject by McDonald and McDonald (1977). However, the importance of fibre type cannot be overemphasised and it seems necessary to discuss the incidence of this condition in those exposed to chrysotile alone.

In studies among Quebec workers, McDonald and Liddell (1978) reported a total of fifteen deaths (all but one male) due to mesothelioma, to the end of 1977. They were distributed as follows:- mine and mill workers: ten at Thetford Mines and two at Asbestos; factory

Figure 6.1

LUNG CANCER MORTALITY BY DUST AND SMOKING

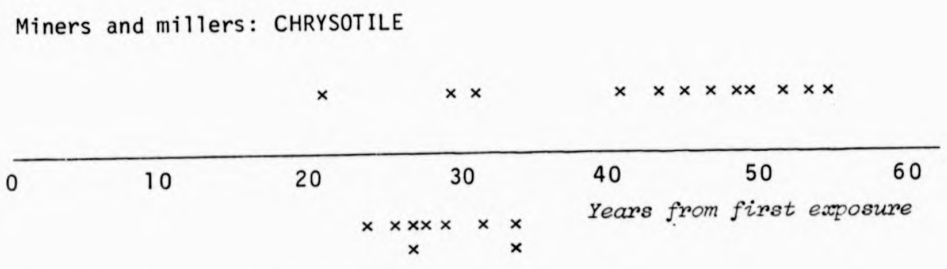


workers: three, including one female, all at Asbestos. Figure 6.2, also from McDonald and Liddell (1978), shows the twelve cases in miners and millers by interval from first employment, and nine cases in persons employed in Canada in World War II on the crocidolite filter pads for service gas masks (McDonald and McDonald, 1978). Two of the factory workers at Asbestos were involved in this process and are included in the lower part of Figure 6.2; the third factory worker may also have been exposed to crocidolite during the same period but is not included. This figure shows that, in the chrysotile mine and mill workers, the median period from first employment to death was nearly 20 years longer than in the factory workers exposed to crocidolite. Other differences were also impressive. Of the twelve "chrysotile cases", nine were in 3,105 men employed twenty years of more and three in 7,834 men employed less than twenty years; all twelve were pleural. The nine "crocidolite cases" were in total of only 199 persons, none of whom had worked in gas mask production for more than $2\frac{1}{2}$ years; six of the nine cases were peritoneal.

Of the nine mesothelioma deaths to the end of 1975 that might be considered due to exposure to chrysotile, seven were at Thetford Mines; none were in men with the highest dust exposures, but there was lower incidence among those more lightly exposed at Thetford Mines. In his study in the same area, Nicholson (1976) reported only one mesothelioma among 132 deaths, a rather higher proportional mortality, but still a rare occurrence. This death was not in the group that Nicholson designated as "high" dust exposure, but as already discussed his "low" dust exposure group surely included many men with substantial exposures by to-day's standards.

Figure 6.2

LATENT PERIODS IN MESOTHELIOMA



It is difficult to obtain an estimate of the number of mesothelioma deaths to be expected in the "main mortality cohort", particularly because of the high ascertainment rate in the Province of Quebec (McDonald and McDonald, 1977), but it seems not unreasonable to put it at about two for the miners and millers. Thus, there were four to five times as many deaths from mesothelioma as expected; it remains essential to keep the absolute number in mind, particularly in relation to the numbers of deaths from lung cancer (245 among men) especially those that might be considered asbestos-related (about 45 or 50).

Of the 336 deaths among Piedmont miners, Rubino reported one mesothelioma, a proportion quite close to that observed in Quebec. Elwood and Cochrane (1964) also reported one mesothelioma, but thought it was due to crocidolite exposure; Weiss (1977) observed no deaths from mesothelioma in his small cohort of chrysotile factory workers. Although Peto (1978) reported only pleural mesotheliomas from the Rochdale factory, crocidolite had been used there, although in what quantities is not known. All other occupational studies with high proportional mortality from mesothelioma have been in persons exposed to amphibole fibres. In all these studies the absolute numbers have been high, and there have been high proportions of peritoneal tumours.

6.7 Summary

In an important "State of the Art" review, Becklake (1976) listed (her Table 1) the pathological effects of asbestos exposure in man, differentiating between effects that are established, associated with a co-factor, possible and remotely possible, as follows:- established: asbestos bodies and/or fibres in the lung; asbestosis; pleural plaques

and calcification; pleural and peritoneal mesothelioma; and neoplasia of the gastro-intestinal tract; adding carcinoma of the lungs as a co-factor with cigarettes. As possible effects, she included carcinoma of the larynx, pleural effusion; as remotely possible, carcinomas of ovary and breast. For completeness, one should also mention asbestos corns, although they are not relevant to this thesis.

In her Table 4, Dr. Becklake listed studies that have demonstrated dose-response relationships between biological responses in man and estimated exposures, pointing out that most of the measures of exposure have been rather crude, including: years of exposure; years since first exposure; occupation; occupation and duration. The studies in Quebec chrysotile workers are nearly unique in having related responses to accumulated dust exposures, but there are two added studies by Weill and his colleagues (1973; 1975). Radiological changes both in the parenchyma and in the pleura have been found to increase with increasing dose, however measured. Lung function measurements, particularly FVC and $FEV_{1.0}$/FVC have often also been related to duration of exposure, and symptoms, particularly breathlessness on exercise, to dust exposure. These signs and symptoms are of course only "signposts" on the way to excess mortality, and this in turn has frequently been related to measures of exposure, with excesses especially noticeable for lung cancer, sometimes gastro-intestinal cancer, occasionally laryngeal cancer, and, where numbers or fibre type have made it possible, mesothelioma. However, the ability of the signs and symptoms themselves to predict excess mortality has not been the subject of such close study. In particular, the essential relationship between radiological change and excess

mortality has been examined so far only to a very limited extent in a general review of the health of Quebec miners and millers.

Chapter 7

THESIS OBJECTIVES AND MATERIALS

7.1 Introduction

Although there is no doubt that exposure to asbestos dust can, if severe enough, lead to premature death, little is known about how the various signs and symptoms make themselves apparent during the disease process. All have been shown to be interrelated, but there is little evidence of whether radiographic changes, depressed lung function or breathlessness are generally the earliest, or how any of them predict mortality. None of the various function tests and none of the respiratory symptoms can be considered specific to asbestos-related disease; on the other hand, x-ray changes that can be categorized into a "classification of the pneumoconioses" devised with particular concern for asbestosis must be taken as more specific. Thus one form of validation of a classification is in the extent to which radiological changes can predict mortality.

Other possibilities of validation are in relating *post mortem* pathology to radiographic appearances in an x-ray taken shortly before death; or, alternatively, in high correlations between appearances, say, in employed workers and measures of their exposure during relevant periods before the x-ray. However, correlations of this latter nature,

although positive in many studies in asbestos workers and in those exposed to other mineral dusts, have never been high enough to provide acceptable validation. In coalworkers, several attempts at validation of x-ray classifications in terms of *post mortem* findings have been made, but mainly in the same lungs (Liddell, 1972; Rossiter, 1972b and in several other reports). These authors concluded that the observed correlations between the profusion of small rounded opacities and the weights of various chemical dusts assessed in the lung were high enough to justify a claim that the ILO, Geneva, 1958, classification was of reasonable validity. However, this was only for coalworkers, and in any case was concerned with a now outdated radiological classification. As Rossiter (1972c) has pointed out, coalmine dust is relatively inert, and in considering the biological effects of asbestos in the lungs, pathological assessment would have to take into account the fibrosis rather than the dust itself. A study to this end has recently been put in hand in the Province of Quebec, but results cannot be expected for several months, and can at best be provisional only - because of the ways in which (a) cases have been selected and (b) assessments, both histological and radiological, have been made.

Although the National Coal Board's Pneumoconiosis Field Research (PFR), set up in 1952, had rather restricted objectives (Fay and Rae, 1959) concerned with the setting of dust standards in the light of radiological change (later extended by consideration of lung function), investigation of mortality was made feasible in the late 1960s, when National Insurance numbers for all men ever included in PFR were incorporated into the record-keeping system, to make it compatible with that introduced for the Board's Periodic X-ray Scheme (PXR) at its

inception in 1959 (Rogan, 1964; Liddell and May, 1966; Lee, 1966; Mead, 1966). Meanwhile Cochrane *et al.* (1964) had carried out a six-year mortality follow-up of males over 15 originally surveyed in the Rhondda Fach in 1952; an earlier study, with only two-and-a-half years of follow-up had been too short to carry much conviction. Although non-miners had lower SMRs than miners, there appeared to be no differences in the SMRs of those whose 1952 x-ray had been placed in any of the categories 0, 1, 2 or 3 of simple pneumoconiosis in the Cardiff-Douai or, for all practical purposes, the ILO, 1958, classification. Indeed, the only predictive value of the x-ray seemed to be that those with progressive massive fibrosis in 1952 had higher SMRs than those with normal x-rays or simple pneumoconiosis only. This was, at least to the present author, a rather surprising finding, which might have been due to several factors, including the rather short period of follow-up and the very special population examined. The former, but not the latter, was overcome in a follow-up of the same population for twenty years, reported by Cochrane (1973). However, the main finding was similar: "Survival rates for miners and ex-miners appear independent of the x-ray category of pneumoconiosis except for category B or C, where survival rates are much reduced". More recently, Jacobsen (1976) produced essentially the same result in a rather larger study, based on all 35,000 miners in the original PFR surveys; nevertheless, the yet larger, and completely representative, sources of PXR have still to be tapped.

These findings in coalworkers were not in accord with those reported by McDonald *et al.* (1974) in asbestos miners and millers; see section 5.6 above. The differences probably lie mainly in the dif-

ferent types of dust to which the subjects were exposed; the radiographic changes associated with asbestos exposure are not common in coalworkers, and certainly were not recognized in the classifications of radiographs used in both Cochrane's and Jacobsen's studies of coalworkers.

7.2 Objectives

In all these circumstances, it seemed of great importance to attempt to answer the question:

1. To what extent can radiological changes in those who have been exposed to asbestos dust predict mortality?

This, then, was the primary objective of the thesis research. Its justification was confirmed in the recent deliberations of eight distinguished film readers (from Germany, Italy, South Africa, the United Kingdom and the USA) who carried out a trial in Johannesburg during October 1977 of the ILO U/C (1971) classification for use specifically in asbestos workers (Irwig, 1978). Under the heading "x-ray abnormality and health impairment", these readers agreed that the morbidity and mortality associated with x-ray abnormality were largely unknown. They felt research in this area to be crucial, because the importance of radiology depends on its ability to predict illness and death, rather than on its sensitivity to asbestos exposure.

As some predictive ability was to be expected in the light of the findings reported by McDonald *et al.* (1974), two further questions arose:

2. Are the predictions of mortality from radiological changes improved or modified by other factors?
3. What are the best factors for predicting mortality?

7.3 Factors for study

The choice of factors for study, other than radiological changes, could only be made in the light of knowledge from mortality studies in exposed workers and in others, and in relation to the causes of death that it would be reasonable for radiographic change to predict.

The asbestos-related causes of death have been seen, from our own studies, to include pneumoconiosis and lung cancer, both of which might well be detected on the chest x-ray. Death certified as from respiratory tuberculosis and other respiratory conditions might also be radiologically diagnosable whether or not associated with dust exposure. Other diseases, including cancer of the oesophagus or stomach, or of the colon or rectum, and diseases of the heart, might well not be diagnosable on a chest x-ray, but if they were associated with heavy dust exposure, such exposure might have led to pneumoconiotic appearances in the radiograph. It was therefore felt necessary to differentiate all the above causes of death in the various analyses. It was also, of course, important to study deaths regardless of cause, while certain other groups (laryngeal cancer, "other" abdominal cancers, "other" cancers, accidents and cerebro-vascular diseases) were also differentiated, together with those where the cause was known but did not fall into any of the other defined categories. Inevitably, a precise cause of death would not be determined for a few deaths, which could not be placed into any of the thirteen defined groups of causes,

but were, of course, included in the counts of total deaths, or "deaths from all causes". Our classification of causes of death is given in Table 7.1.

As far as dust-related diseases were concerned, our own studies in Quebec had shown the undoubted importance of measures of exposure based on estimates of dust concentrations. Although no differences had been found between Asbestos and Thetford Mines in any of the mortality studies (except those concerning cancers of the gastro-intestinal tract) after due allowance for the substantially heavier and longer durations of exposure at the latter, there were some differences between the places in radiological findings. It was therefore felt it would be necessary to distinguish them again. Smoking was clearly important as far as lung cancer was concerned and might be expected to have associations with mortality from certain other causes.

No evidence was available from the Quebec studies about mortality in relation to respiratory symptoms and lung function, but these were known to be related both to dust exposure and to radiographic changes, while there was evidence from population studies, mainly in the USA, concerning mortality in relation to respiratory function and symptoms (see Chapter 14, below).

The remaining issue is of the length of follow-up. Were the objective to validate the x-ray classification against pathological findings *post mortem*, the x-ray should have been taken as late in life as possible, to leave the interval between x-ray and *post mortem* short. However, for a realistic test of the effectiveness of the x-ray in

Table 7.1

CLASSIFICATION OF CAUSES OF DEATH

(The codes are those of the Seventh Revision of the International Classification of Diseases)

Pneumoconiosis	523-524
Cancer of the chest	162-164
162: malignant neoplasm of bronchus and trachea, and of lung specified as primary; 163: malignant neoplasm of lung, unspecified as to whether primary or secondary; 164: malignant neoplasm of mediastinum.	
Tuberculosis of respiratory system	001-008
Other respiratory conditions	470-522; 525-527
470-475: acute upper respiratory infections; 480-483: influenza; 490-493: pneumonia; 500-502: bronchitis; 510-527: other diseases of respiratory system other than pneumoconiosis.	
Diseases of the heart	400-443
400-402: rheumatic fever; 410-416: chronic rheumatic heart disease; 420-422: arteriosclerotic and degenerative heart disease; 430-434: other diseases of heart; 440-443: hypertensive heart disease.	
Cancer of oesophagus or stomach	150-151
Cancer of colon or rectum	152-154
Malignant neoplasm of small intestine, including duodenum, of large intestine or rectum.	
Other cancers of the gastro-intestinal tract	155-159
Malignant neoplasm of biliary passages, liver, pancreas, peritoneum or unspecified digestive organs.	
Cancer of larynx	161
Other malignant diseases	140-148; 160; 165-205
Cerebro-vascular diseases	330-334
Vascular lesions affecting central nervous system	
Accidents, including poisonings and violence	800-999
Other known causes	All codes not listed above

predicting mortality in a working population, the follow-up period has to be rather longer. In diseases where the interval between diagnosis and death is very short, e.g. mesothelioma or to a lesser degree cancer of the lung, it then becomes unlikely that any direct validation of radiographic classification would be possible, as abnormal appearances specific of the terminal condition could hardly have appeared at the start of the follow-up period, usually substantially before diagnosis. In these circumstances, it becomes necessary to rely on indirect validation, i.e. prediction by means of radiographic changes not themselves typical of the condition in question but rather associated with the asbestos exposure, which at least in some of the cases may have led to the terminal disease.

7.4 Criteria for selecting a study population

The ideal criteria for choice of an acceptable study population can thus be listed as follows:-

(1) a chest x-ray towards the end of a person's employment; further, the x-ray should have been assessed, independently, by each of several readers (Weill and Jones, (1975), into a standard, but detailed, classification of pneumoconiotic appearances, including those of asbestos-related disease;

(2) a full work history, including estimates of dust concentrations, to allow calculation of measures of exposure;

(3) smoking history;

(4) lung function measurements and evaluation of respiratory symptoms close to the time of x-ray;

(5) complete follow-up for long enough that a substantial proportion of the population has died; and, for each death, date and certified cause.

No population could be ideal, and to carry out an entirely new study on an adequate scale would have been prohibitively expensive. However, it was possible to select two cohorts, "A" and "B", of Quebec miners and millers, both of which met many of these criteria.

Cohort "A" was intended to consist of all 1,015 men in the "physiology cross section" (see section 4.7 above) defined by both McDonald, Becklake *et al.* (1972) and Becklake *et al.* (1972): these men were still employed by the mining companies in Quebec in November 1966, full work histories to that point were available, and the last employment medical examination x-ray up to that time had been selected and read by six readers; smoking history, and respiratory symptoms had been elicited by questionnaire in 1967 or 1968, and lung function measurements made at that time; about two-thirds of the men had been born between 1891 and 1920, and so they were embraced in the "main mortality cohort" (see section 4.6 above) leaving only about one-third requiring to be followed. However, although the sample had been weighted (by stratification) towards older men, some of whom were close to retirement, most would have continued in employment, probably in the mining industry. Nevertheless, additional exposure beyond 1966 was to concentrations of dust at much lower levels than had been in existence for most of the men in earlier years, so that the increment was likely to have been at a low absolute level, although for many of the younger men it would not have been low in relative terms.

Cohort "B" consisted initially of all those persons in the "main mortality cohort" who had also had a radiograph assessed during the major reading studies of 1967. Well over 5,000 workers were expected to be in this group, but it was reduced for three reasons. First, to ensure the greatest degree of comparability, only those persons whose film had been successfully read in what Rossiter *et al.* (1972) called stage 2, i.e. by one of the six readers, after randomization into as nearly as possible equal sets, but excluding films considered "unreadable". Secondly, to preserve independence, the 603 men common also to Cohort "A" were excluded. Thirdly, the 231 women remaining at this point were excluded, after preliminary examination had confirmed (a) that they had in general had low exposures to asbestos, (b) that all but a few of their films had been assessed as completely normal, and (c) that the SMR, in relation to all women in the Province of Quebec, was considerably less than unity, in fact 0.78. In Cohort "B", we did not know the date of the last x-ray, but could assume that criterion (1) had been met as to the timing of the film, although only one assessment of each was available. Criteria (2) and (5) were met completely, by virtue of membership of the mortality cohort, and (3) partially so; there were no lung function measurements or assessments of symptoms.

Further details of the two study cohorts - definitions, sources of data, assembly of data, and numbers by follow-up status (alive at the end of the follow-up period, known to have died, or lost to view) - are given in the next two sections.

7.5 Cohort "A": definition, sources and numbers

The "physiology cross-section" described in section 4.7 above has been reported on by Becklake *et al.* (1970), who studied lung function in relation to radiological changes in 1,069 men, and by McDonald, Becklake *et al.* (1972) and by Becklake *et al.* (1972), studying respiratory symptoms and lung function in relation to dust exposure, who found it necessary to exclude 54 men for whom data discrepancies had been discovered, to leave a study group of 1,015. The magnetic tape files containing the function measurements, with heights and weights, and the questionnaire responses, were known as LUNF2F and QUESTF, respectively. Matching of LUNF2F against QUESTF indicated that all 1,071 persons on the first were also on the second, which contained records for eleven additional subjects who, presumably, had attended for interview but had not completed satisfactorily the tests in the mobile laboratories. The present concern was with males only, and so 40 females on LUNF2F were excluded. Thus, at that point, the population for study consisted potentially of 1,031 men.

The first stages of follow-up had been instituted early in 1977, making use of a list of 1,015 men, kindly supplied by Dr. Margaret Becklake, and purporting to relate to those included in the studies reported in 1972. The men were classified as to whether they were or were not in the mortality cohort, i.e. had been born in the years 1891 through 1920, or more recently - as all in this population had been at work in 1966, none could have been born before 1891. Arrangements were made for the tracing of those not in the mortality cohort. This work was carried out by Mrs. Proulx, at Asbestos, and Mrs. Beauchemin, at Thetford Mines, two ladies who had been specially trained for such

tasks over a number of years. However, the initial classification had been almost entirely by the date of birth given on Dr. Becklake's list, and that included any amendment made during interview in 1967 or 1968. Further, the list took no account of changes in the cohort since it was first prepared in about 1969, and so the classification required careful checking, which revealed several men who had been wrongly treated recently as part of the mortality cohort, i.e. who would now have to be traced; the field enquiries had also to be extended to cover those among the 1,031 men on LUNF2F who were not on Dr. Becklake's list. In fact, one of these could not be identified in the register either; we could find no trace of him in any of our data banks (except LUNF2F and QUESTF) and he was therefore eliminated from the study population at this stage. Meanwhile, every case in the "main mortality cohort" was positively identified: they totalled 624. This left 406 for follow-up, which was carried into the start of 1976, to bring it into line with that for the mortality cohort proper.

In the event, tracing was complete: as these men were all born after 1920, it was not surprising that most were alive. There had been eleven deaths, and dates and places, all in Quebec, were obtained. A request for copies of the death certificates was refused by the Quebec government, because of a new attitude to confidentiality; nevertheless, a satisfactory cause of death was obtained by further enquiry by Mesdames Proulx and Beauchemin. The eleven new causes of death were coded into the Seventh Revision of the International Classification of Diseases, in conformity with the practice for the "main mortality cohort"; see Table 7.1.

Several processes were needed to identify sets of x-ray readings for these 1,030 potential subjects, i.e. the 1,031 men on LUNF2F less one unidentifiable as described above. The identifying number was a 6-digit number which had been entered on the buff cards at the time of registration in 1966-67; for those men found to have more than one buff card, the number relating to his latest employment was on the LUNF2F record, but for most other purposes a special number, in less than six digits, had been used for the subject with appropriate cross-reference to the several six-digit numbers on the two or more buff cards recording his history. Usually, it was this shorter ID that had been used on the intermediate magnetic tape file, TRIPLF, from which the film reading number had to be extracted. Great care had to be taken to ensure that the search of TRIPLF was truly comprehensive; many checks were possible and all were instituted. Nevertheless, 21 men could not be traced on TRIPLF, which meant that it would not be possible to find any radiological assessments for them. This left 1,009 men in the study, the same number as had been come to in an earlier attempt at reconciliation (White *et al.*, 1974).

Next, the magnetic tape file (BASICX) containing over 42,000 x-ray readings had to be searched for any reading against the appropriate number for each of the 1,009 men still in the population; at least one reading was indeed found for every subject. In most cases, there was a set of six readings (one for each reader), together with a "stage 2" reading, and often additional readings from later stages of the radiographic study. However, for a total of 19 subjects, it was not possible to find or make up a set of six readings, one by each of the different readers. The potential study population was now

reduced to 990.

For these 990 men, we brought on to one magnetic disc file all the desired information from LUNF2F and QUESTF, together with the six radiographic assessments and, for men not in the mortality cohort, the tracing information, including, where appropriate, date and cause of death.

For those in the "main mortality cohort", it was comparatively simple to bring forward, from the magnetic tape records of that cohort, not only the tracing details, i.e. status (alive, dead or lost to view) and date of death (or loss) with cause of death, but also the fully detailed record maintained on what was called the Final Analysis File of the mortality study (Rodrigues, 1976). There remained the corresponding details of work history for men not in the mortality cohort. The details from the buff cards for all persons registered in 1966-67 but not included in the mortality cohort had been punched onto cards and transcribed, in "mirror image" without editing, on to what was called the Bonaventure magnetic tape. It might therefore have seemed a small task to obtain the work histories, for the 406 persons involved, in the same lay-out as for the remainder. However, this had been a laborious aspect of the original data processing (Rodrigues, 1976) and we needed access to many programs in the original suite, some of them used iteratively, and two more had to be written. Much checking was necessary, pinpointed by the computer programs, but rendered slow in execution because of fairly extensive clerical work, key-punching and verification, carried out by the author, while the basic records were held at an outstation. Some indication of the data processing involved

is given in Table 7.2; it was completed for all but one man whose buff card record was not on the Bonaventure tape, while the card itself could not be found in late 1977.

The detail carried forward to this stage was very long, so that costs for disc storage and for analytical computing would have been unnecessarily high. Three major savings were achieved. First, after record linkage had been successfully completed, unneeded identifying detail was eliminated; secondly, the environmental history was reduced to the totals of net service and of dust exposure accumulated to November 1966; and, thirdly, the information on symptoms and lung function measurements was reduced to a working minimum, in consultation with Professor Margaret Becklake and my supervisor. Other, smaller, savings would have been possible, but it was not felt they were worth the extra costs of rewriting the files in further shortened form.

The basic information retained on the working file (XMAFWF) is listed in Table 7.3. The symptoms and measurements recorded in 1967 or 1968 were as defined by McDonald, Becklake *et al.* (1972) and Becklake *et al.* (1972). Smoking was recoded into a single character six-point code as follows:- 0 = Non-smoker; 1 = Ex-smoker; 2 = Not a cigarette smoker; 3 = Smoker of 1-12 cigarettes a day; 4 = Smoker of 13-25 cigarettes a day; 5 = Smoker of 26 or more cigarettes a day. Net service and accumulated dust exposure were as described by Liddell, McDonald and Thomas (1977, p. 471); dates of start of first job were retained so that gross service could have been calculated to November 1966. Only the year of death (or of loss to view) had been recorded, and cause of death was coded (or recoded) into the Seventh Revision

Table 7.2

CALCULATION OF DUST EXPOSURES

for men in Cohort "A" not included in

Program or process	Input	Output
NEW.1	Bonaventure tape	Discs
WHLIST	Discs from NEW.1	Edit lists
NEW.2	Discs as above	Revised discs & cards
Manual/ Keypunch	Cards as above	Revised cards
WHLIST	Cards from above	Edit lists (clear)
UPDTEWH	Cards from above	Revised WH discs
PGM2	WH discs & Dust master	Error print-out
Manual/ Keypunch	Error print-out	Work History cards

"main mortality cohort"

Comment
373 men with single work histories, and 31 with mutiple, separately
404 men as above; 3,181 records
Adjustment to mine codes without alteration of numbers
(a) Removal of errors flagged by WHLIST; (b) Clearance of identity problems
Now 405 men, with 3,080 records
405 men, but redundant records removed, leaving 2,753
17 errors in work histories
17 errors corrected, entered on to punch document; complete revised work histories punched and checked

Table 7.2 (continued)

Program or process	Input	Output	Comment
UPDTEWH	WH disc & amended WH cards	Amended discs	Numerous errors in dust information
Manual/ Keypunch	List of dust errors	Revised dust cards	Preparation for correction of Dust master file
DUSTCHAD	Revised dust cards	Amended Dust master	Amendment of Dust master file
PGM3	Amended WH & Dust master discs	Exposures by job and year	Preparation for input to FAF; calculation of 7,006 annual concentrations by job
MORTMOD	ID and tracing cards	Mortmod disc	Final preparation for input to FAF
FAF	Mortmod disc	FAFile	Consolidation of exposure data, providing annual exposures for 405 men

BASIC INFORMATION FOR MEN IN COHORT "A"

Columns	Item and "format"	
7-12	Date of birth (day/month/year)	3I2
16-21	Identity number	I6
22-27	Date of test (day/month/year)	3I2
28-31	Height (cms)	F4.1
32-35	Weight (kgs)	F4.1
36-39	$FEV_{1.0}$ (litres)	F4.2
40-43	FVC (litres)	F4.2
44-47	MMF (litres)	F4.2
48-52	Persistent cough, persistent phlegm, breathlessness, wheezing, number of chest illnesses	I5
53-61	Smoking habit, recoded into a single character in column 362	I1
62-66	Clinic, and reference number	A1,I4
67-71	Reading sequence number	I5
72-114	X-ray readings: Reader A	
115-157	B	
158-200	C	43 columns laid out as
201-243	D	in p. 4 of the Annex
244-286	E	
287-329	F	
330	Status (Alive, Dead, or Lost to view)	A1
331-336	Date of birth as in "main mortality cohort"	3I2
337-338	Year of death, or loss (blank if alive)	I2
339-341	Cause of death (blank if alive or lost to view)	I3 *
342-345	Date of start of first job (year/month)	2I2
346-349	Recorded end of last job (year/month = 66/11)	2I2
350-353	Net service (years)	F4.2
354-360	Accumulated dust exposure (mpcf.y)	F7.2
361	Mining area (Asbestos or Thetford Mines)	A1

* First digit R or S for accidents at asbestos work

of the International Classification of Diseases.

The x-ray readings had been into the full U/C classification as adopted by the six McGill readers in 1967, i.e. well before its publication in 1970 - see section 3.4 above; however, the detail of which "additional symbols" had been recorded had not been punched, but only the count of the number of "symbols", and similarly there was a record as to whether or not any "comments" had been noted. These last "economies" were introduced in the preparation of the tape file containing the 42,022 readings that replaced one which, during the early 1970s, was found to have been incorrectly written on to tape a year or so earlier; the only way of repairing these deficiencies would have been by recourse to the original reading sheets. The readings for each particular reader were allocated a specific field on the complete record on XMAFWF.

Preliminary processing, partly to test the main analytical program, partly to check on the quality of the data, revealed that the recorded environmental history on a precursor of XMAFWF was inconsistent for one man: his last job was given in the detail as in the 1940s, but he had definitely still been in employment at the end of 1966. A search of the original register showed (a) that he was in the "main mortality cohort" and (b) that he had had employment at three companies, and hence three buff cards; no problems of identity had arisen, but his work since 1947, recorded on one of the buff cards, had inadvertently been omitted in the preparation of the work histories for the mortality cohort study. Although it will be necessary to make appropriate amendments on several files relating to that study before any further

analysis is undertaken, it would have been extremely costly to make the corresponding changes for Cohort "A"; further, this man was still living at the end of 1975 and so of less importance from an epidemiological point of view than a man who had died. He was, therefore, excluded from Cohort "A".

Thus, at the final count, this cohort consisted of 988 men. All were traced to the end of 1975, when 858 were still living (86.8 per cent). A total of 130 had died (13.2 per cent), and cause of death had been ascertained for all but two of the deceased. The attrition from the early count of 1,031 men was of twenty in the "main mortality cohort" and 22 others; none of the latter had died by the start of 1976. (It would have required several additional computer runs to determine the status - alive, dead or lost to view - of those two members of the "main mortality cohort" excluded because no film could be traced on the TRIPLF file or the 17 excluded because there was no complete set of six readings.)

7.6 Cohort "B": definition, sources and numbers

At the outset, it seemed that the enumeration of Cohort "B" would be a comparatively simple task involving only the manipulation of files on magnetic tape. Members of the "main mortality cohort" were defined on ASBMORT, whether an x-ray had been assessed was indicated on TRIPLF, which also gave the reading serial number, and the readings themselves were available on BASICX, indexed by that reading number. However, the complications were great, arising mainly because of men for whom there were now, or had ever been thought to be, more than one buff card in the original register of the complete working population

of the industry. The solution of all identity problems had to be confirmed, and additional difficulties arose for several reasons. First, a man's film might be indexed on TRIPLF under any, some or all of (a) the six-digit numbers identifying his various buff cards and (b) the special number, of less than six digits, allocated to all his records at the time TRIPLF was created (1969-70). Secondly, there might be more than one film for such a man, with increasing problems of accurate linkage. Thirdly, two further files created about the same time, i.e. 1969-70, IDCRDF and SAMASF, were brought into use in the expectation that they would aid the elucidation of the various problems of linkage; however, the first was found to be incomplete and to contain some further errors which, although few in number, rendered the file unsuitable for use as planned, while the latter was found to be even more out-of-date than had been anticipated and to contain certain information of which we could make no sense. Finally, the fact that we had failed to find a complete set of six readings for certain men expected to be in Cohort "A" meant that these men were now available for inclusion in Cohort "B", although initially they had been excluded on the grounds of *prima facie* membership of the other cohort.

Had these shortcomings and difficulties been fully appreciated at the start, it would have been possible to specify a simpler system of data processing, which would have been just as reliable. However, by the time the problems were fully manifest, the original plans were well advanced and there appeared nothing to be gained from abandoning them and starting afresh. Several contingency manoeuvres had to be developed, all devised to "fail safe", and so, at the end of the

process, we were certain that although longer and more complicated than it need have been it had been carried out correctly. In other words, no subject had been excluded from consideration unnecessarily, and none included unless there were no reasonable doubt that the x-ray reading was of a film of the person defined.

After the long process of matching and checking, we found a total of 5,425 cases on both ASBMORT and TRIPLF. Of these, 764 had more than one buff card, but only one film had been read for the majority of them. Indeed, there were only 22 persons for whom readings of two films were traced - too few for any study of differences in readings - and the later film was selected, after a careful study to be sure of its identity, in conformity with criterion (1) of section 7.4 above. We expected to exclude all 604 men from Cohort "A" who were also in the "main mortality cohort" but, because he was under different identity numbers in the two sets of data, one remained in Cohort "B", which at this stage comprised 4,822 cases.

The file BASICX contained 42,022 readings of the films for 15,689 persons. Almost all the films (15,570, or a shortfall of 0.8 per cent) had been read at Stage 2 and so were acceptable for Cohort "B", always provided the subject of the film was in the "main mortality cohort". The 4,822 cases as above were linked with the Stage 2 readings and films for all but 32 men were traced and the readings added to the record; the number of subjects now included was 4,790. The shortfall was 0.7 per cent of 4,822, very similar to that in the complete BASICX file; almost certainly, it was due to the films being

considered "unreadable". There seems no reason to believe that their exclusion could have led to bias in answering the questions of section 7.2. For reasons already given, we also excluded the 231 females, leaving a final count of 4,559 men in Cohort "B".

As before, the rather extensive basic file was cut down as far as reasonable to reduce costs of disc storage and of analysis, and the basic details on the working file (XMBFWF) are given in Table 7.4. Definitions of net service and accumulated dust exposure are as in Liddell, McDonald and Thomas (1977, p. 471). Smoking habit was re-coded from the record on the ASBMORT file as follows:- 0 = non-smokers; 1 through 5 indicate various categories of those believed not to be current cigarette smokers; 6 = 1-12 cigarettes a day; 7 = 13-25 cigarettes a day; 8 = 26-65 cigarettes a day; 9 = not known. This last category (9) included those for whom a question-naire had not been completed and others where interpretation was doubtful; the category was reduced by about twelve per cent by care-ful scrutiny of the latter group.

X-ray readings were complete in the same sense as for Cohort "A"; see previous section. To maintain "blindness" in study of inter-obs-erver differences, the readers' identity numbers were altered by ranking the readers according to the number of subjects whose films they had assessed. Once the specification for this process had been written, the re-labelling was carried out by Mr. Mario Rodrigues with-out further reference to the author, and the computer output contain-ing check totals etc. was verified by a means which meant that the

Table 7.4

BASIC INFORMATION FOR MEN IN COHORT "B"

Columns	Item and "format"	
1	Sex (M)	A1
2	Set (Reader)	I1
9-14	Identity number	I6
15-20	Date of birth (day/month/year)	3I2
30-34	Clinic and reference number	A1,I4
35-39	Reading sequence number	I5
40	Status (Alive, Dead, or Lost ot view)	A1
41	Quality of match in tracing	A/N
42-43	Year of death, or loss (blank if alive)	I2
45-47	Cause of death (blank if alive or lost to view)	I3 *
48-51	Date of start of first job (year/month)	2I2
52-55	Date of end of last recorded job (year/month)	2I2
56-59	Net service (years)	F4.2
60-66	Accumulated dust exposure (mpcf.y)	F7.2
67	Mining area (Asbestos or Thetford Mines)	A1
68-110	X-ray reading' 43 columns laid out as in p. 153 of the Annex	
137	Smoking habit, recoded	I1

* First digit R or S for accidents at asbestos work.

author was kept blind * to the identities of the six readers.

The status of the 4,559 men in Cohort "B" at the end of 1975 was as follows:- 2,957 known to be alive (64.9 per cent); 1,543 dead (33.8 per cent); with 59 lost to view (1.3 per cent). This last percentage is considerably less than in the entire "main mortality cohort", where the losses numbered 1,089 among 10,939 males, or 10.0 per cent. Most of these losses were after short service before 1936, the year in which routine radiology was introduced at Asbestos. Of the losses in Cohort "B", three-quarters were in men whose last employment was before 1951. Cause of death was determined for all but 16 cases (1.0 per cent), mainly among earlier deaths. In the entire "main mortality cohort", there were 125 deaths of unknown cause in a total of 4,463 male deaths (2.8 per cent), a difference again accounted for by the considerably higher proportion of deaths in the entire cohort before the 1950s.

It is usual in follow-up studies to accept the tracing, once achieved, as valid, without further investigation. For the main mortality enquiry, a code had been used to indicate the quality of the linkage of records from various sources. Table 7.5 illustrates how well the tracing had been carried out for the 4,500 men in Cohort "B" known to be alive in 1976 or to have died earlier. The code was devised to reflect the greatest amount of disagreement

---

* The key, still not read by me, was sealed and has been lodged with Professor McDonald, as my supervisor.

Table 7.5

QUALITY OF RECORD LINKAGE

4,500 men in Cohort "B" known to have died or been alive in 1966

X: Surname and at least one forename identical or close match (i.e. phonetically compatible, accepted alternative or French/English equivalent.)

Y: Match of names less good than above, but considered adequate.

Z: Match of names themselves inadequate, but match confirmed by other evidence.

1: Full dates of birth available in all records, and identical.

2: Full dates of birth available in all records, but one day and/or one year out. Full dates of birth available in all records, but day and month interchanged. Worse than above, but year of birth identical or out by one only.

3: Worse than above.

Alive or Dead Work history	Alive Single	Dead Single	Alive Multiple	Dead Multiple	Total
Number of men	2,564	1,315	393	228	4,500
Cumulative percentages					
X 1	*91.0*	*57.5*	*45.3*	*29.4*	*74.1*
X 1 and X 2	*96.8*	*91.0*	*79.6*	*69.3*	*92.2*
X 1 through X 3, Y 1 and Y 2	*99.6*	*98.6*	*94.4*	*93.9*	*98.5*
Above and worse	*100*	*100*	*100*	*100*	*100*

Table 7.5

QUALITY OF RECORD LINKAGE

4,500 men in Cohort "B" known to have died or been alive in 1966

X: Surname and at least one forename identical or close match (i.e. phonetically compatible, accepted alternative or French/English equivalent.)

Y: Match of names less good than above, but considered adequate.

Z: Match of names themselves inadequate, but match confirmed by other evidence.

1: Full dates of birth available in all records, and identical.

2: Full dates of birth available in all records, but one day and/or one year out. Full dates of birth available in all records, but day and month interchanged. Worse than above, but year of birth identical or out by one only.

3: Worse than above.

Alive or Dead Work history	Alive Single	Dead Single	Alive Multiple	Dead Multiple	Total
Number of men	2,564	1,315	393	228	4,500
Cumulative percentages					
X 1	*91.0*	*57.5*	*45.3*	*29.4*	*74.1*
X 1 and X 2	*96.8*	*91.0*	*79.6*	*69.3*	*92.2*
X 1 through X 3, Y 1 and Y 2	*99.6*	*98.6*	*94.4*	*93.9*	*98.5*
Above and worse	*100*	*100*	*100*	*100*	*100*

between sources; quality would thus inevitably appear worse the more documents were involved. The minimum was a single buff card and a smoking questionnaire for the living; however, there were many men with more than one buff card, and of course there was also the death certificate for the deceased. The first two lines of percentages reveal the expected trends in the quality of linkage, but they also indicate extremely high standards of matching records. The linkage indicated by the third line would still be generally considered quite acceptable, and the percentages in each column of this line are uniformly high.

7.7 Summary

In order to answer the following questions:-

1. To what extent can radiological changes in those that have been exposed to asbestos dust predict mortality?
2. Are the predictions of mortality from radiological changes improved or modified by other factors?
3. What are the best factors for predicting mortality?

two cohorts of Quebec chrysotile miners and millers were defined.

Cohort "A" comprised 988 men who were at work at the end of 1966 and had been subjected, mainly in 1967 but in some cases in 1968, to a questionnaire on respiratory symptoms and smoking habits and to lung function tests. The latest chest radiograph to November 1966 had been assessed by each of six readers into the U/C classification, later published by Bohlig *et al.* (1970); see the Appendix at the end of Volume 1 of this thesis. Information available about each man is listed in Table 7.3. By the end of 1975, there had been 130 deaths;

no member of the cohort had been lost to view.

Cohort "B" comprised all 4,559 men who (a) were born in the years 1891 through 1920 and had worked in the chrysotile producing industry for at least a month (and so were included in the "main mortality cohort"), (b) had had an x-ray, the latest to 1966, assessed by one of the six readers mentioned in the previous paragraph, and (c) were not in Cohort "A". A list of the information collected about each man is in Table 7.4. By the end of 1975, there had been 1,543 deaths and 59 men had been lost to view.

The leading information about each man is given in parts "A" and "B" of the Annex to this thesis, bound as Volume 2. The reasons for the sequences in which the men are listed are given in section 8.4, below.

Chapter 8

M E T H O D S

8.1 Introduction

Methods of cohort analysis have for long been a matter of controversy, and will probably remain so despite a recent review by the present author and his colleagues (Liddell, McDonald and Thomas, 1977). This review came about because, from the beginning of their studies of mortality in Quebec chrysotile workers, Professor McDonald and his team were aware of imperfections in the methods they were forced to use in the initial analyses. Several improvements were introduced into later reports (McDonald *et al.*, 1973; 1974), one of them being an approach by taking several controls for each case which I had proposed unaware of Miettinen's (1969) suggestion. The selection of controls and the analysis were carried out by Dr. Gail Eyssen (*cf.* Eyssen and Liddell, 1974), but the method was not fully described in the literature at that time because it had not been adequately explored. There were still possibilities of improvement, and a small group of statisticians met at McGill University in June 1974 to discuss them. Many ideas were exchanged, and a full report (Liddell, 1974) was circulated to all concerned; after agreement, a brief summary was published by Liddell (1975b). Nevertheless, there still remained the need for the McGill group to employ the best possible means of analysis on their important data, and although it was now fairly clear how the basic

problems were to be handled it seemed appropriate to have the principles presented to a wide circle of experts for open discussion which would be published.

Now, only a year after the review was presented to the Royal Statistical Society, there have been further developments in analysis, as mentioned in the discussion and reply (Liddell, McDonald and Thomas, 1977, pp. 485-491) and as explained in a paper by one of the authors of the review (Thomas, 1978). This chapter discusses briefly the need for distinguishing modes of reasoning for analysis from what the study design may appear to imply; thereafter, the main methods readily available with either form of logic are outlined, with advantages and disadvantages, and, finally, the methods used to analyse the data from Cohorts "A" and "B" are described.

8.2 Modes of reasoning

The expression "cohort study" is being used increasingly to describe an investigation which takes a population of known characteristics and works forwards to the affected persons in that population; because of the direction of development, such studies have long been termed "prospective", in the epidemiological literature. However, that term has an everyday meaning, involving placing the enquiry in time, which is frequently misleading. Thus, both Cohort "A" and Cohort "B" were not set up until 1977, and much of the work on them has been, in the temporal sense, retrospective. This is not an unusual situation, and a study of the present nature has sometimes been called a "retrospective cohort" study, which denies the traditional, epidemiologic, use of the adjective (see, for example, Taylor and

Knowelden, 1957; McMahon *et al.*, 1960).

Because a cohort study is prospective, in the sense first used above, it can be analysed by an argument that also works forward, i.e. from cause to effect; such an argument has, since 1710, been styled *a priori*, according to the Oxford English Dictionary. The fundamental application to cohort studies such as the present is as follows:- (1) the population is classified into sub-cohorts according to known characteristics (such as normal or abnormal radiological findings; light or heavy dust exposure; non-smokers, light smokers or heavy smokers); (2) the sub-cohorts are followed through an appropriate "study interval"; (3) the numbers of deaths in each sub-cohort are counted; and (4) comparison of sub-cohorts is made in terms of selected measures of mortality. The mode of argument has clearly been from cause (abnormality of x-ray, dust exposure, smoking) to effect (mortality), i.e. *a priori*.

However, this is not the only form of argument that can be used in a cohort study; it remains possible to compare the characteristics of those who have died against those of the survivors. Here the mode of argument is a working backwards from the fact of death (or survival) to the factors which may have led to the differences. It is equally clear that this style of argument is from effect to cause, designated *a posteriori* (also since 1710 according to the OED). There are two rather different applications of this mode of reasoning. In one, each death, as it occurs, is compared with all still surviving; methods of analysis have been put forward by Cox (1972), based on regression models, and developed by others, including for example

Thomas (1978). In large cohort studies, comparisons of this nature are extremely costly, even with efficient programs for fast computers, and so sampling of the survivors is desirable. If a fixed number of survivors, now called "controls", is selected for each death (or "case"), the material is exactly equivalent to that of a "case-control" study. The method of Cox (1972) and its successors can be applied, but they are rather complex; simpler methods are available in many circumstances. The principle of sampling the living was recommended by Liddell, McDonald and Thomas (1977), and endorsed in the discussion.

The case-control design (previously called "retrospective" in the epidemiological sense, but quite possibly carried out prospectively in the everyday sense) has often been criticised because:- (a) it may be subject to severe bias in data collection; (b) it does not provide estimates of risk, but only of relative risk; and (c) in practice the principles by which the controls have been selected have left much to be desired. It is therefore important to appreciate that the use of *a posteriori* reasoning in a cohort study is of a rather different nature; in particular, criticism (a) will normally not apply (Armitage, 1977). On the other hand, there is no denying that the criteria by which controls are selected are just as important here as in other case-control situations.

8.3 Comparative composite cohort analysis

By far the most generally used applications of *a priori* analysis in the study of mortality in a cohort have been based on "comparative composite cohort analysis", the method that Case and Lea (1955) used for investigating the effects of mustard gas poisoning during World

War I. The cohort is divided into a number of sub-cohorts, who are followed over an appropriate "study interval" (see below). The mortality experienced by each sub-cohort is compared with the experience expected for that group on the basis of some "reference population" (see below). Sex-, age-, year-, cause-specific death rates for the reference population are applied to the "man-years in view" accumulated by the sub-cohort, the man-years being found by summation, over all persons in the sub-cohort, of the years between the start of the study interval and the earliest date of: death, last trace for those lost to view, end of study interval or, when the study interval extends beyond the period of follow-up, the end of follow-up of those alive at that time. In theory, this can be done for each one-year square (or one-year triangle) in the relevant diagonal band of the Lexis (1875) diagram, which has age and time as orthogonal axes. However, the practice has been to use five-year squares to reduce the bulk of the computations.

The choice of *study interval* is of importance, particularly to avoid the fallacy, which appears to have been pointed out first by Enterline and Henderson (1973), that long exposure tends to improve life expectancy; in other words, only those who live to a considerable age have the opportunity to acquire long exposure. It is also important that the classification of sub-cohorts be made on the values of the appropriate characteristics at the start of the study interval, or earlier, but never later.

In Cohort "A", all men were known to be alive at the time of physiological testing, and this has been taken as the start of the

study interval. In Cohort "B", where one set of factors of sub-cohort definition comprised the radiological changes, these must have preceded the start of the study interval. However, as the men were also known to be alive at least until the end of their last recorded job, the study interval could not start earlier than that for each man; otherwise, man-years would be accumulating in the denominators of mortality rates while the numerators remained void until the recorded date of last employment. This date has, then, been taken as the start of the study interval for Cohort "B".

The choice of *reference population* is also not without difficulty. The usual selection has been of national mortality, following Case and Lea (1955), or mortality for other major populations, such as all males in the Province of Quebec (e.g. McDonald and Liddell, 1978) or white males in the United States (e.g. Enterline *et al.*, 1972 etc.) However, these may not be relevant to any specific occupational cohort, because of geographic and socio-economic factors, to say nothing of factors of selection into and out of the cohort. Even rates of a more localized nature may fail to overcome the socio-economic difficulties, and there is no reason to believe that they will improve the situation over selection. Some workers, for instance Dr. I. J. Selikoff's group at Mount Sinai School of Medicine, New York (Selikoff *et al.*, 1978), amend the officially coded cause of death whenever they consider this justified by study of the death certificate or by autopsy findings. However, there would appear to be no way in which corresponding changes could be made for any external reference population, so that it is not possible to find appropriate expected numbers of deaths against which to compare the adusted observed numbers.

Fortunately, these issues are not of great importance if the aim is to make comparisons between sub-cohorts, without trying to obtain absolute risks for each sub-cohort separately. Indeed, for this aim, any reference population will be satisfactory if its mortality experience is not too widely different from that in the cohort under review. Nevertheless, there are often advantages in an internal reference, i.e. comparing sub-cohorts each against the experience of the entire cohort. In particular, the difficulties over selection may be at least reduced, no special data collection is required, and no restrictions get imposed on the study interval by any lack of availability of material for specific years, or causes, for the reference population, while for normally rare conditions that are nevertheless not uncommon in the cohort, e.g. pneumoconiosis in those exposed to dust, the expectations will be more realistic for internal comparisons.

Liddell, McDonald and Thomas (1977) also discussed various ways in which observed and expected deaths could be compared. These workers had hoped that the potential of a flexible program for linear modelling, GLIM (Nelder, 1975), could be explored in the Quebec asbestos mortality study. However, Dr. I. D. Hill, who volunteered to carry out this exploration, has been unable to do more than preliminary analysis. Despite its drawbacks, the use of the simple ratio between observed and expected deaths, which can be seen to be a Standardized Mortality Ratio (SMR), is still widely used if only for its simplicity and universality; it has a further advantage over other ways of relating observations to expectations in the ease with which it can be partitioned in analysis by χ^2, in the ways described in general by Armitage (1971, p. 362 *et seq.*) and with particular reference to mor-

tality studies by Liddell, McDonald and Thomas (1977).

A major drawback of comparative composite cohort analysis is in the conflicting aims for the definition of sub-cohorts, which have to remain reasonably large if comparisons between them are to be in any way reliable. If there are several factors of interest, and particularly if their interactions may be important, they cannot easily be examined together, in mutually exclusive sub-cohorts, as is theoretically essential. Instead, they have to be examined one at at time, or in pairs, and this leads to unresolvable problems in the disentangling of "effects" when the factors themselves are correlated.

8.4 *A posteriori* methods of cohort analysis

The approach of comparing each death with all surviving to that time is theoretically possible, but is not feasible in large cohorts; further, it usually requires modification (of the sort described by Thomas, 1977) from the original proposals, which were devised for use in clinical trials, with rather different constraints (Cox, 1972). This section will therefore be concerned with situations in which the living have been sampled. Further, we will consider only purposive sampling, e.g. to find a set of "controls" against which certain "cases" can be compared; the number of controls for each case will be taken as fixed. This is simpler, and so more practical, than when differing numbers of controls are taken for each case, and there seems no need to extend the discussion further, although Thomas (1978) claims that the methods of analysis he has developed cope with all case-control situations.

Two important aspects of *a posteriori* analysis should be mentioned at the outset. First, all comparisons are internal; this has clear advantages, with the corollary that absolute risks cannot be calculated (except when a method such as that of Cox, 1972, is applied to a cohort in which there has been no sampling). However, unless the reference population in *a priori* analysis is truly relevant, such methods are also unable to produce reliable absolute risks. The second aspect is that, in all but the most exceptional circumstances, all cases of interest can be included. Even if some deaths are of unknown cause, the likelihood is that only a trivially few cases will be missed, while the effect on the controls is only that the pool from which they are to be drawn is a little smaller than otherwise.

There is much current argument (see, for example, Miettinen, 1970; McKinlay, 1975; 1977) about the value of matching in the sampling of controls. Sometimes matching is essential for validity, and then it would appear from a seminar sponsored by the *Journal of Chronic Diseases* in April 1978 (Drs. G. E. Eyssen and D. C. Thomas, personal communications) that the matching should be taken into account in the analysis. However, there are strong indications that results are often virtually unaffected by whether or not the analysis is performed treating the data as matched or unmatched. For example, it is difficult to distinguish the results obtained by Dr. Thomas (personal communication) of the two forms of analysis when applied to the lung cancer deaths to the end of 1975 and their controls, as described by McDonald and Liddell (1978). When controls have been matched with cases for disturbing variables (using the nomenclature of Cochran, 1965), no analysis can assess the effects of such variables, although interactions with

the variables of direct interest (which therefore have not been included in the matching) can be evaluated; they can, of course, be evaluated along with the effects of the disturbing variables themselves, if such variables are not matched for. Thus, a strong argument is being developed for reducing matching to that essential for validity.

As in all forms of case-control investigation, the criteria for the selection of controls are vital. In the Quebec mortality studies, the fundamental criteria were that selection would be strictly at random from among men born in the same year as the case and known to have survived at least into the year following that in which the case died.

Although discussion up to this point has been confined to case-control situations, this is no restriction on *a posteriori* argument. The foundation of such methods is some form of discrimination - so far between the characteristics of the dead and those of the living. The same mode of argument can be applied to comparison between any groups of cases, without reference against "controls". An example would be a comparison of exposure factors in smokers and in non-smokers all of whom had died from lung cancer. It would not then be reasonable to match, in the same way as before, for time variables, but rather to see whether one of the important differences between smoking and non-smoking lung cancer cases was, for instance, age at death. Nor need the groups compared be only two in number. Thus it has recently been possible to examine "latent periods" (i.e. the intervals between first exposure and death) in the 245 lung cancer deaths within the Quebec "main mortality cohort", classified *post hoc* according to dust exposure accumulated to age 45; the first results are in Table 2.2.

Exploitation of such methods of reasoning leads to great flexibility in hypothesis formulation.

8.5 Methods for *a priori* analysis of Cohorts "A" and "B"

Whatever advantages lie with *a posteriori* reasoning, there can be no doubt that the traditional approach to the analysis of a cohort has attractions, although the simplicity frequently claimed for it (for example by Doll, 1964; Fox, 1977) is more apparent than real. It remains important to carry out certain basic analyses using *a priori* reasoning, and for the moment the best approach appears to be the comparative composite cohort analysis of Case and Lea (1955) - with the modification that Case and Lea used probabilities of dying, while most computer programs, such as MYCL (Hill, 1972) or PGM1A, written by Mario Rodrigues, to my specification, for the McGill analyses, use death rates.

For both cohorts, "A" and "B", we have used as reference the mortality of males in the Province of Quebec. Annual mid-year populations and deaths from all causes (i.e. total deaths), both by five-year age groups, have been published by Statistics Canada, and were punched from the latest revisions. The years covered were 1926 through 1974, and the material for the last year was reproduced to provide approximations for 1975. This has been called Quebec Deck 1. Cause-specific information was sought from Statistics Canada, who were able to supply details of every death, either sex, all ages, for the causes we had specified by codes from the Seventh Revision of the International Classification of Diseases, for the years 1951 through 1973. Programs were written (a) to assemble this material for males, in five-year age

groups, annually, for each of the 12 groups of specific causes listed in Table 7.1, and (b) to calculate the numbers of deaths for causes not specified in that table, by subtraction from the data in Quebec Deck 1. The material for 1973 was reproduced twice to provide approximations for 1974 and 1975, and this has been styled Quebec Deck 2.

Quebec Deck 2 was adequate for Cohort "A"; as already explained, the start of the study interval was, for each man, his date of test and this was never earlier than mid-1967. However, for Cohort "B" there were 116 deaths before 1951 and for these cause-specific death rates for Quebec over the period 1926-50 would have been desirable. Attempts had been made to assemble this material, which would of course have been useful in the main mortality studies, but great difficulties had been encountered. Despite the expenditure of much effort and many dollars, a substantial proportion of error was found in what had been punched, and it would have been necessary to spend much further effort if the material were to be made reliable. After discussion with my supervisor, it was decided not to proceed with this work, and so the only Quebec mortality rates available for 1926-50 were for all causes, i.e. Quebec Deck 1.

The data of Cohort "A" are considerably more extensive than those of Cohort "B", but on rather limited numbers. Nevertheless, because they include respiratory function and symptom details, they are of particular interest. It remained desirable to find, if possible, a sub-division of Cohort "B", as closely comparable as possible to Cohort "A", if only to ensure that the exclusion of the latter from those initially available for the former had not led to any unforeseen

biases. A sub-division to resemble Cohort "A" would consist of those still at work in November 1966 who were known to be alive at the end of 1967 - bearing in mind that no detail of the date of death or loss to view was available other than the year in which the event had occurred. The number of men meeting these criteria was 1,732, and it seemed appropriate to divide the remaining 2,827 into two further classes according to date of last job. The obvious choice was to conform with the dates of Quebec Decks 1 and 2: it was found that 1,422 men had left employment before 1951, and they were designated "Era 1"; 1,405 men had left employment some time from the start of 1951 to October 1966, or were still employed at November 1966 but died before the end of 1967, and they were taken to comprise "Era 2". The previously determined group of 1,732, as like as possible to Cohort "A", was termed "Era 3".

For Cohort "A", each man's study interval began at the time of the physiological test in 1967 or 1968. For Cohort "B" as a whole, the intervals started when the men left employment. However, when this cohort was split by Era, and when regard was taken of which Quebec Deck was available for use, the study intervals had to be adjusted as follows:-

Era		Start	End
1	Before 1951	End of last job	End of 1950
	After 1950	Start of 1951	End of 1975
2		End of last job	End of 1975
3		Start of 1968	End of 1975

It will be appreciated that the man-years accumulated for the three Eras separately do not sum to those for Cohort "B" in its entirety: the interval from end of job (November 1966) to the end of 1967 for

men in Era 3 has been excluded. Most analyses were carried out Era by Era, but as will be explained later it is inappropriate to present them in this way. The observed and expected numbers of deaths were therefore totalled, over the three Eras, to obtain corresponding values, and SMRs, for the entire Cohort "B". The numbers observed were correct, but the expectations were slightly low. One analysis was repeated on the complete cohort, and this allowed some study of the effects. Man-years from 1951 through 1975 accumulated for the entire cohort were 55,970, compared with 54,021 when the separate figures for the three Eras were added, a shortfall of 3.5 per cent. The corresponding figures for numbers of deaths expected were 990.3 and 965.5, a shortfall of 2.5 per cent; SMRs would of course be overstated by the same amount, i.e. 2.5 per cent. As was to be anticipated, the shortfall in expectations was consistent over each group of causes of death. Further, in the two sub-cohorts which could be compared on both bases, there was no suggestion of differences in the *relative* effects. While it would have been possible to repeat all the *a priori* analyses on the entire Cohort "B", this would have been expensive and could have gained little. It was therefore decided, again in consultation with my supervisor, that this additional work could not be justified.

A rather simplistic form of the first question to be answered (see Chapter 7, above) is: do those whose chest radiographs are assessed as completely normal have lower mortality than others? This has been answered, directly, in both cohorts, by classifying each subject as radiologically "normal" or "less-than-normal". A reading was taken as normal if there were no record of parenchymal change (profusion of small opacities 0/- or 0/0 for both rounded and

irregular; no large opacities), no record of pleural thickening (whether of the walls or affecting the costophrenic angles, the diaphragm or the cardiac border), no record of pleural calcification, and no "additional symbols". There were 302 subjects in Cohort "A" (30.6 per cent) in whom all six readings were normal. In Cohort "B", where there was only a single reading of each film, the criteria of normality were much easier to meet: 67.7 per cent of subjects were "normal". In both cohorts, mortality in the "normals" has been compared with that in the others, i.e. the "less-than-normals". In Cohort "B", the analysis was carried out separately for each reader.

The instructions for the use of the U/C (and later) classifications of radiographs include provision for recording 0/- for "barndoor" normal films, i.e. those whose parenchyma are so exceptionally normal that the reader has no doubt that all other readers would also call them normal (*cf.* Liddell, 1963). Not all film readers make substantial use of this coding and even for those who do it is rare in a working population. However, when it is used, it is most unusual for other abnormality to be recorded, and it is seldom indeed that other readers rate the parenchyma as other than normal. For a few of the "normal" men in Cohort "A", at least one reader had recorded 0/- for both rounded and irregular small opacities. In Cohort "B", the number of subjects recorded as "barndoor" normal differed from reader to reader, as was to have been expected. In both cohorts, these exceptionally normal cases were compared in terms of mortality with the rest of the "normals", by reader separately in Cohort "B".

A closer examination of the first question was possible from five

further analyses, for both cohorts, after sub-division according to a score of:- (1) small opacities, rounded and irregular combined; (2) large opacities; (3) pleural changes, other than calcification; (4) pleural calcification; and (5) "additional symbols". These analyses were not independent of those by "normality"; nor were they independent of each other. For each radiographic feature, the subjects were classified afresh and the "less-than-normal" subjects may have appeared on several occasions with positive scores for the various features.

The method of scoring the x-ray readings is given in Table 8.1, the first part summarizing the detail of the second. In Cohort "A", the six scores of each feature, one score per reader, were added together to give a summary score. For small opacities, rounded and irregular combined (SSC in Cohort "A" and SC in Cohort "B"), three classes were distinguished, i.e. "absent", "slight" and "present". Three similar classes of pleural changes (PL) were also distinguished in Cohort "B". All other features were dichotomized into "absent" and "present".

In preliminary attempts to answer the second question, about whether radiographic or other factors are important in predicting mortality, three further analyses were also carried out for each cohort, again without regard for independence. The factors were:- (1) mining area (two sub-cohorts in each case: Asbestos and Thetford Mines); (2) accumulated dust exposure (four sub-cohorts in each case); and (3) cigarette smoking (two sub-divisions of Cohort "A", with a third, "unknown smoking habit", in Cohort "B").

Table 8.1

TRANSLATIONS OF X-RAY READINGS

Part 1: Summary

PARENCHYMAL CHANGES

Small opacities: rounded		(profusion) x (# zones)
irregular		(profusion) x (# zones)
combined		SC
Large opacities		LO

PLEURAL CHANGES

Pleural thickening		PT = "Extent" x Grade
Costophrenic angle(s)	CP	
Irregular diaphragm	ID	
Irregular border	IBG	
Pleural, other, "total"		PO
Pleural changes, other than calcification		PL
Calcification (grade)		PCG
SYMBOLS		SY

Part 2.1: Detail (SCALING)

Small rounded opacities:	profusion	Scale AR *
	zones affected	Count (BR)
Small irregular opacities:	profusion	Scale AI *
	zones affected	Count (BI)
Large opacities		Scale LO †
Costophrenic angle		Scale D1 §
Pleural thickening:	diffuse	Scale D2 §
	plaque	Scale D3 §
	grade	0, 1, 2, 3 (PTG)
Irregular diaphragm		Scale D4 §
Irregular cardiac border		0, 1, 2, 3 (IBG)
Pleural calcification:	grade	0, 1, 2, 3 (PCG)
"Additional Symbols"		Count (SY)

* Scales AR and AI: Notional scale of Liddell and May, (1966, p. 9) except 0/- → 0

† Scale LO: (Well-defined) A → 1, B → 2, C → 3.
(Poorly defined) D → 1, E → 2, F → 3.

§ Scales D1 through D4: L → 1, R → 1, B → 2.

Part 2.2: Detail (SCORING)

Small opacities	SC = (AR x BR) + (AI x BI)
Large opacities	LO
Pleural changes, other than calcification	PL = D1 + (D2 +D3)(PTG) + D4 +IBG
Pleural calcification	PCG
"Additional Symbols"	SY

In Cohort "A" only, a further eight analyses were possible; these were again based on subdivision of the cohort for one factor at a time, not in combination. For each of persistent cough, persistent phlegm and wheezing, the classification was into those in whom the symptom was absent or present; the same subject may well have appeared more than once as showing symptoms. For breathlessness, the breakdown was into three grades: absent, slight and more definite, corresponding to the codes 0, 1 and 2 + 3, recorded on tape.

Three lung function measurements were considered, *viz:-* FVC, the $FEV_{1.0}/FVC$ ratio and MMF. In each case, we calculated deviations from the regression line relating the measure to height and age, and negative deviations greater in absolute value than one standard deviation of the scatter about the regression line were treated as "impaired". Adiposity was assessed in terms of $(weight)/(height)^2$, i.e. Quetelet's index (Billiewicz *et al.*, 1962), and a subject was considered overweight if his index was more than one standard deviation greater than the mean.

In all cases, Relative Risks were calculated for all causes (total deaths) and for each specific group of causes, and differences between sub-cohorts were examined by a modification of the usual χ^2 procedure. Where there were only two sub-cohorts for any factor under examination, there was only one degree of freedom for the χ^2 calculation. Otherwise, we partitioned the χ^2 orthogonally to allocate one degree of freedom to each partition in what appeared the most logical way. The procedures are illustrated in Chapters 10 through 12 on actual findings.

8.6 Methods for *a posteriori* analysis of Cohorts "A" and "B"

No detailed planning was possible before most of the results from *a priori* analysis had been obtained. It was then clear that, although the "normals" did indeed have lower SMRs than the "less-than-normals", and although important relationships had been found, one of the most interesting findings was of the failure of radiology *always* to predict mortality even where it might have been expected to. These phenomena required investigation, which involved design of the type discussed in section 8.4. But first, a conventional form of case-control analysis has to be described.

Case-control studies could, in theory, have been carried out in relation to all reported deaths. Certain considerations, however, reduced the cause groups of interest to six, which can best be discussed in three pairs: pneumoconiosis and respiratory cancer; accidents and strokes; respiratory tuberculosis and diseases of the heart. One would certainly expect pneumoconiosis to be detected on x-ray, provided that, after the x-ray had been taken, there had been neither significant progression of the disease, i.e. a late "attack", nor substantial additional exposure to a dust hazard (not necessarily asbestos). There appear to be two carcinogens for lung cancer - asbestos dust and, much the more powerful, cigarette smoking - which may act multiplicatively. There might well be what could be termed "smoking cancers", without undue exposure to asbestos, and these might not be detected on the radiograph; equally, there might be "dust cancers" in non-smokers which, although comparatively rare, would be detected, one might expect, through the pneumoconiotic appearances associated with the dust exposure.

As far as the second pair of causes, accidents and cerebro-vascular diseases, are concerned, the aim of case-control studies would be essentially to "prove a negative" - a thankless task, however important in theory. As for the third pair, both respiratory tuberculosis and deaths from heart disease might be linked in some way with dust exposure. However, tuberculosis, if seen on the x-ray, should certainly have been recorded, probably as an "additional symbol"; it might, of course, have been mis-diagnosed, perhaps as large opacities, or indeed the diagnosis on death certification might be incorrect. There might be cases where death was certified as due to a disease of the heart in which the underlying cause of death was dust-related, but there would certainly be many cases, probably the majority, where death recorded as due to heart disease was in no way related to asbestos exposure, and so could not be detected as pneumoconiotic change on the x-ray.

In the light of these considerations, the case-control studies were confined, after consultation with my supervisor, to pneumoconiosis and lung cancer. Further, largely because of the small numbers of such deaths in Cohort "A", the more formal case-control studies were restricted to Cohort "B".

For the two selected conditions, one control was chosen in respect of each case, 31 of pneumoconiosis and 118 of lung cancer. Ideally, the control would have been born in the same year as the case and have survived him, but ensuring that the control's survival was long enough made it necessary on a few occasions to relax the first of these criteria, but never by more than a year or at most two.

This form of matching is considered essential for the validity of the case-control comparison. Additionally, the control was selected from among men whose radiograph had been assessed by the same reader, but no other form of matching was felt necessary, or even desirable, in the light of recent debate on this issue. Where, as usually, there were several men from amongst whom a control could be selected, the choice was made by the author, by strict use of a process of randomization.

Two of the most important questions left unanswered by the *a priori* analyses were why some cases of dust-related disease which one would have expected to be detected on x-ray were not; and what was seen on the radiograph in the "less-than-normal" who later died. To these ends, we studied the readings of all cases of pneumoconiosis, lung cancer and mesothelioma, in both cohorts, and examined the provenance of those with "normal" and "less-than-normal" films.

The simplest form of analysis was applied in each of the *a posteriori* studies.

8.7 Summary

Traditional methods of cohort analysis have used *a priori* reasoning, i.e. from cause forward to effect, classifying the cohort into sub-cohorts which differ in the factors of prime interest, such as radiological features, and comparing sub-cohorts in terms of their mortality experience. However, the aims for defining sub-cohorts are conflicting: if they are to be large enough that measures of mortality will be reliable, it becomes extremely difficult to maintain

them mutually exclusive, and so the examination of more than one or two factors, and particularly of the interactions between several factors, is virtually impossible. Nevertheless, these methods *appear* simple in concept - and of explanation - and so they have been adopted here, at lest for exploratory purposes.

Both cohorts have been divided into sub-cohorts, *one factor at a time,* for each of the following factors: radiological normality or otherwise; presence of several radiographic features; mining area; dust exposure; and smoking habit. In addition, Cohort "A" has been correspondingly subdivided according as the subjects had symptoms or depressed lung function or were overweight, or not. A two-way breakdown of Cohort "B" was possible by radiological normality and reader.

Methods using *a posteriori* reasoning, from effect back to cause, are much more flexible, even in a cohort, or "prospective", design. Two causes of death, pneumoconiosis and cancer of the chest, have been singled out for detailed study by such methods, which have included more-or-less conventional case-control studies and also examination of the reasons for the apparent "failures" of the radiological system to predict mortality.

The leading data for each man are listed in two parts, one for each cohort, in the Annex of this thesis, which is bound as Volume 2. The order of presentation of the material, which should aid any approach of an *a posteriori* nature, either on the same causes of death but in greater detail or to other causes of death, and the lay-outs, are described in the Annex.

Chapter 9

DESCRIPTION OF THE STUDY COHORTS

9.1 Introduction

In this chapter, the study cohorts are described and compared. The first section deals with Cohort "A", and then Era 3 of Cohort "B" is examined, showing how little like Cohort "A" it turned out to be, despite the method of its selection. The three Eras of Cohort "B" are then compared, before the entire cohort is described, in as nearly as possible the same terms as for Cohort "A". Finally, it is shown that the six groups of men within Cohort "B" whose radiographs were assessed by the different readers were in fact, as was to have been expected from the method of randomization described by Rossiter *et al.* (1972), closely similar in all measured features.

9.2 The men of Cohort "A"

To recapitulate, these workers were the great majority, 97.3 per cent, of the "physiology cross-section", which has been fully described by McDonald, Becklake *et al.* (1972) and Becklake *et al.* (1972). All 988 men were still at work in November 1966, but the sampling had been heavily weighted towards older men, excluding altogether some of the youngest (i.e. less than 21 years old) and utilising small sampling fractions, except for the oldest of those still under 65 in 1966. All

men were interviewed in 1967 (about 85 per cent of them) or 1968, the earliest interview being in April 1967 and the latest in June 1968. As follow-up was from the date of the physiological testing, age at test is an important consideration: ages ranged from 22.1 years to 66.5, with a mean of 49.3 years. All of the 988 men were traced to the end of 1975; 130 had died.

Table 9.1 gives the distribution of the 988 men by age at test, and shows that the proportion coming from Asbestos (30.1 per cent, overall) was similar in all age groups. Net service, to November 1966, was closely associated with age at test, suggesting that the average age of first employment was about the same in each age group. Accumulated dust exposure was also associated with age at test, as were average dust "concentrations"; even after re-adjustment for the length of the working week, there can be no doubt that the older men had been subjected to much higher dust concentrations, on average, than the younger. The proportion of smokers of at least 13 cigarettes a day was largely independent of age, except for those aged 65 or more at the time of test.

Table 9.2, showing the two-way distribution of the 988 men, by net service and accumulated dust exposure, reveals the expected close association of these two factors; it is also compatible with the previously observed relationship between length of exposure and average "concentration".

The prevalence of each feature of radiographic change is shown, by age at test, in Table 9.3. There was, in most cases, a steady

Table 9.1

MINING AREA, SERVICE, EXPOSURE AND SMOKING: COHORT "A"

	Age at Test					
	<35	45-44	45-54	55-64	≥65	Total
Number of men	149	201	243	378	17	988
Percentage from Asbestos	26.8	27.9	30.5	33.6	-	30.1
Net service (years)	5.3	14.8	19.0	28.3	32.0	19.9
Accumulated dust exposure (mpcf.y)	22	128	215	429	687	259
Average dust "concentration" (mpcf)	4.1	8.7	11.3	15.2	21.5	13.0
Percentage smoking at least 13 cigarettes a day	68.5	73.6	66.3	62.7	41.2	66.3

Accumulated dust exposure (mpcf.y)	Net		
	<1	1, <5	5, <10
<1	5	4	
1, <3	5	54	
3, <6		25	4
6, <10		28	1
10, <30		23	60
30, <100		4	30
100, <300			
300, <600			
600, <1,000			
1,000, <2,000			
2,000 or more			
Total	10	138	95

Table 9.2

SERVICE AND EXPOSURE: COHORT "A"

service (years)				
10, <15	15, <20	20, <30	≥30	Total
				9
				59
1				30
4	5			38
33	5	10	8	139
40	73	70	17	234
19	55	101	61	236
1	16	49	51	117
	5	22	47	74
1	3	6	26	36
		5	11	16
99	162	263	221	988

Table 9.3

PREVALENCE OF RADIOGRAPHIC CHANGES: COHORT "A"

(Percentages of readings)

	Age at Test					
	<35	35-44	45-54	55-64	≥65	Total
Number of readings (six per subject)	894	1,206	1,458	2,268	102	5,928
Small opacities: rounded						
0/1 or greater	1.6	2.2	5.1	4.2	5.9	3.7
1/0 or greater	0.4	0.7	2.5	2.0	2.9	1.7
Small opacities: irregular						
0/1 or greater	6.2	11.3	17.8	25.2	34.3	17.8
1/0 or greater	1.7	2.2	8.0	12.5	19.6	7.8
Large opacities: present	-	0.4	0.3	0.8	-	0.5
Costophrenic angle involvement	0.1	3.6	5.8	10.3	5.9	6.2
Pleural thickening						
Grade 1 or greater	0.2	2.2	4.8	7.7	12.7	4.8
Irregular diaphragm: present	0.2	1.2	2.2	4.9	4.9	2.8
Irregular cardiac border	-	0.3	1.0	3.2	3.9	1.6
Pleural calcification	-	0.6	1.6	7.3	16.7	3.6
"Additional symbols"						
At least one recorded	2.5	5.2	4.1	11.2	15.7	7.0

gradient with age, often distorted only by the figure for the oldest group which contained only 17 men. It was to be expected that the older men, who had also had the heavier exposure to asbestos dust, would show more dust-related changes on x-ray than the younger men. The corresponding gradient for "additional symbols", which are largely unrelated to dust exposure, was again not unexpected, as chest diseases are known to be age-related. The small opacities seen were mostly irregular, there were very few large opacities, but substantial proportions of the men had pleural changes of one sort or another. Thus, reading into the earlier ILO, Geneva, 1958, classification, devised mainly for silicosis and coalworkers' pneumoconiosis and excluding pleural changes, would have produced a very much lower prevalence of radiographic abnormality. The first line of Table 9.4 shows how few men, particularly in the older groups, had films assessed as normal by all six readers. The remainder of this table gives the average values of the scores adopted for use in the *a priori* analyses. That the trends revealed here are closely similar to those of Table 9.3 is confirmation that the scoring system was acceptable for the purposes for which it was devised.

Table 9.5 indicates the prevalence of symptoms, age group by age group. The very low overall prevalence both of persistent cough and of persistent phlegm, and the lack of a gradient with age for the former, are not consistent with the data in Table 3 of McDonald, Becklake *et al.* (1972). This indicates clearly that the answers to the relevant questions, as recorded on the tape QUESTF, have been incorrectly interpreted recently. Although these symptoms are included in the analyses, they cannot be considered reliable.

Table 9.4

RADIOGRAPHIC SCORES: COHORT "A"

	Age at Test					
	<35	35-44	45-54	55-64	≥65	Total
"Less-than-normal" (%)	37.6	60.7	70.8	84.7	94.1	69.4
Small opacities (combined)	1.9	3.0	8.4	12.8	20.8	8.2
Pleural changes *	0.0	0.5	1.1	2.1	3.4	1.2
Pleural calcification	-	0.0	0.1	0.6	1.5	0.3
"Additional symbols"	0.2	0.3	0.3	0.8	0.9	0.5

* other than calcification

Table 9.5

RESPIRATORY SYMPTOMS: COHORT "A"

	Age at Test					
	<35	35-44	45-54	55-64	≥65	Total
Prevalence of symptoms (%)						
Persistent cough	8.1	5.5	6.2	6.3	5.9	6.4
Persistent phlegm	2.7	4.5	4.5	7.1	-	5.2
Breathlessness:						
Grade 3	0.7	1.5	4.9	8.5	17.6	5.2
Grades 3 and 2	9.4	12.4	19.3	28.8	35.2	20.3
Grades 3, 2 and 1	32.2	45.3	54.3	68.5	76.5	55.0
Wheezing						
Grade 2	2.0	6.5	12.8	16.4	-	11.0
Grades 2 and 1	24.2	36.3	42.4	45.8	47.1	39.8
Chest illnesses						
Average number of illnesses per hundred men	8.7	26.4	29.6	30.7	47.1	26.5

Fortunately, these are the only inconsistencies revealed for either cohort, when compared with published material, after allowance for the differences in selection and presentation. Thus, breathlessness, although in some sense standardized for age by the form of the questions, showed a clear and not unexpected gradient with age, as did the prevalence of wheezing. The average number of chest illnesses reported is given for the sake of completeness; this average also showed a clear gradient with age, a reflection of the increasing incidence of chest illness with ageing.

Mean values of height, weight and adiposity (assessed by Quetelet's index; see Billiewicz *et al.*, 1962), and of lung function measurements, are given in Table 9.6, by age at test. As frequently in a cross-section, the older men were shorter than the younger. Although weight was also negatively associated with age, adiposity varied only slightly with age, tending to be a little higher for the older than for the younger men. The three direct measures of lung function ($FEV_{1.0}$, FVC and MMF) all showed strong age-gradients, but the effects of differences in height between the age groups has not at this stage been allowed for. The ratio $FEV_{1.0}$/FVC tended to be slightly less in older men than in younger.

Adiposity and the four measures of lung function were each, separately, related to age at test and height, various combinations of age and height, and weight, by means of standard multiple regression analyses (Armitage, 1971, Chapter 10), using a program in the SPSS package (Nie *et al.*, 1970). Table 9.7 gives the coefficients of regression of each variable on age at test and height (units in Table),

Table 9.6

HEIGHT, WEIGHT AND LUNG FUNCTION: COHORT "A"

	Age at Test					
	<35	35-44	45-54	55-64	≥65	Total
Anthropometry						
Mean height (m)	1.72	1.70	1.68	1.66	1.64	1.68
Mean weight (kg)	73.4	73.0	73.4	71.5	67.8	72.5
Adiposity (1,000)W/H^2	2.48	2.54	2.58	2.59	2.52	2.56
Lung function						
$FEV_{1.0}$ (l)	3.93	3.45	2.94	2.45	2.08	2.99
FVC (l)	4.75	4.25	3.76	3.20	2.74	3.78
MMF (l)	4.32	3.75	2.93	2.34	1.92	3.06
Ratio: $FEV_{1.0}/FVC$	.830	.814	.781	.764	.766	.788

Table 9.7

LUNG FUNCTION AND ADIPOSITY RELATED TO AGE AND HEIGHT

(Cohort "A")

"Dependent" variable	Regression coefficients			Standard error	
	of age at test (years × 10^2)	of height (m)	constant term	after regression	before
$FEV_{1.0}$	- 4.0370	3.9582	- 1.6780	0.4976	0.7898
FVC	- 3.9676	5.4212	- 3.3868	0.5489	0.8688
MMF	- 5.8869	3.1807	0.6129	1.0323	1.2999
$FEV_{1.0}/FVC$	- 0.2209	-	0.8974	0.0806	0.0847
$(1,000)W/H^2$	-	-	2.5597	-	0.3701

together with the constant term in the regression equation, and the standard errors before and after regression analysis.

As had been hoped, and expected from the findings of Billiewicz *et al.* (1962), adiposity was virtually independent of height. It was also only slightly related to age at test; although the F-statistic was 8.09 (degrees of freedom 1 and 985) and so of enormous "statistical significance", the partial correlation coefficient was only 0.0903. Even after all age and height adjustments, the standard error was reduced only trivially, i.e. from 0.3701 to 0.3687. Both $FEV_{1.0}$ and FVC were clearly related to age at test and height, but to no other combinations of these variables, nor to weight. The multiple correlation coefficients were 0.7771 and 0.7757, respectively, with F-statistics of 750.6 and 744.0. The standard errors were considerably reduced by the fitting of the appropriate equation. Preliminary discussion with Professor Becklake had suggested that there might have been some errors in the recording of MMF, and slight confirmation appeared in the rather lower multiple correlation coefficient and F-statistic, compared with those above, i.e. 0.6089 and 290.1. However, these may do no more than reflect the greater inherent errors in the MMF test compared with that on which both FEV and FVC are based. In any case, the analysis confirmed that only age at test and height needed to be taken into account, and that there was considerable reduction in the standard error by doing so. The ratio $FEV_{1.0}$/FVC was virtually unrelated to height, as might have been expected from the close relationship with height of both numerator and denominator of the ratio. Adjustment for age appears justified, but could reduce the standard error only slightly, while

the coefficient of multiple correlation and F-statistic were only 0.3096 and 104.4, respectively.

A simple demonstration of the extent to which certain of the various factors were interrelated is given in the correlation matrix of Table 9.8. No great reliance should be put on the values of the actual coefficients, particularly as "statistical significance", at the five per cent level of tradition, is associated with a coefficient as low as 0.062. Most of the larger coefficients in this matrix, i.e. those greater than about 0.25 in absolute value, simply reflect phenomena already discussed. Thus, there were substantial correlations between all the radiographic scores (variables 1 through 4), and between them and:- age at test (variable 8), dyspnoea (variable 9), dust exposure (variable 6) and lowered FVC (variable 10, negative values). Dust exposure (variable 6) was directly related to age at test (variable 8) and to dyspnoea and depressed FVC (variables 9 and 10), whereas these last two were not closely correlated. Not shown, but not unexpected, were associations between certain measures of lung function; by far the largest (.80) was that between deviations from the regression predictions of MMF and the $FEV_{1.0}$/FVC ratio.

Finally, Table 9.9 shows the distribution by cause of the 130 deaths observed in Cohort "A", against expectations based on Quebec Deck 2. Also given in this table are the values of the χ^2 statistics obtained from the Observed and Expected numbers of deaths as $(O - E)^2/E$. These values were high, indicating considerable excesses, for pneumoconiosis and lung cancer; there was also a slight excess of deaths from laryngeal cancer.

Table 9.8

MATRIX OF CORRELATIONS: COHORT "A"

		Variable number									
		1	2	3	4	5	6	7	8	9	10
Radiographic scores											
"Abnormality"	1	·	.51	.31	.34	.05	.24	.00	.37	.13	-.09
Small opacities	2		·	.35	.19	-.01	.25	.03	.32	.23	-.17
Pleural changes *	3			·	.19	.05	.18	-.00	.28	.18	-.18
"Symbols"	4				·	-.01	.10	-.09	.22	.13	-.11
Environmental factors											
Mining area †	5					·	.04	.03	-.05	-.12	-.04
Dust exposure §	6						·	.04	.49	.23	-.21
Social factors											
Smoking	7							·	-.03	.11	-.03
Age at test	8								·	.28	·
Symptomatology											
Dyspnoea	9									·	-.19
FVC ¶	10										·

* other than calcification

† a positive sign means higher value of correlate at Thetford Mines

§ square root of accumulated dust exposure

¶ deviation from regression "prediction"

Table 9.9

DEATHS IN COHORT "A"

From date of test to the end of 1975

(O = Observed deaths; E = Deaths expected from Quebec Deck 2; SMR = O/E)
$\chi^2 = (O - E)^2/E$

	O	E	SMR	χ^2
Pneumoconiosis	3	0.14	*21.48*	58.43
Cancer of the chest	22	10.61	*2.07*	12.23
Respiratory tuberculosis	0	1.00	*0*	1.00
Other respiratory conditions	6	7.71	*.78*	0.38
Diseases of the heart	44	52.36	*.84*	1.33
Cancer of oesophagus or stomach	5	3.88	*1.29*	0.32
Cancer of colon or rectum	3	4.26	*.71*	0.37
Other abdominal cancers	5	3.17	*1.58*	1.06
Cancer of larynx	2	0.70	*2.87*	2.41
Other malignant diseases	11	9.49	*1.16*	0.24
Cerebro-vascular diseases	5	8.64	*.58*	1.53
Accidents	6	8.96	*.67*	0.98
Other known causes	16	18.05	*.84*	0.23
Cause not known	2	-	-	-
ALL CAUSES	130	128.95	*1.01*	0.01

9.3 Era 3 of Cohort "B"

It will be recalled that this subdivision of Cohort "B" was made with a view to comparisons with Cohort "A". Here are the percentage age distributions of the two groups:-

	Cohort "A"	Era 3 of Cohort "B"
	(Age at test)	(Age at Nov. 66)
Less than 35	15.08	-
35 - 44	20.34	-
45 - 54	24.60	69.69
55 - 64	38.26	27.31
65 and over	1.72	3.00
	100	100

The mean age at test in Cohort "A" was 49.3 years and at November 1966 in Cohort "B" was 52.9 years; adjustments to the start of the study interval in that cohort increased the difference between the mean ages to 4.7 years. Further, and perhaps more important, because there was a substantial proportion of the men in Cohort "A" who were born after 1920 but none, by definition, in Cohort "B", the *shapes* of the distributions are quite different. In addition, net service to November 1966 was 24.8 years in Era 3 compared with 19.9 years in Cohort "A", and dust exposure accumulated to November 1966 was 333 mpcf.y against 259, although this is a reflection of the length of employment difference rather than of differences in dust concentrations.

Although smoking habits had been assessed on rather different bases, there did not appear to be great dissimilarity between the two groups, and, after due allowance had been made for the number of

readers, the scores of radiological change tended to be a little higher in Era 3, no doubt because of the higher average exposure to asbestos. Finally, Table 9.10 gives the distribution by cause of the 241 deaths in Era 3, in the same layout as for the previous table, and shows a tiny shortfall of total deaths, and marked excess only for deaths due to pneumoconiosis.

Despite some of the similarities of these two groups of men, the differences in age distributions and in exposure are considered large enough to render further comparisons between them unrewarding.

9.4 The three Eras of Cohort "B"

Some important differences between the three Eras of Cohort "B" are illustrated in Table 9.11. The confounding of the restriction on dates of birth, to the years 1891 through 1920, and the definitions of the eras in terms of dates of last employment in the industry, meant that Era 1 was much the youngest of the three at the start of their study intervals, and Era 3 much the oldest, while the average length of study interval was much greater in Era 1 than for the others. Although there were only comparatively small differences between the Eras in their distributions by dates of birth, tracing problems had been much worse for men in Era 1. Another important difference arose from the much earlier start of routine chest radiography at Asbestos than at Thetford Mines; this led to a very much higher proportion of men from this town in Era 1 than in the other Eras, when the proportion reflects much more accurately the numbers employed in the two mining areas. One reason for the comparatively low rate of tracing in Era 1 was the short net service; many men would have had employment of very

Table 9.10

DEATHS IN COHORT "B", Era 3

1968-75

(O = Observed deaths; E = Deaths expected from Quebec Deck 2; SMR = O/E)
$\chi^2 = (O - E)^2/E$

	O	E	SMR	χ^2
Pneumoconiosis	11	0.25	*43.65*	462.25
Cancer of the chest	27	21.72	*1.24*	1.28
Respiratory tuberculosis	0	1.84	*0*	1.84
Other respiratory conditions	13	14.07	*.92*	0.08
Diseases of the heart	97	104.43	*.93*	0.53
Cancer of oesophagus or stomach	7	7.47	*.94*	0.03
Cancer of colon or rectum	4	8.03	*.50*	2.02
Other abdominal cancers	6	6.58	*.91*	0.05
Cancer of larynx	1	1.45	*.69*	0.14
Other malignant diseases	19	17.90	*1.06*	0.07
Cerebro-vascular diseases	11	15.40	*.71*	1.26
Accidents	16	15.51	*1.03*	0.02
Other known causes	26	34.78	*.75*	2.22
Cause not known	3	-	-	-
ALL CAUSES	241	249.42	*.97*	0.28

Table 9.11

DIFFERENCES BETWEEN ERAS IN COHORT "B"

	Era 1	Era 2	Era 3
Number of men	1,422	1,405	1,732
Distribution of man-years by age	%	%	%
Less than 45	*40.8*	*13.6*	-
45-64	*52.9*	*56.0*	*89.0*
65 and over	*6.4*	*30.4*	*11.0*
	100	*100*	*100*
Man-years accumulated per man	25.0	9.7	7.6
Average age on survival to the end of 1975 (years)	65.5	69.6	62.0
Lost to view (per cent of total)	3.1	1.1	-
Smoking histories not available (per cent of total)	11.9	2.8	0.9
Percentage of men from Asbestos	78.3	45.8	38.3
Net service (years)	6.4	21.8	24.8
Accumulated dust exposure (mpcf.y)	156	459	333
Average dust "concentration" (mpcf)	24	21	13

short duration only, and such persons are notoriously difficult to trace. Accumulated dust exposures in the three Eras represent the resultant of differences both in net service and in dust concentrations.

One other difference is even more dramatic: because all deaths in 1966 and 1967 had been excluded from Era 3, in the attempt to make it similar to Cohort "A", the proportional mortality was affected, as it was also by secular trends, particularly in the almost complete eradication of respiratory tuberculosis, and the growing incidence of lung cancer; some of the larger differences between Eras are illustrated below:-

	Era 1	Era 2	Era 3
Number of deaths (all causes)	532	770	241
Percentage due to:-			
Pneumoconiosis	*0.4*	*2.3*	*4.6*
Cancer of the chest	*5.5*	*8.4*	*11.2*
Respiratory tuberculosis	*7.1*	*2.7*	-
Other respiratory	*4.1*	*5.1*	*5.4*
Cerebro-vascular diseases	*4.5*	*8.7*	*4.6*
Accidents	*13.7*	*7.5*	*6.6*
Other causes	*64.6*	*65.2*	*67.6*
	100	*100*	*100*

As noted in section 8.5, the *a priori* analyses were, for the most part, carried out on each Era separately, but the findings reported below are for the complete cohort. No important differences between Eras were noted.

9.5 The men of Cohort "B"

To recapitulate, men were included in Cohort "B" if (a) they were born in the years 1891 through 1920 and had worked for at least

a month in the Quebec chrysotile producing industry, i.e. were in the "main mortality cohort", and (b) a radiograph taken during employment had been collected in 1967 and read at Stage 2 (as described by Rossiter *et al.*, 1972) by one of six readers, into the forerunner of the U/C classification (Bohlig *et al.*, 1970). The study interval for each man started at the end of his last recorded employment in the industry, and so "age at last job" is an important consideration: ages ranged from 15.1 years to 74.0 years, with a mean of 47.2 years. All but 59 were traced to the end of 1975; there had been 1,543 deaths.

Table 9.12 corresponds to Table 9.1, except that the distribution of men is by age at last job, as distinct from age at test, but for both tables age has been calculated from the start of the study interval. The proportion from Asbestos varied with age, because of the interaction between this factor and the earlier start of radiology in that area. As in Cohort "A", net service and accumulated dust exposure showed the expected trends. The average dust "concentration", however, is less easy to interpret, because of further interactions with time and place. The smoking percentage in this cohort was dependent on age at last job, perhaps reflecting habits varying with era of birth.

The two-way distributions, by net service and accumulated dust exposure, are shown for the two mining areas in Table 9.13. The diagonal patterns in both sections of this table are similar to that in Table 9.2. The differences between Asbestos and Thetford Mines are, of course, complicated by the varying proportions from the two areas by era of employment, bearing in mind that dust concentrations were

Table 9.12

MINING AREA, SERVICE, EXPOSURE AND SMOKING: COHORT "B"

	Age at Last Job					
	<35	35-44	45-54	55-64	≥65	Total
Number of men	901	738	1,702	878	340	4,559
Percentage from Asbestos	80.8	67.9	41.2	45.2	27.1	53.1
Net service (years)	4.2	8.4	21.3	28.6	34.0	18.2
Accumulated dust exposure (mpcf.y)	104	162	320	506	709	317
Average dust "concentration" (mpcf)	25	19	15	18	21	17
Percentage smoking cigarettes	67.9	63.5	65.1	54.3	40.7	61.3

Accumulated dust exposure (mpcf.y)	Net		
	<1	1, <5	5, <10
<1	137	7	
1, <3	109	30	1
3, <6	37	83	15
6, <10	21	74	7
10, <30	24	105	109
30, <100	5	87	65
100, <300		29	54
300, <600			33
600, <1,000			1
1,000, <2,000			
2,000 or more			
Total	333	415	285

Table 9.13 (A)

SERVICE AND EXPOSURE: COHORT "B" (ASBESTOS)

service (years)				
10, <15	15, <20	20, <30	≥30	Total
				144
				140
2				137
8	8			118
43	16	10	8	315
59	154	178	62	610
42	48	161	99	433
53	25	103	83	297
15	23	48	82	169
	8	12	35	55
		1	1	2
222	282	513	370	2,420

Accumulated dust exposure (mpcf.y)	N e t		
	<1	1, <5	5, <10
<1	31	8	
1, <3	33	27	3
3, <6	15	13	6
6, <10	8	23	3
10, <30	16	67	52
30, <100	7	48	42
100, <300	1	17	36
300, <600		3	14
600, <1,000		3	3
1,000, <2,000			5
2,000 or more			
Total	111	209	164

Table 9.13 (TM)

SERVICE AND EXPOSURE: COHORT "B" (THETFORD MINES)

service (years)				
10, <15	15, <20	20, <30	≥30	Total
				39
				63
5				39
3	3			40
31	7	12	17	202
70	67	95	35	364
62	72	212	144	544
22	50	148	110	347
6	12	124	87	235
6	8	63	97	179
1	4	18	64	87
206	223	672	554	2,139

substantially lower at Asbestos than at Thetford Mines, but in both areas decreased greatly over the years.

The prevalence of each radiographic feature is given in Table 9.14 (*cf.* Table 9.3). Fairly similar trends with age can be discerned, as well as a broadly similar pattern of the sorts of abnormality observed. Because there was only one reader of each film, the proportion of "less-than-normals" was much lower in Cohort "B" than in Cohort "A"; however, over half the men aged 65 or more at the time of last job (shortly after the x-ray in most cases) were assessed as "less-than-normal" - see Table 9.15 (*cf.* Table 9.4) which again reveals trends similar to those in the previous table, and confirms the utility of the scoring system.

The correlation matrix in Table 9.16 is of rather smaller dimensions than those for Cohort "A" (Table 9.8); it revealed bigger differences between mining areas than in the other cohort, particularly in dust exposure, but neither this nor any other association was unexpected.

Table 9.17 gives the numbers of deaths observed since 1950 against expectations based on Quebec Deck 2, and adds SMR and χ^2 as before. There was a large excess of deaths from all causes; in addition to the clearly significant excesses from pneumoconiosis and lung cancer, which were to have been expected, there were major excesses of deaths due to many other causes. This experience, rather different from that in the "main mortality cohort" of 10,939 men (McDonald *et al.*, 1979) from which Cohort "B" was drawn, requires explanation. Net service

Table 9.14

PREVALENCE OF RADIOGRAPHIC CHANGES: COHORT "B"

(Percentages of readings)

	Age at Last Job					
	<35	35-44	45-54	55-64	≥65	Total
Number of readings (one per subject)	901	738	1,702	878	340	4,559
Small opacities: rounded						
0/1 or greater	1.1	1.2	2.3	4.7	5.6	2.6
1/0 or greater	0.8	0.8	1.3	3.3	5.0	1.8
Small opacities: irregular						
0/1 or greater	4.1	9.3	16.9	27.1	30.6	16.1
1/0 or greater	1.4	5.1	7.1	15.9	22.4	8.5
Large opacities: present	1.2	0.4	1.5	2.7	3.2	1.6
Costophrenic angle involvement	4.3	2.6	8.6	11.8	17.9	8.1
Pleural thickening						
Grade 1 or greater	2.2	1.8	6.0	10.3	17.9	6.3
Irregular diaphragm: present	1.0	1.4	3.8	7.3	9.4	3.9
Irregular cardiac border	0.3	0.5	2.2	5.0	8.5	2.6
Pleural calcification	1.6	1.5	3.8	6.6	12.4	4.2
"Additional symbols"						
At least one recorded	6.1	5.6	8.1	13.1	22.6	9.3

Table 9.15

RADIOGRAPHIC SCORES: COHORT "B"

	Age at Last Job					
	<35	35-44	45-54	55-64	≥65	Total
"Less-than-normal" (%)	14.5	18.6	34.4	47.6	59.1	32.3
Small opacities (combined)	0.4	0.8	1.3	3.3	3.7	1.6
Pleural changes *	0.1	0.1	0.3	0.5	0.9	0.3
Pleural calcification	0.0	0.0	0.1	0.1	0.2	0.1
"Additional symbols"	0.1	0.1	0.1	0.2	0.2	0.1

* other than calcification

Table 9.16

MATRIX OF CORRELATIONS: COHORT "B"

		Variable number						
		1	2	3	4	5	6	7
Radiographic scores								
"Abnormality"	1	·	.58	.54	.46	.24	.23	.02
Small opacities	2		·	.37	.16	.16	.20	-.01
Pleural changes *	3			·	.16	.19	.18	.01
"Symbols"	4				·	.07	.09	-.03
Environmental factors								
Mining area †	5					·	.26	.04
Dust exposure §	6						·	-.02
Social factor								
Smoking	7							·

* other than calcification

† a positive sign means higher value of correlate at Thetford Mines

§ square root of accumulated dust exposure

Table 9.17

DEATHS IN COHORT "B"

1951-75

(O = Observed deaths; E = Deaths expected from Quebec Deck 2; SMR = O/E)
$\chi^2 = (O - E)^2/E$

	O	E	SMR	χ^2
Pneumoconiosis	31	0.91	*34.07*	994.95
Cancer of the chest	119	67.16	*1.77*	40.01
Respiratory tuberculosis	40	11.85	*3.38*	66.87
Other respiratory conditions	67	52.89	*1.27*	3.76
Diseases of the heart	566	415.93	*1.36*	54.15
Cancer of oesophagus or stomach	53	31.10	*1.70*	15.42
Cancer of colon or rectum	28	32.35	*.87*	0.58
Other abdominal cancers	21	23.19	*.91*	0.21
Cancer of larynx	4	5.02	*.80*	0.21
Other malignant diseases	93	71.60	*1.30*	6.40
Cerebro-vascular diseases	101	70.02	*1.44*	13.71
Accidents	110	61.36	*1.79*	38.56
Other known causes	183	146.92	*1.25*	8.86
Cause not known	11	-	-	-
ALL CAUSES	1,427	990.28	*1.44*	192.60

in Cohort "B" was 18.2 years compared with only 10.5 years in the complete cohort, and accumulated dust exposure was 317 mpcf.y compared with 202 mpcf.y. However, these are not the major reasons for the high excess mortality in Cohort "B"; rather the explanation lies in death at work or which followed retirement on grounds of ill-health. Except for Era 3, either of these events would have led to the inclusion of the man concerned in the study group. Indeed, in the whole of Cohort "B", a high proportion of deaths (27.9 per cent) occurred before the end of the year following that in which employment terminated; any such deaths among men still employed in November 1966 would move them from Era 3 to Era 2 and helps to account for an extremely high proportion of such deaths, 46.2 per cent, in Era 2. It is possible to infer from a statement on p. 472 of Liddell, McDonald and Thomas (1977) that in the entire "main mortality cohort", less that about a fifth of deaths to the end of 1975 occurred within twenty years of first employment, a startling contrast when it is borne in mind that the average period of employment in Cohort "B" was less than twenty years.

Although so many early deaths in Cohort "B" might suggest a denial of the so-called "healthy worker effect" (see for example Fox and Collier, 1977), evaluation would require a rather different analysis, in which all men in the cohort at work at a given time be followed from that point. However, what is clear is that Cohort "B" would not have been suitable for an investigation of mortality in relation to environmental factors. On the other hand, it in no way detracts from the data for the present purposes; indeed, the comparatively large number of early deaths allows the possibility of examining whether or not they could be predicted from a radiograph taken only a fairly

short time before death.

9.6 Randomization of men in Cohort "B" to film readers

The method by which the films for all 15,689 subjects were placed into thirty batches, five of which were to be assessed by each reader, was described by Rossiter *et al.* (1972); it was one of shuffling by dealing, common among card players as one of the best modes of randomization. In practice, even on the enormous numbers of large films, it seems to have worked extremely well. The 4,559 men in Cohort "B" had been classified by reader into what will be called "sets" varying in size from 727 to 787, against the average of 760; there is no trace of inequality in this allocation, particularly when it is recalled that one reason for differing sizes would be the proportion of films considered "unreadable", a proportion determined by the subjective judgement of the individual reader.

The total number of men lost to view was 59, distributed between sets as follows:- 5, 7, 9, 9, 14, 15. Again, there is no suggestion of factors other than chance at work. Of those traced, 34.3 per cent had died: the proportion varied between sets from 32.5 per cent to 36.4 per cent, again without any trace of other than chance effects: a test of the equality of proportions yielded $\chi^2 = 4.57$ with five degrees of freedom, a value that would be at least equalled in more than 60 per cent of allocations. Examination of the differences between sets in the numbers of deaths by specific groups of causes suggested once more that all differences could be accounted for by the effects of randomization. Similarly, the six distributions of subjects by quinquennium of birth, within set, were tested for equality; here the χ^2

statistic has 25 degrees of freedom and was calculated as 30.47, with associated P-value of a little less than 20 per cent.

Finally, three other variables were examined:- age at last job; net service; and accumulated dust exposure. A one-way analysis of variance was carried out on each to test the hypothesis that the means were equal in the six sets. This led in each case to an F-statistic with 5 and 4,553 degrees of freedom; the values of F were 1.08, 1.45 and 0.54, respectively, all without trace of statistical significance - on the null hypothesis, the median value of F would be close to 4.4, and statistical significance at the traditional five per cent level would require F as large as 11.1.

It would therefore seem that the randomization achieved its purpose in equalizing the sets, and hence that differences that did exist between the six sets of subjects in terms of radiographic assessment or relations of such assessments to mortality or other factors were almost certainly due to differences between the readers. In fact, the percentage assessed "less-than-normal" by each reader is given, by age at last job, in Table 9.18. Although, within reader, a gradient with age is obvious, its severity depended on the reader: the prevalence of "less-than-normals" in those 65 and over, expressed as a ratio against the corresponding prevalence in those less than 35 on last employment, varied from 67.7 / 18.5 or 3.66:1, for Reader 6, to 60.0 / 11.3 or 5.31:1, for Reader 3. More important is the very large difference between readers in their assessments of overall prevalence of abnormality, varying from 20.9 per cent (Reader 1) to 39.9 per cent

Table 9.18

RADIOGRAPHIC ABNORMALITY, BY READER

(Percentages of readings assessed as "Less-than-normal")

	Age at Last Job					
	<35	35-44	45-54	55-64	≥65	Total
Reader 1	11.1	11.2	19.9	32.8	45.6	20.9
Reader 2	11.5	11.4	24.4	33.1	47.2	23.8
Reader 3	11.3	14.7	43.1	60.9	60.0	37.1
Reader 4	16.5	28.8	44.1	54.4	70.6	39.9
Reader 5	17.4	24.8	37.2	46.8	67.9	35.0
Reader 6	18.5	20.9	37.2	53.1	67.7	36.2
ALL READERS	14.5	18.6	34.4	47.6	59.1	32.3

(Reader 4). These differences are of undoubted significance: χ^2 was calculated as 105.85, with five degrees of freedom, and the P-value is extremely low.

9.7 Summary

Although the 988 men in Cohort "A" were considerably older than the population at work in November 1966, the period of follow-up was short - no more than seven-and-a-half years - and only 130 had died by the end of 1975, almost exactly the number expected on the basis of Quebec male mortality. However, there were excesses due to diseases known to be asbestos-related, i.e. pneumoconiosis and cancer of the chest; excluding these causes, there were 105 deaths compared with 118.20 expected, giving a Standardized Mortality Ratio of 0.89. As was to have been anticipated, both from first principles and from previous publications, the older men in this cohort had had longer service, at heavier dust concentrations, than the younger. The older men were a little shorter, but of similar adiposity, and they had fairly similar smoking habits; they reported more respiratory symptoms, and exhibited more signs of pulmonary abnormality, both radiological and physiological. Errors in data processing meant that the symptoms listed as persistent cough and persistent phlegm were not reliably transcribed; it is possible they refer to particularly severe manifestations of bronchitis.

Cohort "B" did not overlap with Cohort "A", and the 4,559 men in it contained much more than a representative proportion from Asbestos, Quebec, because of the earlier start of routine radiology there. The

method of selection also meant that mortality was high, especially from sudden death, including accidents, myocardial infarction and stroke. There were also large excesses from pneumoconiosis and chest cancer. As in Cohort "A", men who were older when they left employment had had longer service; however, because they might have left at any time in the period from the start of radiology to the end of 1966, there was little variation in average dust concentration with age at leaving. Those older at leaving included a lower proportion of cigarette smokers than the younger. Again as was to be expected, the older showed more radiographic change, both parenchymal and pleural, and of "additional symbols".

Chapter 10

F I N D I N G S I

10.1 Introduction to Chapters 10 through 13

Chapters 10 through 13 present the findings from both study cohorts. Those from Cohort "A" are given before those for Cohort "B", but even although the radiological assessments were made by six readers the many fewer deaths in Cohort "A" (130 compared with over 1,400) render the findings in this cohort less reliable than those in Cohort "B"; further there are several tables in which it would be impossible or unrewarding to provide results for the smaller cohort.

In Chapter 10, the first concern is with total mortality, i.e. that from "all causes", in relation to whether the radiograph was assessed as "normal" or "less-than-normal", with consideration of differences between readers for Cohort "B". The study is then extended to examine, one after the other:- deaths due to specific groups of causes; various radiographic features; and other factors, environmental, physiological, etc.

Pneumoconiosis, cancer of the chest and mesothelioma are all asbestos-related diseases and should be associated with x-ray change, although the rapid progress of the malignant conditions may make direct association with radiographic change tenuous. These three causes of

death are studied in considerable depth in Chapter 11. Deaths from respiratory tuberculosis and other respiratory conditions, and some deaths recorded as due to heart diseases may also be asbestos-related; they might be manifest on the chest radiograph either directly or perhaps indirectly through the pneumoconiotic changes associated with the dust exposure. Relationships between x-ray changes and deaths from these causes are also described in Chapter 11.

Whether or not deaths from the other groups of causes of Table 7.1 are dust-related, any x-ray changes could surely only be pneumoconiotic and related at best indirectly to the disease process. Deaths from these causes (cancer of oesophagus or stomach; cancer of colon or rectum; other abdominal cancer; cancer of the larynx; other cancers; strokes; accidents; and known causes not already included) form the subject of Chapter 12. A brief summary of findings is in Chapter 13.

In many of the tables, the following headings:- O, E, SMR, RR and χ^2 are used, with the meanings indicated below.

O represents the number of deaths observed, from 1951 or later start of the study interval to the end of 1975.

E represents the number of deaths expected on the basis of mortality in Quebec, 1951-75, i.e. calculated by comparative composite cohort analysis (Case and Lea, 1955) using Quebec Deck 2 as reference; note that estimates have had to be made for the last two years - see section 8.5, above.

SMR is the ratio O/E, which can be shown to be a mortality ratio standardized, by the "indirect method" (*cf.* Liddell, 1960), for both age and year of death.

RR, or Relative Risk, is the ratio of the two SMRs it stands beside.

χ^2 designates a statistic which, asymptotically, has the χ^2 distribution with one degree of freedom. The various methods of calculating this statistic are discussed as each is introduced.

The values of Relative Risk, RR, measure the size of an effect, those of χ^2 give an indication of its "statistical significance". The critical values of the theoretical distribution are as follows (calculated from Diem, 1962):-

Probability	10%	5%	1%	0.1%	0.01%	0.001%
χ^2	2.71	3.84	6.64	10.83	15.14	19.51

There are several reasons why this brief table does not give reliable estimates of the significance of Relative Risks quoted in these chapters. First, many are based on expectations so small that the distribution of the statistic is not close to the asymptotic form. Secondly, the statistics have not been determined independently. Thirdly, many statistics have been calculated for both cohorts, and the problems of simultaneous inference arise (see, for example, Miller, 1966). A fourth difficulty, of interpretation, derives from the fact that the χ^2 statistic, which has the form $(O - E)^2/E$, is of dimension E (or O), in other words depends on the numbers of deaths in the test. This means that the same Relative Risk in Cohort "B" as in Cohort "A" would lead to a value of χ^2 about ten times larger in the cohort with over 1,400 deaths than in that with only 130.

Nevertheless, the χ^2 statistics can be used as a guide to the relative importance of an observed Relative Risk, although no P-value

can be associated with it. With this proviso, and with particular caution, guidance can still be obtained even when expectations are very small. It is important not to make the best (i.e. an accurate probability statement) the enemy of the good (i.e. a less reliable but still revealing approximation). Many statistical texts state that χ^2 statistics should not be calculated in any situation where an expectation falls below some arbitrary value (often 5), although Cochran (1954), among others, has suggested considerably more lenient rules*.

---

* An illustration of what can be lost by rigid application of a rule of thumb can be found in considering the incidence of mesothelioma in Cohort "B". From the data of McDonald and McDonald (1977), adjusting the proportional mortality of mesothelioma in Canada (i.e. 25 male deaths in 1970 in a total of 82,052 deaths from all causes in men over 24 years of age, or 0.305 per thousand) by a factor of two to allow for the higher ascertainment rate of mesotheliomas in the Province of Quebec, the number of mesotheliomas to have been expected in Cohort "B" may be estimated as 2 x 0.305 x 1,427/1,000 or 0.87, whereas five were observed; the value of $\chi^2 = 19.62$, with associated probability a fraction less than 0.001 per cent. While this P-value is in no sense precise, it does suggest that as many as five mesotheliomas in Cohort "B" did not arise from purely chance factors. In Cohort "A", the corresponding figures are:- O = 1; E = 0.08; $\chi^2 = 10.70$, with probability, from the tables, a little greater than 0.1 per cent. Here, with only one observed death, the finding *by itself* would have to be treated with great caution; nevertheless, in conjunction with that in Cohort "B", it provides convincing evidence of a serious mesothelioma risk.

10.2 Total mortality in men with "less-than-normal" radiographs

Mortality from all causes is summarized for both cohorts in Table 10.1, in relation to whether a subject had been assessed as "normal" or "less-than-normal". The χ^2 statistics have been calculated by multiplying each tabled value of E by a factor (all observed deaths) / (total of expected deaths). In this way, expectations were obtained for the calculations which were, in total, the same as the total of deaths observed, and which then allowed an internal comparison of the two sub-cohorts defined in terms of radiological findings. It can be shown, by simple but tedious algebra, that the statistic can be calculated as

$$\chi^2 = (RR - 1)^2 \, O_1 \, O_2 \, / (RR)(O_1 + O_2)$$

where RR and O have the usual meanings and the suffixes indicate the two groups being compared.

In every case of Table 10.1, the Relative Risk of the "less-than-normals" compared with the "normals" was greater than unity. As indicated by the values of χ^2, the effect was rather less significant for Cohort "A" than for Era 3 of Cohort "B", although similar in magnitude (RRs of 1.24 and 1.33, respectively), at least in part due to the differences in the numbers of deaths. The effects were undoubtedly large for the other two Eras of Cohort "B" (RRs of 1.59 and 1.72). One reason for these differences may lie in the exclusion of deaths before the end of 1967 from the two groups recently at work and with comparatively low Relative Risks. In the two earlier Eras of Cohort "B", the intervals between x-ray and death were short for substantial proportions of the men, and "prediction" of mortality from radiographic changes may thus have been improved.

10.2 Total mortality in men with "less-than-normal" radiographs

Mortality from all causes is summarized for both cohorts in Table 10.1, in relation to whether a subject had been assessed as "normal" or "less-than-normal". The χ^2 statistics have been calculated by multiplying each tabled value of E by a factor (all observed deaths) / (total of expected deaths). In this way, expectations were obtained for the calculations which were, in total, the same as the total of deaths observed, and which then allowed an internal comparison of the two sub-cohorts defined in terms of radiological findings. It can be shown, by simple but tedious algebra, that the statistic can be calculated as

$$\chi^2 = (RR - 1)^2 \, O_1 \, O_2 \, / (RR)(O_1 + O_2)$$

where RR and O have the usual meanings and the suffixes indicate the two groups being compared.

In every case of Table 10.1, the Relative Risk of the "less-than-normals" compared with the "normals" was greater than unity. As indicated by the values of χ^2, the effect was rather less significant for Cohort "A" than for Era 3 of Cohort "B", although similar in magnitude (RRs of 1.24 and 1.33, respectively), at least in part due to the differences in the numbers of deaths. The effects were undoubtedly large for the other two Eras of Cohort "B" (RRs of 1.59 and 1.72). One reason for these differences may lie in the exclusion of deaths before the end of 1967 from the two groups recently at work and with comparatively low Relative Risks. In the two earlier Eras of Cohort "B", the intervals between x-ray and death were short for substantial proportions of the men, and "prediction" of mortality from radiographic changes may thus have been improved.

Table 10.1

RADIOLOGICAL ABNORMALITY AND TOTAL MORTALITY

		O	E	SMR	RR	χ^2
Cohort "A"	"Normal"	21	24.91	.84		
	"Less-than-normal"	109	104.04	1.05	*1.24*	0.83
Cohort "B"						
Era 1 *	"Normal"	306	301.49	1.01		
	"Less-than-normal"	110	68.20	1.61	*1.59*	17.67
Era 2	"Normal"	354	205.73	1.72		
	"Less-than-normal"	416	140.66	2.96	*1.72*	57.49
Era 3	"Normal"	131	153.03	.86		
	"Less-than-normal"	110	96.41	1.14	*1.33*	4.97
All Eras †	"Normal"	791	675.15	1.17		
	"Less-than-normal"	636	315.12	2.02	*1.72*	106.88

* From 1951

† The figures for Eras 1, 2 and 3 do not total to those for All Eras (except for observed deaths): expectations for Era 3 are low because the study interval when this Era was considered separately did not start until 1968; and the Relative Risks and χ^2 statistics are not, in any case, additive.

Table 10.2 gives distributions of man-years, accumulated in the comparative composite cohort analyses, by broad age groups, for "normals" and "less-than-normals" in Cohorts "A" and "B", the latter divided by Era. Those for Era 1 were for the period after 1950 only, and so for the complete study interval would have been weighted even more to the younger groups. The distributions of the four groups of "normals" were completely different, one from another, and those for the "less-than-normals" almost equally so. An important, but expected, finding was that the "less-than-normals" were consistently older on average than the "normals"; further, this was repeated for each radiological feature examined. It emphasises the importance of some form of age-standardization in order to facilitate comparisons, and confirms the necessity for ensuring that effects are maintained over all portions of a cohort's ageing through the diagonal band of a Lexis (1875) diagram.

In Table 10.3, the six readers are compared in terms of the "sensitivity" and "specificity" of the predictions of mortality possible from radiological findings; the usual definitions, as for example in Armitage (1971, p. 434), have been used, together with the index J (or sensitivity plus specificity, expressed as percentages, less 100 per cent), proposed by Youden (1950). This is rather arbitrary in giving equal weight to sensitivity and specificity which, in this instance, were at quite different levels - less than half the deaths were predictable, whereas nearly three quarters of survivors were among "normals" - but ranks the readers in an order similar to that suggested from a two-way plot. At first sight, an index J = 16.7 per cent is disappointing, but it must be appreciated that the radio-

Table 10.2

DISTRIBUTIONS OF MAN-YEARS BY AGE

	Cohort "A"	Cohort "B"		
		Era 1 *	Era 2	Era 3
"Normals"				
Less than 45	49.9	36.2	19.7	-
45 through 64	43.1	60.8	65.9	93.3
65 and over	6.9	3.0	14.4	6.7
	100	100	100	100
"Less-than-normals"				
less than 45	18.4	17.8	16.8	-
45 through 64	58.9	73.5	60.1	91.4
65 and over	22.6	8.8	23.1	8.6
	100	100	100	100

* From 1951

Reader	Outcome	Radiological finding			Sensitivity (%)
		Normal	Other	Total	
5	Alive	369	145	514	
	Dead	125	126	251	*50.2*
6	Alive	343	148	491	
	Dead	146	135	281	*48.0*
4	Alive	335	176	511	
	Dead	124	132	256	*51.6*
1	Alive	411	75	486	
	Dead	158	76	234	*32.5*
3	Alive	317	154	471	
	Dead	142	123	265	*46.5*
2	Alive	386	98	484	
	Dead	176	80	256	*31.3*
ALL	Alive	2,161	796	2,957	
	Dead	871	672	1,543	*43.6*

Table 10.3

"SENSITIVITY" AND "SPECIFICITY", BY READER

(Cohort "B")

Specificity (%)	Youden's J (%)
71.8	22.0
69.9	17.9
65.6	17.2
84.6	17.1
67.8	14.3
79.8	11.1
73.1	16.7

logical aim was not the prediction of mortality but the description of pneumoconiotic appearances. Further, it would not be unexpected were the relationships to be quite different when individual radiological features are evaluated in terms of deaths from specific causes; see the sections below on pneumoconiosis and lung cancer.

In the ILO U/C (1971) classification of radiographs (ILO, 1972) category 0/- is introduced in terms almost identical to those used by Bohlig *et al.* (1970) in publishing the U/C classification, except that they are called "very obviously normal" films where earlier the phrase "barndoor" normal of the original proposal (Liddell, 1963) had been retained. Table 10.4 differentiates subjects with such films among the "normals". The χ^2 statistics are calculated as for Table 10.1 i.e. on a purely internal basis. For Cohort "A", the SMRS were very similar. In assessment of films for Cohort "B", only Readers 1 and particularly 5 made substantial use of the 0/- category, and for both these readers the SMR for the "barndoor" normals was less than for the remainder of "normals", leading to Relative Risk for the latter of 2.75 for Reader 1 and 1.24 for Reader 5. Although there is no trace of statistical significance in the findings in Table 10.4, as indicated by the values of χ^2 reaching only 2.27, the tendencies for Readers 1 and 5 are suggestive that more common use of the category could lead to clearer differences. Bohlig *et al.* (1970) stated that "barndoor" normal films were usually from young subjects, but there has been some fear that the category 0/- could mask emphysema. The lower SMRs, which of course take age differences into account, might indicate that this last concern is not well founded.

Table 10.4

"BARNDOOR" NORMAL FILMS AND TOTAL MORTALITY

		O	E	SMR	RR	x^2
Cohort "A"	"Barndoor" normal	2	2.41	.83		
	Other normal	19	22.50	.84	*1.02*	0.001
Cohort "B"						
Reader 5	"Barndoor" normal	17	19.43	.87		
	Other normal	98	90.43	1.08	*1.24*	0.67
Reader 1	"Barndoor" normal	2	4.81	.42		
	Other normal	143	125.16	1.14	*2.75*	2.19
Others	"Barndoor" normal	4	2.43	1.65		
	Other normal	527	432.89	1.22	*.74*	0.36
All readers	"Barndoor" normal	23	26.67	.86		
	Other normal	768	648.48	1.18	*1.37*	2.27

10.3 Cause-specific mortality in the "less-than-normals"

Table 10.5 gives the numbers of deaths in each of 13 cause groups, together with the risk in the "less-than-normals" relative to the "normals" and the associated χ^2 statistic, calculated as previously. In Cohort "B", among those with radiographic changes, there were greatly enhanced risks (all with χ^2 values greater than that associated with the 0.1 per cent "significance level" in an independent test) of deaths from:- pneumoconiosis (RR = 11.75); respiratory tuberculosis (RR = 6.28); "other" respiratory conditions (RR = 2.29); cancer of the chest (RR = 3.24); and diseases of the heart (RR = 1.53). There also appeared to have been excesses in the "less-than-normals" of deaths from (Relative Risks in brackets):- cancer of oesophagus of stomach (1.58); cancer of colon or rectum (2.34); "other" cancers (1.44); accidents (1.58); and "other" known causes (1.53).

Few of these findings were repeated in Cohort "A": all three deaths from pneumoconiosis were indeed in the "less-than-normals", leading to a Relative Risk expressed as infinity (∞), because the SMR for "normals" was zero, but there were so few deaths that the value of χ^2 was small. Similar estimates of "infinite" Relative Risks, of accidents and of "other" known causes, were associated with higher values of χ^2, although neither reached a conventional level of statistical significance.

10.4 Total mortality and specific radiographic changes

The first two lines of Table 10.6 are repeated from the first table in this chapter, except that the expected numbers of deaths (E) for Cohort "B" were obtained by summation over the three Eras, and so,

	Cohort "A"	
	$O_1 + O_2$	RR
Pneumoconiosis	3	∞
Cancer of the chest	22	*.78*
Respiratory tuberculosis	-	
Other respiratory conditions	6	*1.03*
Diseases of the heart	44	*1.03*
Cancer of oesophagus or stomach	5	∞
Cancer of colon or rectum	3	∞
Other abdominal cancers	5	*.91*
Cancer of the larynx	2	*.23*
Other cancers	11	*.40*
Cerebro-vascular diseases	5	*.82*
Accidents	6	∞
Other known causes	16	∞

Table 10.5

RADIOLOGICAL ABNORMALITY AND CAUSE-SPECIFIC MORTALITY

		Cohort "B" (1951-75)		
	χ^2	$O_1 + O_2$	RR	χ^2
	0.50	31	*11.75*	41.24
	0.24	119	*3.24*	44.63
		40	*6.28*	37.28
	0.00	67	*2.29*	12.17
	0.01	566	*1.53*	25.25
	1.08	53	*1.58*	2.79
	0.66	28	*2.34*	5.34
	0.01	21	*1.34*	0.43
	1.31	4	*2.21*	0.66
	2.23	93	*1.44*	3.02
	0.03	101	*1.17*	0.59
	2.59	110	*1.58*	5.24
	3.85	183	*1.53*	8.12

Table 10.6

		Cohort "A"					Cohort "B" (1951-75)				
		O	E	SMR	RR	χ^2	O	E	SMR	RR	χ^2
"Normal"		21	24.91	.84			791	660.25	1.20		
"Less-than-normal"		109	104.04	1.05	*1.24*	0.83	636	305.27	2.08	*1.74*	110.72
"Less-than-normal" with:-											
Small opacities (a)	absent	56	63.82	.88			253	143.52	1.76		
	present	53	40.21	1.32	*1.56*	3.44	383	161.75	2.37	*1.98*	120.30
Large opacities	absent	103	100.09	1.03			589	296.42	1.99		
	present	6	3.94	1.52	*1.81*	1.56	47	8.85	5.31	*4.43*	99.94
Pleural changes *	absent	56	65.03	.86			331	169.47	1.95		
	present	53	39.00	1.36	*1.61*	4.01	305	135.80	2.25	*1.87*	83.69
Pleural calcification	absent	90	91.48	.98			544	257.92	2.11		
	present	19	12.55	1.51	*1.80*	3.73	92	47.35	1.94	*1.62*	16.59
"Additional symbols"	absent	68	65.84	1.03			418	223.10	1.87		
	present	41	38.19	1.07	*1.27*	0.79	218	82.17	2.65	*2.21*	104.67

* Other than calcification (a) For Cohort "A" includes $1 \leq SSC \leq 6$.

as explained in section 8.5, were slightly lower, both for "normals" and for "less-than-normals", than in Table 10.1; the SMRs are correspondingly a little higher, but the Relative Risk virtually unaffected.

For the remainder of this table the "less-than-normals" were subdivided according to the absence or presence of specific radiographic appearances, treating each feature one at a time. The Relative Risks and χ^2 statistics were calculated comparing those in whom a feature was present against the "normals"; on this basis, the Relative Risks were all higher than when presence of a feature was compared with its absence, whether or not another feature rendered such a film "less-than-normal". The procedure leads to a partition of that χ^2 statistic with two degrees of freedom which compares all three groups; the quoted χ^2 statistics, as before with one degree of freedom, were larger only when the value of RR was increased sufficiently to compensate for the smaller numbers obtained by the exclusion of those "less-than-normals" in whose films the specific feature was not recorded.

For each radiographic feature, the SMRs for those in whom it was present was higher than in the "normals", in both cohorts. This effect was clearly significant in Cohort "B" for all features. Even for pleural calcification, where the Relative Risk was only 1.62, the χ^2 statistic was large by conventional standards (16.59); χ^2 statistics were enormous, varying from 120.30 to 83.69, for small opacities (RR = 1.98), "additional symbols" (RR = 2.21), large opacities (RR = 4.43) and non-calcified pleural changes (RR = 1.87), respectively. (RR and χ^2 are not more closely correlated because of the differing numbers of deaths associated with each type of x-ray change.) For

Cohort "A", with many fewer deaths, χ^2 values were much smaller, but Relative Risks were not inconsiderable; they could probably be taken as "significant" for pleural changes without calcification (1.61) and with calcification (1.80) and for small opacities (1.56).

10.5 Total mortality and non-radiographic factors

The next three tables (10.7 through 10.9) deal with factors other than radiographic. For each factor separately, each cohort was divided into two sub-cohorts and the SMR in the second was related to that in the first. Although the initial classification by accumulated dust exposure had been into four sub-cohorts, the three with lowest exposures were found to differ only slightly in SMRs, and so they were re-combined to yield a comparison of those whose accumulated exposure was at least 300 mpcf.y against those with lower exposures. Correspondingly, those with only grade 1 breathlessness were grouped with those who did not report this symptom, to allow comparison against those with definite dyspnoea. Thus, in each section of the three tables, there were only two sub-cohorts to be contrasted, and the calculations of χ^2 could be on the same basis as for Table 10.1.

The SMR of men at Thetford Mines was a fraction lower than of those at Asbestos, in Cohort "A", but slightly higher in Cohort "B" (Table 10.7), while those with higher dust exposures had higher SMRs in both cohorts, RR = 1.21 in Cohort "A", and 1.59, with χ^2 = 75.37, in Cohort "B". The lack of independence must be emphasised; dust exposures at Thetford Mines were on average greater than at Asbestos, and it seems likely that the observed higher risk at Thetford Mines in Cohort "B" was caused mainly by the heavier exposure rather than by

Table 10.7

TOTAL MORTALITY BY MINING AREA, DUST EXPOSURE AND SMOKING HABIT

	Cohort "A"					Cohort "B" (1951-75)				
	O	E	SMR	RR	χ^2	O	E	SMR	RR	χ^2
Asbestos	41	39.98	1.03			728	536.63	1.36		
Thetford Mines	89	88.97	1.00	*.98*	0.02	699	428.87	1.63	*1.20*	12.04
Accumulated dust exposure (mpcf.y)										
less than 300	77	82.08	.94			853	678.53	1.26		
at least 300	53	46.86	1.13	*1.21*	1.10	574	286.95	2.00	*1.59*	75.37
Smoking habit:										
non-, ex-, light	33	50.33	.66			494	459.65	1.07		
cigarettes *	97	78.61	1.23	*1.88*	10.18	885	493.42	1.79	*1.67*	84.99

* For Cohort "A", at least 13 cigarettes a day
For Cohort "B", known cigarette smokers

"neighbourhood" or other environmental differences. Cigarette smokers had substantially worse SMRs in both cohorts compared with the remainder; that the Relative Risk was higher in Cohort "A" (1.88) than in Cohort "B" (1.67) may have something to do with the different classification of smoking habits indicated in the footnote to the table. This was much the most "significant" effect noted so far in Cohort "A", χ^2 = 10.18, and was also associated with very large χ^2, i.e. 84.99, in Cohort "B".

Tables 10.8 and 10.9 can only refer to the one cohort, "A", because corresponding information was not obtained for the other. Of symptoms, only breathlessness was definitely associated with enhanced mortality (RR = 1.49, χ^2 = 4.70), but there were suggestions of positive effects associated with persistent cough (despite the unreliability of data transcription) and with wheezing. Mortality in those with sub-normal FVC was rather worse than in the others, but the other two lung function measurements were unrelated to mortality. Those who were overweight in 1967 or 1968 did not have an elevated risk.

Table 10.8

RESPIRATORY SYMPTOMS AND TOTAL MORTALITY

(Cohort "A")

	O	E	SMR	RR	χ^2
Breathlessness					
Absent or slight	87	96.89	.90		
Definite	43	32.05	1.34	*1.49*	4.70
Persistent cough *					
Absent	120	120.47	1.00		
Present	10	8.47	1.18	*1.19*	0.27
Persistent phlegm *					
Absent	124	120.33	1.03		
Present	6	8.62	.68	*.68*	0.89
Wheezing					
Absent	69	72.58	.95		
Present	61	56.36	1.08	*1.14*	0.55

* As explained in relation to Table 9.5, these symptoms cannot be considered reliable.

Table 10.9

LUNG FUNCTION, ADIPOSITY AND TOTAL MORTALITY

(Cohort "A")

	O	E	SMR	RR	χ^2
Forced Vital Capacity					
Normal	103	110.04	.94		
Sub-normal *	27	18.90	1.43	*1.53*	3.88
Ratio: $FEV_{1.0}/FVC$					
Normal	112	111.09	1.01		
Sub-normal *	18	17.85	1.01	*1.00*	0.00
Maximal mid-expiratory flow					
Normal	112	110.62	1.01		
Sub-normal *	18	18.32	.98	*.97*	0.01
Adiposity					
Normal	109	107.77	1.01		
Overweight *	21	21.17	.99	*.98*	0.01

* At least one standard deviation from "adjusted" mean

Chapter 11

FINDINGS II

11.1 Introduction

As explained in section 10.1, the present chapter is concerned with deaths from disease which might be expected to have been detected on the chest radiograph, either directly or through changes arising from the retention of asbestos dust. Sections 11.2 and 11.3 examine in some depth radiological findings in men whose deaths were certified as from pneumoconiosis and from cancer of the chest, respectively. The next section deals with mesothelioma, and the chapter ends with consideration of deaths from respiratory tuberculosis, other respiratory conditions and heart diseases.

11.2 Pneumoconiosis

Although fibrosis of the lung due to the inhalation of asbestos dust may lead to premature death which is not certified as due to pneumoconiosis, deaths which are coded to that cause remain those that one would expect to be best predicted by a classification of radiographic appearances considered to be due to the retention of dust in the lungs. This is confirmed by the high risks of death from pneumoconiosis in the "less-than-normals" relative to the "normals" seen in Table 10.5, and the ability of the presence of parenchymal and pleural changes to predict total mortality (Table 10.6). The present section

is concerned with deaths coded to pneumoconiosis; there were three such deaths in Cohort "A" and 31 in Cohort "B". Table 11.1 gives Relative Risks, for both cohorts, associated with the presence of each radiographic feature, and with mining area, comparing Thetford Mines against Asbestos, higher accumulated dust exposure and cigarette smoking. χ^2 calculations for the former were on the same basis as for Table 10.6 and for the latter on the same basis as for Table 10.1. Corresponding figures for those with symptoms, depressed lung function, or overweight are also given for Cohort "A"; χ^2 basis again as for Table 10.1.

Because there were only three deaths recorded as due to pneumoconiosis in Cohort "A", it would have been most unlikely that any value of χ^2 reached a conventional level of significance, even although for all three their films were "less-than-normal"; small opacities were recorded in all three films, and the χ^2 statistic is about as high as it would be possible to achieve, and so is at least suggestive, particularly when considered in conjunction with the very high value (86.60) for Cohort "B", wherein the Relative Risk was 21.58. In that cohort, there were also clear associations of high mortality and the presence of pleural changes other than calcification (RR = 21.07) and of "additional symbols" (RR = 19.17), and with high levels of accumulated dust exposure (RR = 8.78). Only four of the 31 deaths were in men in whom large opacities had been recorded, but the expectation was too small to be computed to two decimal places; this led to unmeasurably high SMR (and hence RR and χ^2), but the actual numbers suggest that too much reliance should not be placed on these facts. The higher SMR at Thetford Mines was again probably no more than a reflection of the higher dust exposures there. There were slight

Table 11.1

DEATHS FROM PNEUMOCONIOSIS
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	3		31	
	RR	χ^2	RR	χ^2
"Less-than-normal"	∞	0.50	11.75	41.24
Small opacities	∞	2.40	21.58	86.60
Large opacities	-	-	†	†
Pleural changes *	∞	1.07	21.07	71.62
Pleural calcification	∞	1.17	2.44	0.18
"Additional symbols"	∞	0.39	19.17	39.55
Thetford Mines *cf.* Asbestos	.80	0.03	3.37	10.64
Accumulated dust exposure	3.00	0.89	8.78	37.35
Cigarette smoking	1.50	0.11	1.11	0.08
Breathlessness	0	1.09		
Persistent cough	0	0.23		
Persistent phlegm	0	0.23		
Wheezing	.67	0.11		
Depressed FVC	3.00	0.89		
Depressed ratio $FEV_{1.0}/FVC$	0	0.50		
Depressed MMF	0	0.50		
Overweight	3.00	0.89		

* other than calcification † see text

signs of a dust effect in Cohort "A", but the three cases were largely free of respiratory symptoms.

The next two tables (11.2 and 11.3) describe the radiographic changes seen in the films of the men who died from pneumoconiosis (codes 523 and 524 of the Seventh Revision of the International Classification of Diseases); for Cohort "A", the 18 readings, six per case, are presented in one-way distributions. From Table 11.2, it can be seen that parenchymal change was recorded in the majority of the readings, 14 (or 77.8 per cent) and 23 (or 74.2 per cent) in the two cohorts, but other changes in the absence of parenchymal change were rare. There were two and five assessments as normal (11.1 per cent and 16.1 per cent) in Cohorts "A" and "B".

Table 11.3 illustrates the recording of parenchymal change in the pneumoconiosis cases. In Cohort "A", only small opacities were recorded, all irregular (types s, t, u) rather than rounded; the profusion averaged 3.5 on the notional scale of Liddell and May (1966, p. 9), corresponding to a reading between 1/1 and 1/2, considerably higher than the average in other cases where small opacities were seen. The pattern in Cohort "B" was not dissimilar, but among the 23 readings of small opacities, there were three where rounded opacities (p, q, r) predominated, and four in which large opacities were seen, each time in association with small opacities of profusion at least 2/2. The average profusion of small opacities in the 23 films was 5.6 on the notional scale, close to 2/2 and even higher than in Cohort "A".

For further investigation, a control was selected for each case

Table 11.2

RADIOGRAPHIC CHANGES IN PNEUMOCONIOSIS DEATHS

	Cohort "A"	Cohort "B"
Number of deaths	3	31
Number of readings	3 x 6 = 18	31
Type of change		
Parenchymal and other	9	17
Parenchymal only	5	6
	14	23
Pleural only	2	1
	16	24
Other *	-	2
	16	26
No change	2	5
	18	31

* One case of left costophrenic angle obliteration, with one "additional symbol"; one case of a single "additional symbol".

Table 11.3

PARENCHYMAL CHANGES IN PNEUMOCONIOSIS DEATHS

Entries in square brackets concern large opacities, A, B and C well-defined, D, E and F ill-defined.

Profusion of small opacities	Cohort "A"	Cohort "B"
(0/-)	-	-
(0/0)	-	-
0/1	2 (2t)	2 (1t, 1u)
1/0	2 (2s)	-
1/1	4 (3t, 1u)	4 (3t, 1u)
1/2	-	2 (1p, 1u)
2/1	-	1 (u)
2/2	2 (1t, 1u)	7 (1r, 2s, 1t, 3u) [2 (1A, 1E)]
2/3	1 (t)	1 (u) [1(D)]
3/2	1 (t)	2 (1q, 1u)
3/3	2 (1t, 1u)	4 (1s, 3u) [1(D)]
3/4	-	-
	14	23

in Cohort "B", as described in section 8.6, and some results from the case-control pairs are given in Tables 11.4 and 11.5. The former shows, reader by reader, the number of pairs in which pneumoconiotic change, i.e. small opacities, pleural thickening or ill-defined diaphragm or cardiac border, was:- (a) present in both members of the pair; (b) present only in the case; (c) present only in the control; and (d) absent in both. The appropriate test for association is that due to McNemar (1947), although the correction for continuity usually used should be halved (Pirie and Hamdan, 1972). This test is based solely on the disparate pairs, (b) and (c), and leads to yet another form of χ^2 statistic, i.e.

$$\chi^2 = \{ |(b) - (c)| - \tfrac{1}{2}\}^2 \div \{ (b) + (c) \}$$

again with one degree of freedom. Numbers are too small for a test for each reader separately; pooling yields $\chi^2 = 11.07$, which can be taken as providing some confidence that the excess of pairs in (b) over those in (c), common to five of the readers, was not due to chance.

Table 11.5 classifies cases and controls, independently, by accumulated dust exposure and by smoking habit. For the one case with exposure apparently less than 30 mpcf.y, the last recorded job ended in September 1930 at Thetford Mines. Clearly this man could not have been x-rayed at that time, and there is obviously a gap in the recorded work history; it is not unlikely that he had had substantial exposure in the period between 1930 and the time of x-ray that would have placed him in a higher exposure category. However, even including him with exposure as recorded gives the Relative Risks as in the table, showing the clear dose-response relationship expected, as these men

	Pneumoconiotic change:		
In case:	Present	Present	Absent
In control:	Present	Absent	Present
	(a)	(b)	(c)
Reader 1	-	2	-
Reader 2	-	2	-
Reader 3	-	4	-
Reader 4	3	1	1
Reader 5	3	3	-
Reader 6	1	5	1
ALL READERS	7	17	2

Table 11.4

RADIOGRAPHIC CHANGES IN PNEUMOCONIOSIS DEATHS, AND CONTROLS

(Small opacities or uncalcified pleural changes)

Absent Absent (d)	Number of case-control pairs
2	4
1	3
-	4
1	6
-	6
1	8
5	31

Table 11.5

ASBESTOS DUST EXPOSURE AND SMOKING HABIT
IN PNEUMOCONIOSIS DEATHS AND IN CONTROLS

Accumulated dust exposure (mpcf.y)	Cases	Controls	RR
Less than 30	1 *	7	*1*
30, less than 100	-	7	*0*
100, less than 300	6	7	*6.0*
300 or greater	24	10	*16.8*
	31	31	

Smoking habit	Cases	Controls	RR
Non-smoker	5	4	*1*
Not current cigarette smoker	9	11	*0.6*
Cigarette smoker	17	16	*0.8*
	31	31	

* See text

formed part of the "main mortality cohort" (McDonald and Liddell, 1978). Again the lack of a relationship between smoking and pneumoconiosis is confirmation of the findings in the entire "main mortality cohort" (McDonald *et al.*, 1979).

Finally, we wished to discriminate between those pneumoconiosis deaths in which the x-ray had shown pneumoconiotic change (as defined for Table 11.4) and the others. Table 11.6 shows that the 23 cases with pneumoconiotic change on the x-ray differed little from the other seven either in accumulated dust exposure or in interval between last recorded job and death.

11.3 Cancer of the chest

The investigation of cancer of the chest (i.e. deaths coded in the Seventh Revision of the International Classification of Diseases to: 162, malignant neoplasm of bronchus and trachea; 163, malignant neoplasm of lung, unspecified as to whether primary or secondary; or 164, malignant neoplasm of mediastinum) followed the same lines as that for pneumoconiosis deaths. The tables follow the same broad pattern as those illustrating section 11.2, and the same definitions have been used.

Table 11.7 shows that in Cohort "B", the presence of each radiographic feature was associated with an enhanced risk of chest cancer, the strongest association being with large opacities: RR = 20.73; χ^2 = 142.98. There were also increased Relative Risks in the presence of "additional symbols", 5.27 with χ^2 = 55.24, uncalcified pleural

Table 11.6

PNEUMOCONIOSIS DEATHS WITH AND WITHOUT RADIOGRAPHIC CHANGES

(Excluding one death with exposure less than 30 mpcf.y)

Accumulated dust exposure (mpcf.y)	Changes:-	
	Present	Absent
Less than 30	-	-
30, less than 100	-	-
100, less than 300	3	3
300 or greater	20	4
	23	7

Interval between last recorded job and death (years)	Changes:-	
	Present	Absent
Less than 5	13	4
5 or greater	10	3
	23	7

Table 11.7

DEATHS FROM CANCER OF THE CHEST
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	22		119	
	RR	χ^2	RR	χ^2
"Less-than-normal"	.78	0.24	3.24	44.63
Small opacities	1.41	0.66	2.88	19.46
Large opacities	1.20	0.03	20.73	142.98
Pleural changes *	1.21	0.16	3.73	34.80
Pleural calcification	.75	0.13	2.82	5.89
"Additional symbols"	.25	2.11	5.27	55.24
Thetford Mines *cf.* Asbestos	1.21	0.16	1.59	6.48
Accumulated dust exposure	2.04	2.90	2.87	36.03
Cigarette smoking	4.11	6.10	3.35	30.33
Breathlessness	.87	0.07		
Persistent cough	.71	0.12		
Persistent phlegm	.68	0.14		
Wheezing	1.82	1.98		
Depressed FVC	1.69	1.10		
Depressed ratio $FEV_{1.0}/FVC$	.61	0.44		
Depressed MMF	1.32	0.25		
Overweight	1.11	0.04		

* other than calcification

changes (RR = 3.73, χ^2 = 34.80), small opacities (RR = 2.88, χ^2 = 19.46), and perhaps pleural calcification (RR = 2.82, χ^2 = 5.89). Higher accumulated dust exposure and cigarette smoking also led to higher SMRs (RR = 2.87 and 3.35, respectively, with χ^2 = 36.03 and 30.33), but the high Thetford Mines risk relative to Asbestos was, once more, probably due to the higher levels of dust exposure there, and related to the high risk in those with pleural calcification. In Cohort "A", the risk in comparatively heavy cigarette smokers relative to others was great enough, 4.11, to yield a high value of χ^2, 6.10; the Relative Risks in those with higher dust exposure and in those whose films showed parenchymal or pleural change, without calcification, were also greater than unity, as were those in men who reported wheeze or had low FVC.

The pattern of radiographic change in chest cancer cases (including two in Cohort "B" which occurred before 1951, but excluding three mesotheliomas in that cohort whose deaths had been coded 162 or 163), shown in Tables 11.8 and 11.9, was quite different from that in pneumoconiosis (Tables 11.2 and 11.3). First, there were much higher proportions of normal readings, i.e. 65 out of 132, or 49.2 per cent and 48 in 118, or 40.7 per cent, in the two cohorts, compared with 11.1 per cent and 16.1 per cent in pneumoconiosis. Secondly, the proportions of the chest cancer cases showing parenchymal changes were rather lower, i.e. 90 readings out of 250, or 36.0 per cent, than of pneumoconiosis cases, where there were 37 readings of parenchymal change out of 49, or 75.5 per cent. Thirdly, such parenchymal changes as were recorded were of substantially lower profusion of small opacities (averages corresponding to profusions of less than 1/1 and

Table 11.8

RADIOGRAPHIC CHANGES IN CHEST CANCER DEATHS

	Cohort "A"	Cohort "B"
Number of deaths	22	118 *
Number of readings	22 x 6 = 132	118
Type of change		
Parenchymal and other	29	26
Parenchymal only	22	13
	51	39
Pleural	15	18
	66	57
Costophrenic angle only	1	2
	67	59
"Additional symbol" only	-	11
	67	70
No change	65	48
	132	118

* Consisting of 119 cases in the years 1951 through 1975, plus two before 1951, less three mesotheliomas coded 162 or 163 (see Table 11.14).

Table 11.8

RADIOGRAPHIC CHANGES IN CHEST CANCER DEATHS

	Cohort "A"	Cohort "B"
Number of deaths	22	118 *
Number of readings	22 x 6 = 132	118
Type of change		
Parenchymal and other	29	26
Parenchymal only	22	13
	51	39
Pleural	15	18
	66	57
Costophrenic angle only	1	2
	67	59
"Additional symbol" only	-	11
	67	70
No change	65	48
	132	118

* Consisting of 119 cases in the years 1951 through 1975, plus two before 1951, less three mesotheliomas coded 162 or 163 (see Table 11.14).

Profusion of small opacities	Cohort "A"
(0/-)	-
0/0	-
0/1	16 (1p, 2q, 2s, 1(ps), 10t)
1/0	10 (1p, 1(qs), 8t)
1/1	19 (1p, 1q, 3s, 11t, 3u) [1(D)]
1/2	3 (2t, 1u)
2/1	-
2/2	3 (2t, 1u)
2/3	-
3/2	-
3/3	-
3/4	-
	51

Table 11.9

PARENCHYMAL CHANGES IN CHEST CANCER DEATHS

Cohort "B"

-	
6	[6 (1A, 3B, 1D, 1E)]
6 (5t, 1u)	[2 (1D, 1E)]
6 (1q, 1s, 3t, 1u)	[1(B)]
5 (1p, 1q, 3t)	
4 (1p, 1s, 2t)	[2(D)]
2 (1p, 1q)	
7 (1s, 5t, 1u)	[1(D)]
1 (p)	[1(A)]
-	
2 (1p, 1s)	[1(B)]
-	

39

a little more than 1/1 in Cohorts "A" and "B", respectively), while the opacities were more frequently rounded (p, q, r), i.e. in 15 out of 84 readings of profusion at least 0/1 (17.9 per cent), compared with 3 out of 37 (8.1 per cent) in pneumoconiosis. Finally, in Cohort "B", there were 15 cases in which large opacities had been recorded, only three associated with small opacities of profusion 2/2 or greater; see also Table 11.12.

The numbers in Table 11.10 are just large enough to allow tests, of the sort described in relation to Table 11.4, reader by reader; for each reader, the number of case-control pairs in which radiographic change was present in the case but not in the control, column (b), was greater than the number in which the reverse was true, column (c), but only for Readers 6 and 2 was χ^2 substantial (7.52 and 5.56, respectively). However, pooling over all readers led to $\chi^2 = 16.54$, a little higher than for pneumoconiosis - because of the larger numbers rather than better discrimination.

Table 11.11 reveals the expected dose-response relationships for both dust exposure and smoking, but these two factors do not discriminate well between those cases whose x-rays were normal and others; see the upper part of Table 11.12. However, the shorter the interval between last recorded job (usually less than a year after the x-ray had been taken) and death, the lower the probability of the film being assessed as normal: for the four intervals in the lower part of Table 11.12, the proportions with normal films were 18.8 per cent, 44.4 per cent, 64.3 per cent and 70.0 per cent, as the intervals increased. In 11 of the 14 chest cancer cases in whose films "large

	Radiographic change:-			
In case:	Present	Present	Absent	Absent
In control:	Present	Absent	Present	Absent
	(a)	(b)	(c)	(d)
Reader 1	2	6	1	6
Reader 2	-	11	2	10
Reader 3	7	6	4	5
Reader 4	4	7	2	2
Reader 5	4	5	4	5
Reader 6	7	11	1	6
ALL READERS	24	46	14	34

Table 11.10

RADIOGRAPHIC CHANGES IN CHEST CANCER DEATHS, AND CONTROLS

(Any radiographic changes)

Number of case-control pairs	
15	
23	
22	
15	
18	
25	
118	

Table 11.11

ASBESTOS DUST EXPOSURE AND SMOKING HABIT
IN CHEST CANCER DEATHS AND IN CONTROLS

Accumulated dust exposure (mpcf.y)	Cases	Controls	RR
Less than 30	18	25	*1*
30, less than 100	20	24	*1.16*
100, less than 300	17	21	*1.12*
300 or greater	63	48	*1.82*
	118	118	

Smoking habit *	Cases	Controls	RR
Non-smoker	6	8	} *1*
Not current cigarette smoker	17	45	
Cigarette smoker	91	61	*3.44*
	114	114	

* Excluding four pairs in which habit was not known for case

Table 11.12

CHEST CANCER CASES WITH AND WITHOUT RADIOGRAPHIC CHANGES

Smoking habit	Accumulated dust exposure (mpcf.y)	Changes:- Present	Changes:- Absent
Not cigarettes	Less than 300	3 (2)*	3
	300 or greater	9 (6)	9
Cigarettes	Less than 300	30 (11)	16
	300 or greater	27 (14)	17
		69 (33)	45

* Numbers of cases in which small opacities were recorded

Interval between last recorded job and death (years)	Changes:- Present	Changes:- Absent
Less than 5	39 (11) ¶	9
5, less than 10	20 (1)	16
10, less than 20	5 (1)	9
20 or greater	6 (1)	14
	70 (14)	48

¶ Numbers of cases in which large opacities were recorded

Table 11.12

CHEST CANCER CASES WITH AND WITHOUT RADIOGRAPHIC CHANGES

Smoking habit	Accumulated dust exposure (mpcf.y)	Changes:- Present	Changes:- Absent
Not cigarettes	Less than 300	3 (2)*	3
	300 or greater	9 (6)	9
Cigarettes	Less than 300	30 (11)	16
	300 or greater	27 (14)	17
		69 (33)	45

* Numbers of cases in which small opacities were recorded

Interval between last recorded job and death (years)	Changes:- Present	Changes:- Absent
Less than 5	39 (11) ¶	9
5, less than 10	20 (1)	16
10, less than 20	5 (1)	9
20 or greater	6 (1)	14
	70 (14)	48

¶ Numbers of cases in which large opacities were recorded

opacities" had been assessed, the interval was less than five years; in the six cases with "large opacities" but no small opacities, the intervals were all short, three dying in the same year as that of last employment, two in the following year, and one in the year after that.

11.4 Mesothelioma

A total of six deaths within Cohorts "A" and "B" had been recognized, during the course of the main mortality study, as due to malignant mesothelioma, all of the pleura; one was in Cohort "A" and had been coded to cause 227 in the Seventh Revision of the International Classification of Diseases, and in Cohort "B" two had been coded to 162, one to 163 and two to 212. Table 11.13 gives the six readings of the film for the one case in Cohort "A". He died in 1972, aged 62; his first employment in the Quebec asbestos industry was in January 1928, giving an interval between first exposure and death of 44 years. At November 1966, his net service was 39 years, but the dust exposure accumulated until then was only 227 mpcf.y. The five cases in Cohort "B" are described in Table 11.14. The first six lines indicate the radiographic changes, and there follows a brief summary of other facts about each case.

One of the most interesting findings about asbestos-induced mesothelioma is the long latent period, i.e. interval between first exposure to asbestos and death, probably even longer for chrysotile than for crocidolite; see Figure 6.2 above. A total of twelve cases exposed to chrysotile only have now been ascertained among Quebec miners and millers; the six not reported here had had rather longer latent periods, ranging from 41 years to 56, with a median of 52 years.

Table 11.13

MESOTHELIOMA: ONE CASE IN COHORT "A"

Death in 1972, at age 62 years, coded "227"

Interval from first exposure to death: 44 years

Net service, at Thetford Mines: 31 years; 227 mpcf.y accumulated.

Cigarette smoker

		ROUNDED SMALL OPACITIES			IRREGULAR SMALL OPACITIES			LARGE OPACITIES			PLEURAL THICKENING			ILL DEFINED DIAPHRAGM	ILL DEFINED CARDIAC BORDER	PLEURAL CALCIFICATION				14917	
Rdr	Quality	Type	Profusion	Zones	Type	Profusion	Zones	(a)	(b)	Costo-phrenic angle	(c)	(d)	(e)			Diaph	Wall	Other	Grade	Symbols	Comments
A	+		/			/										R L			1		
B	+		/			/								R,L		R L	L		1		
C	+		/			/										R L	R L		1		
D	+		/		u	1/0	✓ ✓ ✓ ✓ ✓									R L	R L		1		✓
E	+		/		t	0/1	✓									R L			1		
F	+	p	0/1	✓		/										R L	L		1		
	+ ± ± U/R	p q r	0/– 0/0 0/1 1/0 1/1 1/2 2/1 2/2 2/3 3/2 3/3 3/4	Check zones involved	s t u	0/– 0/0 0/1 1/0 1/1 1/2 2/1 2/2 2/3 3/2 3/3 3/4	Check zones involved	O A B C	O D E F	O R L	R L	R L	O 1 2	O R L	O 1 2 3		R L		O 1 2 3	O Cn Es Od	Co Cp Ho Np Tb

(a) Well defined (c) Diffuse

(b) Poorly defined (d) Plaques

(e) Grade

Table 11.14

MESOTHELIOMA: FIVE CASES IN COHORT "B"

	Case number				
	1	2	3	4	5
Parenchymal change (type and profusion)	-	-	p: 1/0 t: 0/1		-
Thickening of pleural walls	-	-	-	-	-
Ill-defined diaphragm	-	R	-	-	-
Ill-defined cardiac border	-	-	-	-	-
Pleural calcification (grade)	-	3	-	-	-
"Additional symbols" (count)	1	-	-	-	-
Coded cause of death	162	162	212	212	163
Year of death	1956	1964	1967	1967	1975
Age at death (years)	40	57	73	57	64
Interval from first exposure to death (years)	21	45	30	31	52
Mining area (Asbestos or Thetford Mines)	TM	TM	TM	A	TM
Year of last employment	1955	1963	1962	1966*	1966*
Net service (years)	15	44	19	30	31
Accumulated dust exposure (mpcf.y)	71	353	52	622	684
Cigarette smoker	Yes	NK	Yes	Yes	Yes

* Still employed at November 1966

Only for one man in Cohort "B" was the latent period as long as the median for the complete group of twelve cases. This difference between the cases in the studies now being reported and the others is undoubtedly due to these others having completed their employment in the chrysotile mines and mills before radiology started there, and so being excluded from either study cohort.

11.5 Respiratory tuberculosis

Each of the next three sections is concerned with deaths from the three groups of causes mentioned in section 11.1 not already dealt with. Each group is the subject of a single table, with the same lay-out and definitions as for Table 11.1.

Although respiratory tuberculosis (Table 11.15) used to be a fairly common cause of death in Quebec, there were no deaths from this cause in Cohort "A", nor in Era 3 of Cohort "B". Not surprisingly, the risks of the "less-than-normals" were very much higher than those of the "normals". It is well-known that the radiological appearances of tuberculosis can be confused with pneumoconiotic change, particularly with large opacities (RR = 51.21), while the "additional symbols" (RR = 12.80) include means of recording diagnoses of tuberculosis. As the dust effect (RR = 1.64) was not nearly as large as that associated with abnormality of x-ray (RR at least 6.28), it seems possible that the high Relative Risks for small opacities (7.58) and for pleural changes (9.63 and 7.49) were artefactual rather than the results of heavy exposure to asbestos dust. The difference between Thetford Mines and Asbestos is probably a reflection of differences between the areas in the prevalence of tuberculosis in the general population, for

Table 11.15

DEATHS FROM RESPIRATORY TUBERCULOSIS
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	0		40	
	RR	χ^2	RR	χ^2
"Less-than-normal"			6.28	37.28
Small opacities			7.58	33.64
Large opacities			51.21	159.98
Pleural changes *			9.63	51.89
Pleural calcification			7.49	10.96
"Additional symbols"			12.80	64.88
Thetford Mines *cf.* Asbestos			2.06	5.41
Accumulated dust exposure			1.64	2.29
Cigarette smoking			1.85	3.22
Breathlessness				
Persistent cough				
Persistent phlegm				
Wheezing				
Depressed FVC				
Depressed ratio $FEV_{1.0}/FVC$				
Depressed MMF				
Overweight				

* other than calcification

it was observed also in the main mortality study (McDonald *et al.*, 1979) for all male workers regardless of exposure. The smoking effect was so small compared with all the others that it should probably not be given much weight.

11.6 Other respiratory conditions

Deaths from other respiratory conditions (Table 11.16) also seem to have been predictable from radiographic changes and once more there appears to have been some misdiagnosis, either on the x-ray or on death certification, where "large opacities" are concerned. In Cohort "B", the dust effect was considerable (RR = 1.85, χ^2 = 6.47), and so the high Relative Risks for the men with pneumoconiotic changes (RRs 2.99 and 3.27 for parenchymal and pleural changes; χ^2 values 18.21 and 20.61) may well have been reflections of heavier exposure. The Relative Risk for smokers may have been because of chronic bronchitis.

In Cohort "A", only pleural calcification, among radiographic features, was associated with high risk; no explanation has been found. The most marked findings in this cohort were Relative Risks of 5.95 and 6.21 for depressed FVC and MMF: they are both eminently reasonable, as are the high Relative Risks, even if without high values of χ^2, associated with breathlessness (2.87), persistent phlegm (2.60), wheeze (1.26) and $FEV_{1.0}$/FVC (3.10).

11.7 Heart disease

Although relative risks of death from heart disease (Table 11.17) were not generally as great as for the conditions just discussed, the

Table 11.16

DEATHS FROM OTHER RESPIRATORY DISEASES
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	6		67	
	RR	χ^2	RR	χ^2
"Less-than-normal"	1.03	0.00	2.29	12.17
Small opacities	1.05	0.00	2.99	18.21
Large opacities	0	0.16	11.82	34.04
Pleural changes *	1.07	0.00	3.27	20.61
Pleural calcification	3.30	1.94	1.58	0.55
"Additional symbols"	1.64	0.26	1.90	2.10
Thetford Mines *cf.* Asbestos	.92	0.01	.98	0.00
Accumulated dust exposure	.31	1.28	1.85	6.47
Cigarette smoking	.68	0.23	1.39	1.74
Breathlessness	2.87	1.83		
Persistent cough	0	0.43		
Persistent phlegm	2.60	0.82		
Wheezing	1.26	0.08		
Depressed FVC	5.95	6.17		
Depressed ratio $FEV_{1.0}/FVC$	3.10	1.90		
Depressed MMF	6.21	6.25		
Overweight	0	1.19		

* other than calcification

Table 11.17

DEATHS FROM HEART DISEASE
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	44		566	
	RR	χ^2	RR	χ^2
"Less-than-normal"	1.03	0.01	1.53	25.25
Small opacities	1.62	1.87	1.71	27.92
Large opacities	2.25	1.76	1.12	0.05
Pleural changes *	1.44	0.93	1.54	13.96
Pleural calcification	1.64	1.11	1.34	2.25
"Additional symbols"	1.32	0.50	1.98	30.46
Thetford Mines *cf.* Asbestos	.96	0.01	1.13	1.96
Accumulated dust exposure	1.42	1.36	1.57	27.90
Cigarette smoking	1.38	1.00	1.78	41.95
Breathlessness	2.26	7.58		
Persistent cough	1.42	0.46		
Persistent phlegm	0	3.17		
Wheezing	1.39	1.20		
Depressed FVC	1.29	0.42		
Depressed ratio $FEV_{1.0}/FVC$	.79	0.23		
Depressed MMF	.60	0.94		
Overweight	1.12	0.08		

* other than calcification

values of χ^2 are larger because they are based on so many more deaths. The dust and pneumoconiotic effects may be explicable by diagnosis of heart disease in deaths accelerated by pneumoconiosis in those heavily exposed to asbestos. The "additional symbols" associated with high risk may have included those relating to heart conditions, e.g. cor pulmonale or enlarged heart. The smoking effect was to have been expected from other studies in asbestos workers (e.g. McDonald *et al.*, 1979) and in other populations (see several reports summarized by Holman, 1976), as was the high Relative Risk for those who reported breathlessness (see, for example, Higgins and Keller, 1970).

Chapter 12

F I N D I N G S I I I

12.1 Introduction

It seems most unlikely that any manifestation of the remaining groups of causes of death could be discernible on an x-ray of the chest. However, in dust related conditions, there might be pneumoconiotic changes as indirect signs of disease. As in the previous chapter, each group of causes of death is the subject of a table on the same lines as Table 11.1.

12.2 Cancer of the gastro-intestinal tract

The pattern of relationships between dust and *cancer of the oesophagus or stomach* (Table 12.1) are far from clear. In Cohort "B", the effect of exposure to asbestos dust (RR = 2.76, χ^2 = 14.79) was rather larger than was to have been expected from the main mortality study (McDonald and Liddell, 1978), but most of the pneumoconiotic x-ray appearances with high Relative Risks probably arose from the dust exposure. The high Relative Risk for pleural calcification (3.45), together with the high risk at Thetford Mines (2.06), where most of the calcification is concentrated, might suggest a common aetiology, conceivably in the drinking water supplies. It is not impossible that the high risks in Cohort "A" for the overweight (RR = 3.38) and those with persistent cough (RR = 3.63) reflect true underlying relation-

Table 12.1

DEATHS FROM CANCER OF OESOPHAGUS OR STOMACH
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	5		53	
	RR	χ^2	RR	χ^2
"Less-than-normal"	∞	1.08	1.58	2.79
Small opacities	∞	0.88	2.06	5.87
Large opacities	-	-	4.70	4.82
Pleural changes *	∞	0.92	2.44	9.42
Pleural calcification	-	-	3.45	10.85
"Additional symbols"	∞	0.96	0.76	0.17
Thetford Mines *cf.* Asbestos	1.81	0.29	2.06	6.76
Accumulated dust exposure	0	3.08	2.76	14.79
Cigarette smoking	∞	3.29	1.56	2.47
Breathlessness	0	1.73		
Persistent cough	3.63	1.52		
Persistent phlegm	0	0.37		
Wheezing	.31	1.20		
Depressed FVC	0	0.86		
Depressed ratio $FEV_{1.0}/FVC$	1.55	0.16		
Depressed MMF	1.52	0.14		
Overweight	3.38	2.01		

* other than calcification

ships.

For *cancer of the colon or rectum* (Table 12.2), the dust effect in Cohort "B" was quite small and could hardly account for the Relative Risks of those with pneumoconiotic changes on the x-ray. However, the χ^2 values were not large, whereas those in Cohort "A" for breathlessness and depressed FVC were. It is not clear why cancer of the lower gastro-intestinal tract should cause respiratory signs and symptoms.

Table 12.3 deals with *other causes of the abdomen*, i.e. malignant neoplasms of:- biliary passages and of liver, stated to be primary site (155); liver, secondary or unspecified (156); pancreas (157); peritoneum (158); or unspecified digestive organs (159). In view of the comparatively low values of the χ^2 statistics, particularly in relation to dust exposure, it would seem that the chest x-ray cannot materially affect prediction of mortality from these causes.

12.3 Cancer of the larynx

Laryngeal cancer (Table 12.4) has been cited (see Chapter 2) as one response to asbestos exposure, but here the only sign of a dust effect in the admittedly very few cases in either cohort was in the reverse direction. On the other hand, McDonald and Liddell (1978) showed no excess of cancer of the larynx, but a very clear dose-response relationship with cigarette smoking, which is in no way contradicted by the present information. Nor is it surprising that this disease should be associated with dyspnoea. However, the lack of any other important association of laryngeal cancer was according to ex-

Table 12.2

DEATHS FROM CANCER OF COLON OR RECTUM
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	3		28	
	RR	χ^2	RR	χ^2
"Less-than-normal"	∞	0.66	2.34	5.34
Small opacities	∞	1.51	1.76	1.07
Large opacities	-	-	0	0.12
Pleural changes *	∞	0.39	2.42	3.32
Pleural calcification	∞	2.11	2.94	2.47
"Additional symbols"	∞	1.62	2.31	1.81
Thetford Mines *cf.* Asbestos	.23	1.76	1.85	2.60
Accumulated dust exposure	3.29	1.06	1.44	0.89
Cigarette smoking	∞	1.96	.74	0.62
Breathlessness	∞	8.81		
Persistent cough	0	0.21		
Persistent phlegm	0	0.22		
Wheezing	.64	0.14		
Depressed FVC	11.71	6.53		
Depressed ratio $FEV_{1.0}/FVC$	0	0.48		
Depressed MMF	0	0.49		
Overweight	0	0.59		

* other than calcification

Table 12.3

DEATHS FROM OTHER CANCERS OF THE ABDOMEN
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	5		21	
	RR	χ^2	RR	χ^2
"Less-than-normal"	.91	0.01	1.34	0.43
Small opacities	1.18	0.02	1.27	0.16
Large opacities	0	0.16	0	0.16
Pleural changes *	1.22	0.03	2.28	3.22
Pleural calcification	0	0.37	3.34	4.15
"Additional symbols"	1.24	0.04	1.89	1.01
Thetford Mines *cf.* Asbestos	∞	2.24	1.12	0.07
Accumulated dust exposure	.43	0.61	1.20	0.15
Cigarette smoking	.97	0.00	2.70	4.03
Breathlessness	0	1.69		
Persistent cough	0	0.35		
Persistent phlegm	3.52	1.45		
Wheezing	.84	0.04		
Depressed FVC	0	0.87		
Depressed ratio $FEV_{1.0}/FVC$	0	0.81		
Depressed MMF	0	0.83		
Overweight	0	1.00		

* other than calcification

Table 12.4

DEATHS FROM LARYNGEAL CANCER
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	2		4	
	RR	χ^2	RR	χ^2
"Less-than-normal"	.23	1.31	2.21	0.66
Small opacities	.59	0.28	4.10	2.73
Large opacities	0	0.36	0	0.02
Pleural changes *	0	1.66	2.55	0.57
Pleural calcification	0	0.94	0	0.09
"Additional symbols"	0	1.66	0	0.16
Thetford Mines *cf.* Asbestos	∞	0.92	3.71	1.49
Accumulated dust exposure	0	1.18	.81	0.03
Cigarette smoking	∞	1.26	∞	3.58
Breathlessness	∞	5.78		
Persistent cough	0	0.15		
Persistent phelgm	0	0.15		
Wheezing	∞	2.52		
Depressed FVC	0	0.33		
Depressed ratio $FEV_{1.0}/FVC$	0	0.33		
Depressed MMF	0	0.33		
Overweight	0	0.41		

* other than calcification

pectation.

12.4 Other causes

Again, with *other cancers* (Table 12.5), it is not surprising that none of the tabulated Relative Risks appears of significance.

It is difficult to see how *cerebro-vascular diseases* (Table 12.6) could be associated with exposure to asbestos dust, but the Relative Risk in Cohort "B" was not trivially enhanced; there was also an elevated risk, in both cohorts, among those in whose films large opacities had been recorded. These films require careful study to see whether there is any possibility of predicting strokes. The Relative Risks for certain respiratory signs and symptoms in Cohort "A" may well appear important only because they are based on so few deaths due to cerebro-vascular disease.

In considering Table 12.7, it is important to appreciate that the *accidents* included all deaths coded 800–999; only a minority were accidents at work, and by no means all of these occurred while the man was employed in the asbestos industry. Compared with the causes of death discussed in the last few pages, there is even less reason to believe that the x-ray could predict mortality from accidents. Fortunately, there are few high values of χ^2; on the other hand, there are several contradictions, e.g. in the high Relative Risk for small opacities without a corresponding effect of higher dust exposure. Nor can the high risks for smokers be adequately reconciled. The pattern is only confused by the differences between the two cohorts.

Table 12.5

DEATHS FROM OTHER CANCERS
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	11		93	
	RR	χ^2	RR	χ^2
"Less-than-normal"	.40	2.23	1.44	3.02
Small opacities	.15	3.52	1.50	2.42
Large opacities	1.48	0.26	1.34	0.07
Pleural changes *	.46	1.40	1.52	2.33
Pleural calcification	0	1.15	.96	0.01
"Additional symbols"	.16	3.40	1.13	0.09
Thetford Mines *cf.* Asbestos	.79	0.14	.84	0.70
Accumulated dust exposure	.64	0.45	1.14	0.34
Cigarette smoking	1.73	0.67	1.42	2.71
Breathlessness	.30	1.50		
Persistent cough	3.13	2.36		
Persistent phlegm	1.38	0.10		
Wheezing	.48	1.22		
Depressed FVC	0	1.87		
Depressed ratio $FEV_{1.0}/FVC$	2.34	1.67		
Depressed MMF	.61	0.23		
Overweight	0	2.17		

* other than calcification

Table 12.6

DEATHS FROM CEREBRO-VASCULAR DISEASES
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	5		101	
	RR	χ^2	RR	χ^2
"Less-than-normal"	.82	0.03	1.17	0.59
Small opacities	0	0.77	1.23	0.69
Large opacities	5.25	3.40	4.43	9.90
Pleural changes *	1.07	0.00	.98	0.00
Pleural calcification	0	0.45	1.08	0.03
"Additional symbols"	1.08	0.00	1.65	3.18
Thetford Mines *cf.* Asbestos	.30	1.90	1.34	2.17
Accumulated dust exposure	1.03	0.00	1.63	6.07
Cigarette smoking	2.70	0.85	1.09	0.17
Breathlessness	4.29	3.02		
Persistent cough	0	0.37		
Persistent phelgm	0	0.39		
Wheezing	5.06	2.61		
Depressed FVC	9.02	8.56		
Depressed ratio $FEV_{1.0}/FVC$	1.57	0.16		
Depressed MMF	1.58	0.17		
Overweight	1.26	0.04		

* other than calcification

Table 12.7

DEATHS FROM ACCIDENTS
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	6		110	
	RR	χ^2	RR	χ^2
"Less-than-normal"	∞	2.59	1.58	5.24
Small opacities	∞	1.54	1.97	8.51
Large opacities	-	-	1.29	0.05
Pleural changes *	∞	0.43	1.39	1.17
Pleural calcification	∞	2.08	.64	0.34
"Additional symbols"	∞	1.66	1.41	0.86
Thetford Mines *cf.* Asbestos	2.10	0.48	1.00	0.00
Accumulated dust exposure	3.02	2.02	1.16	0.49
Cigarette smoking	1.07	0.01	1.80	7.46
Breathlessness	1.99	0.66		
Persistent cough	0	0.41		
Persistent phlegm	0	0.34		
Wheezing	1.52	0.26		
Depressed FVC	1.15	0.02		
Depressed ratio $FEV_{1.0}/FVC$	1.28	0.05		
Depressed MMF	1.12	0.01		
Overweight	1.15	0.02		

* other than calcification

The last table (12.8) deals with deaths from *causes known but not included in any group already discussed.* Although the Relative Risks for the higher dust exposure sub-cohorts were not particularly high, those for several radiographic changes were, and that for small opacities in Cohort "B" is inexplicable. The high risks, in both cohorts, among those whose films were read as having "additional symbols", might be explained by careful consideration of the particular "symbol" and the exact code of the cause of death. The smoking effect, present in both cohorts, could possibly be elucidated by similar detailed enquiry.

Table 12.8

DEATHS FROM OTHER KNOWN CAUSES
RELATED TO RADIOGRAPHIC CHANGES AND OTHER FACTORS

(Relative Risks, and χ^2 statistics)

	Cohort "A"		Cohort "B"	
Number of deaths	16		183	
	RR	χ^2	RR	χ^2
"Less-than-normal"	∞	3.86	1.53	8.12
Small opacities	∞	1.24	1.86	13.44
Large opacities	-	-	2.75	3.78
Pleural changes *	∞	6.61	1.22	0.73
Pleural calcification	∞	6.88	1.80	3.98
"Additional symbols"	∞	4.12	2.16	13.74
Thetford Mines *cf.* Asbestos	.75	0.32	1.17	1.08
Accumulated dust exposure	1.06	0.01	1.15	0.76
Cigarette smoking	2.76	2.74	1.51	7.31
Breathlessness	1.01	0.00		
Persistent cough	.94	0.00		
Persistent phlegm	.93	0.01		
Wheezing	.43	2.26		
Depressed FVC	1.35	0.22		
Depressed ratio $FEV_{1.0}/FVC$	.89	0.02		
Depressed MMF	.86	0.04		
Overweight	1.18	0.07		

* other than calcification

Chapter 13

S U M M A R Y O F F I N D I N G S

13.1 Introduction; total mortality

This chapter summarizes briefly the findings described in the preceding pages. Synthesis and discussion are in Chapter 14.

Those whose chest radiographs revealed abnormality of any feature (small opacities, large opacities, pleural changes with or without calcification, or additional symbols) had Relative Risks of total mortality greater than unity, substantially so far all features in Cohort "B"; in Cohort "A", the Relative Risks were generally rather smaller, but only the comparatively few deaths appeared to prevent "significance".

In Cohort "A", cigarette smoking was associated with the most significant Relative Risk (1.88, χ^2 = 10.18), more so than for any of the radiographic changes and considerably greater than that for the men most heavily exposed to dust (RR = 1.21, χ^2 = 1.10). Relative Risk of death from all causes in cigarette smokers was slightly less pronounced in Cohort "B" (1.67), but the dust effect was almost as large (1.59), and both were associated with very large values of χ^2. The dust effect in Cohort "B" probably accounted for the higher SMR at Thetford Mines than at Asbestos, in that cohort. In Cohort "A",

those with dyspnoea and depressed FVC also had enhanced Relative Risks.

13.2 Asbestos-related diseases of the respiratory system

The radiographs of those who died from *pneumoconiosis* generally showed parenchymal change, often well advanced. The Relative Risk of pneumoconiosis in those more heavily exposed to asbestos dust was high in both cohorts, but considerably less than the Relative Risk of those with pneumoconiotic changes. Smoking was not a factor, and the three cases in Cohort "A" were largely asymptomatic.

The great majority of the men who died from *cancer of the chest* were cigarette smokers, or had had substantial exposure to asbestos dust, or both. In both cohorts, cigarette smokers had a higher Relative Risk than those with heavier exposure, markedly so in Cohort "A" (RRs of 4.11 and 2.04, respectively), where none of the Relative Risks for radiographic change were very great. Perhaps because of the larger dust effect in Cohort "B", some of the Relative Risks for radiographic changes were considerable, with that for "large opacities" dominating. This last may well have been recognition, on the x-ray, of the malignancy itself; for those in whom "large opacities" were diagnosed, the interval between x-ray and death was usually short. In both cohorts, only about half the x-ray readings were of pneumoconiotic change, and it was generally not advanced.

There were only six *mesotheliomas*, one in Cohort "A", whose film at least six years before death showed bilateral calcified plaques, and five in Cohort "B", with highly variable x-ray findings. The very short duration of this illness, after diagnosis, means that the changes

on a routine x-ray taken during employment are likely to be largely irrelevant. The latent periods, between first asbestos employment and death, were rather shorter than in the remainder of those in the "main mortality cohort" who died from this malignancy.

13.3 Other respiratory diseases; heart disease

There were forty cases of *respiratory tuberculosis* in Cohort "B", all before 1967. Very high Relative Risks were found for all radiographic features, particularly for "large opacities" (perhaps again with some element of mis-diagnosis) and "additional symbols" (probably including those specific for tuberculosis, i.e. tba and tb).

The Relative Risks of *other respiratory diseases* in Cohort "A" were high for men with depressed lung function (MMF: 6.21; FVC: 5.95; $FEV_{1.0}$/FVC: 3.10) and dyspnoea (2.87); however, there was a low Relative Risk for those with heavy dust exposure and little excess risk associated with x-ray change. In Cohort "B", on the other hand, there was a considerable dust effect, and, probably as a result of this, high Relative Risks for large opacities, pleural changes (without calcification) and small opacities.

Death at work, or shortly after ending employment, was a criterion for exclusion from Cohort "A", but not from Eras 1 and 2 of Cohort "B". Some deaths ascribed to *heart disease* may well have been due to the after-effects of dust retention, and this is substantiated by high Relative Risks both among the heavily exposed and associated with small opacities, in both cohorts. Smokers also had high Relative Risks of heart disease, as has been shown in many other studies (see review by

Holman, 1976). Those in Cohort "A" who reported breathlessness also had high risk of death from heart disease.

13.4 Other cancers

The patterns with cancers of the *gastro-intestinal tract* are confused. For the upper tract (oesophagus and stomach), there was a major dust effect in Cohort "B" and some high risks associated with changes on chest x-ray, for which no explanation has been found. For the lower tract (colon and rectum), there were dust effects in both cohorts, together with high risks associated with pleural changes and, in Cohort "A", with breathlessness and depressed FVC. For other abdominal cancers, there were no clear-cut findings.

There were only six *cancers of the larynx*, all among smokers, confirming the dose-response relationship found by McDonald *et al.* (1979), while no marked excess, nor relation to dust exposure or x-ray changes, again confirmed earlier findings. The two cases in the smaller cohort reported breathlessness and wheeze.

No consistent findings were observed with *cancers of other sites.*

13.5 Strokes; accidents; other causes

Strokes and accidents should surely be unrelated to asbestos exposure or to x-ray change. However, for *cerebro-vascular diseases*, the Relative Risks for those with large opacities were high in both cohorts; in Cohort "A", so were the risks of those who were breathless, wheezed or had depressed FVC. Again, Relative Risks for *accidents* (including, but by no means dominated by, accidents at work in

the asbestos industry) were high for those with small opacities and, in Cohort "B", for smokers.

The Relative Risks for the *other causes* of death not so far summarized were high, in both cohorts, for men whose radiographs showed "additional symbols", small opacities, and pleural calcification, and for smokers.

13.6 Conclusion

Most of the findings summarized in sections 13.1 through 13.3 could be taken as validation of the system of radiological classification. Some of those in sections 13.4 and 13.5 are difficult to explain and require further investigation.

Chapter 14

D I S C U S S I O N , S Y N T H E S I S
A N D R E C O M M E N D A T I O N S

14.1 Introduction

This has been the report of research aimed at answering specific questions about the prediction of mortality in asbestos workers from changes observed in radiographs of men while still employed. The next sections examine the weaknesses and strengths, both of materials and of methods, for these purposes. Section 14.2 shows how the present study cohorts would not have been suitable for a general investigation of mortality, but were of great strength for the current objectives. Section 14.3 emphasises the limitations of the commonly used *a priori* form of reasoning and highlights the need for the adopted strengthening by use of *a posteriori* methods.

Premature death is the end-point of a disease process which may have been initiated or accelerated by exposure to agents such as inhaled asbestos dust or cigarette smoke, and which may have been manifest, during life, by symptoms or signs. Severe exposure to asbestos dust has long been known to be associated with increased prevalence of dyspnoea, and of radiographic changes in the parenchyma of the lungs, and of their pleura, and with excess mortality from pneumoconiosis, cancer of the chest, malignant mesothelial tumours of the pleura (and sometimes of the peritoneum), and certain other causes. Cigarette

smoking can lead to respiratory symptoms, depressed lung function, and increased mortality from lung cancer, coronary heart disease, and some other causes; such effects may be synergistic with those of asbestos exposure. Section 14.4 considers total mortality in relation to various signs and symptoms.

The successes and failures of radiology as a predictive tool are discussed in the following sections, 14.5, 14.6, 14.7, dealing with pneumoconiosis and related conditions, neoplasia, and other causes of death, respectively. The next sections review the validation of the current radiographic classification of dust-related chest conditions and discuss its use for the surveillance of the asbestos worker.

The chapter ends by considering oustanding gaps in knowledge, with recommendations as to how they might be filled.

14.2 Mortality in relation to dust exposure, smoking and mining area

The continuing study of the "main mortality cohort" has shown clear excesses of deaths from certain causes, with dose-response relationships, as summarized by McDonald and Liddell (1978). The two present study cohorts, "A" and "B", were selected to achieve specific objectives; they were not intended to provide any substitute for a general investigation of mortality in relation to factors such as accumulated dust exposure and cigarette smoking. Nevertheless, basic findings of this nature were very similar to those seen in the entire cohort of nearly eleven thousand workers. Had they not been so, serious doubts would have been cast on the utility of the present

research materials. In fact, both cohorts had strengths and weaknesses; particular concerns are with the periods of follow-up and the definitions of study intervals.

Cohort "A" was comparatively small and the period of follow-up was short. Deaths from all causes numbered only 130, but many other studies have been based on even smaller numbers. A more important deficiency was that, by definition of this cohort, any deaths occurring within a short interval after the last available radiograph were excluded; see below. Total mortality was close to expectation, but there were excesses due to pneumoconiosis and cancer of the chest. The three deaths from pneumoconiosis were among men with heavier dust exposure; the 22 deaths from chest cancer almost entirely in men who had been cigarette smokers, or had had heavier dust exposure, or both.

Cohort "B" was almost half the size of the "main mortality cohort"; however, relative to that cohort, there were certain selection biases. First, a rather higher than representative proportion of men had worked at Asbestos, because radiology had started there several years earlier than at Thetford Mines; thus some of the highest dust exposures were excluded. Secondly, in order to have had an x-ray while employed, the men were considerably younger, on average, than those in the "main mortality cohort"; see Table 14.1. Thirdly, as discussed in section 9.5 above, the selection procedure led to the inclusion of all men who died at work or shortly afterwards; this was the reverse of the situation in Cohort "A", and is also discussed below. Not least because of these earlier deaths, mortality from all causes was higher than expected in Quebec; there were excesses

Table 14.1

DATES OF BIRTH: COHORT "B" AND "MAIN MORTALITY COHORT"

	Cohort "B"	"Main mortality cohort"
Number of men	4,559	10,939
Percentage distribution by quinquennium of birth		
1891 through 1895	*7.2*	*13.8*
1896 through 1900	*9.3*	*17.7*
1901 through 1905	*10.2*	*18.0*
1906 through 1910	*15.7*	*16.7*
1911 through 1915	*25.6*	*16.0*
1916 through 1920	*32.0*	*17.7*
	100	*100*

from pneumoconiosis and related conditions (respiratory tuberculosis, "other" respiratory conditions and heart diseases) and from cancer of the chest and other sites for which asbestos has been implicated, particularly of oesophagus and stomach. Relations with dust exposure and smoking were found more-or-less as could have been forecast from the main studies.

14.3 Limitations of *a priori* argument

The main methods of analysis followed convention in that they used *a priori* reasoning, classifying the men into sub-cohorts according to the values of certain factors, and following each sub-cohort separately. Because of the many factors to be examined, each classification (with a few exceptions) had to be carried out without regard for any other, so that when factors were interrelated it became impossible to disentangle effects. This is a well-known disadvantage of the procedure, and there is no reliable means of overcoming it when cross-classification by two or more factors creates sub-cohorts so small that there are too few deaths within them to be reliable, particularly when any specific cause of death is under consideration. Methods of analysis such as GLIM (Nelder, 1975) attempt to deal with the problem by fitting models to the re-grouped sub-cohorts, and then seeking signs, in the full detail, of divergence from the model; however, this cannot be very revealing for the same reason, i.e. small unreliable cells in the multi-dimensional array.

The use of *a posteriori* methods - examining factors of interest among the cases, often in comparison against controls - can be more revealing and was adopted for the investigation of the more important

causes of death. Only where case-control studies have been carried out can we make statements on the sensitivity and specificity of the radiological system in predicting mortality.

One example of the problem of disentangling effects is afforded by the apparent differences between the two mining areas, Asbestos and Thetford Mines, in mortality from pneumoconiosis. There were 31 such deaths in Cohort "B", 22 of them from Thetford Mines, a disproportionally high number. However, this was undoubtedly the more dusty area and the need was to determine whether area or dust was the causal factor. When a control was chosen for each case, it was found that 18 of the controls were also from Thetford Mines; the number of cases from Thetford Mines with a control from Asbestos was eight, and the reverse occurred four times, so that, in the McNemar test based on the disparate case-control pairs, the test statistic was $\chi^2 = 1.02$, which with one degree of freedom has an associated P-value of about thirty per cent, i.e. without trace of significance. In other words, it would seem likely that the differences between pneumoconiosis cases and their controls were in the dust exposures (see the large differences in Table 11.5) and not in the areas where the men had worked.

14.4 Total mortality in relation to signs and symptoms

Review of the literature relating to non-exposed populations suggests that certain symptoms and lung function tests may predict mortality from respiratory conditions and also from heart diseases and all causes. There have been many studies of morbidity and mortality in patients with chronic bronchitis or emphysema (recent examples are by Cole *et al.*, 1974, and Petty *et al.*, 1976), but

what is relevant in the present context is mortality related to respiratory symptoms and signs in general populations. Higgins and Keller (1970) pointed out that little was known about the prognostic implications of what they called the "less severe but very common manifestations of chronic respiratory disease"; they then described a study of the adult population of the American town of Tecumseh. Here, 2,452 men over 16 years of age were examined in 1959-60, and 1,759 (or 72 per cent) were re-examined about four years later. The number known to have died in the interval was 113 and the deaths were classified according to:- symptoms at the earlier examination; diagnosis then of chronic bronchitis, emphysema or asthma; ventilatory capacity; and certain combinations. The method of mortality analysis, particularly in determining expected numbers of deaths, is not entirely clear. The sign or symptom with the highest SMR (2.5) was shortness of breath: it would appear that 63 deaths had been observed compared with 25 expected. The SMRs for cough and phlegm grade II and for chronic bronchitis were both 1.8, while men with $FEV_{1.0}$ below 2 litres had an SMR of 1.4. As *a priori* arguments had been used, without attempt to make the subcohorts mutually exclusive, the usual lack of independence of findings arose and has to be noted.

Kauffmann *et al.* (1975) examined the prognostic value of chronic cough, sputum and spirometry in a ten-year mortality study among 1,487 men working in factories near Paris. Mean indices of lung function, adjusted for age, were worse for those who died than for those who survived, but the differences were small and patterns were not consistent from one age group to another, the youngest, i.e. those aged 30 through 34 years, conforming least well. The "statistical signific-

ance" claimed for the differences lay largely in the numbers of subjects, and provided no grounds for prediction.

Ashley *et al.* (1975) related pulmonary function to ageing, cigarette habit and mortality, as part of the Framingham Study. In two medical examinations, approximately ten years apart, the numbers of men studied were 1,937 and 1,127. It is not clear whether all those examined on the later occasion were part of the cross-section from the former, but the proportion is at best 58 per cent. The only tabular material on mortality provided "standardized univariate logistic risk function coefficients for risk of death in ten years for FVC and $FEV_{1.0}$ per cent in an eighteen year follow-up" but no details are given of the methods. From a figure giving the "*smoothed* (my italics) probability of death in ten years by FVC at [the earlier] examination in those then aged 50-59" (without explanation of the reason for choosing this group) it might appear that there was a dose-response relationship.

This evidence on prognosis in general populations is suggestive but not particularly convincing.

In Cohort "A", where respiratory symptoms and signs had been assessed, dyspnoea and depressed FVC were associated with high Relative Risks of mortality from all causes, 1.49 and 1.53, respectively, but other symptoms and other function measurements had low predictive value. In the same cohort, total mortality was predicted especially well by cigarette smoking (RR = 1.88, with $\chi^2 = 10.18$), and also, but less well, by parenchymal changes on the x-ray (RRs of 1.56 for small

opacities and 1.81 for large opacities), by pleural changes (RRs of 1.80 for calcification and 1.81 for other pleural changes); the Relative Risks quoted in this sentence were higher than for the one respiratory symptom and the one lung function test that had fair predictive value. Accumulated dust exposure was associated with enhanced risk, but only to the extent of RR = 1.21.

In Cohort "B", all features of radiographic change predicted excess mortality from all causes (RRs of parenchymal changes: 1.98 for small opacities and 4.43 for large opacities; RRs of pleural changes: 1.87 for un-calcified and 1.62 for calcified; and RR = 2.21 for "additional symbols"); so did cigarette smoking (RR = 1.67) and comparatively severe dust exposure (RR = 1.51).

In all these "comparisons" of effects, it is important to bear in mind their lack of independence, and the different methods by which they have been assessed. However, it seems not unreasonable to infer that respiratory symptoms and lung function changes are not better predictors of excess mortality than radiographic changes, nor than cigarette smoking; asbestos dust exposure by itself does not appear a particularly good predictor of mortality.

14.5 Pneumoconiosis and related conditions

Pneumoconiosis is surely due to retention of dust in the lungs and so death from this cause should be associated with x-ray change. There are other conditions which may well be associated, directly or indirectly, with dust retention, and so should be detectable on the

radiograph, again either directly or indirectly, *viz:*- respiratory tuberculosis, "other" respiratory diseases and heart diseases.

Pneumoconiosis. The effect of asbestos dust exposure was obvious, but there was no effect of smoking. These findings were clear in the main mortality study, summarized by McDonald and Liddell (1978) and equally so in both cohorts of the present research; further they were confirmed by case-control methods in Cohort "B". Most of the radiographs of men who died from pneumoconiosis showed radiographic change, usually parenchymal, with or without pleural change. "Sensitivity" was found as 77 per cent, i.e. 24 men with changes in 31 deaths. "Specificity", assessed in the controls, was 71 per cent: 22 men without parenchymal change among 31 controls. The small opacities in the radiographs of men who died from pneumoconiosis were nearly always irregular; their profusion was comparatively high, all but four of the 37 readings, i.e. nearly nine-tenths, being of category 1/0 or greater. Large opacities were present only rarely and only when the background small opacities were of profusion at least 2/2.

In view of the causal association with dust exposure, some pneumoconiotic x-ray change was to be expected in every case of death from pneumoconiosis. However, there were seven men who died from this condition, all of whom had been exposed to at least 100 mpcf.y (four of them to more than 300 mpcf.y), in whom no radiographic change was noted. The explanation for this "failure" of the radiological system does not lie in a long interval between x-ray and death; the distribution of intervals was almost identical in those men whose films were

normal and others. However, one or perhaps two of the "failures" might conceivably have had time for a radiological attack as they did not die until 1975 and 1974, having been still at work in November 1966. Three of the seven "failures" had accumulated dust exposures by the time of x-ray of 987 mpcf.y, 1,036 mpcf.y and 2,798 mpcf.y. Although their deaths were attributed to pneumconiosis, it might be that the symptoms were non-specific but that known heavy exposure led to this cause being included at death registration. On the other hand, there may well have been some fibrosis of the lung generated by such large quantities of dust to which the men had been exposed, but the fibrosis was either not radio-opaque or had been missed in the radiographic assessment; three different readers were involved. Another factor that can be eliminated as an excuse for the "failures" is film quality: four of the seven films had been scored "+" and the other three "+/-".

Respiratory tuberculosis. Although this cause of death was common before 1965, much more so at Thetford Mines than at Asbestos, there were no deaths from this disease in Cohort "A" nor in Era 3 of Cohort "B". However, there were 40 deaths from tuberculosis in the earlier Eras of this latter cohort; Relative Risks were high for each type of radiographic change, particularly "large opacities" and "additional symbols". These shadows may have been of the tuberculosis itself, while the other recorded changes may have been indirect manifestations.

The generally accepted view has been that tuberculosis is not related to asbestos exposure, although it is well-known to interact with silica (see, for example, the review by Liddell, 1975c). Table 11.15 shows that men at Thetford Mines had a risk of death from respiratory

tuberculosis twice as high as that at Asbestos, while the Relative Risk associated with heavier dust exposure was rather less (1.64). This might suggest that for this disease, the causative factor lay in the socio-economic environment of Thetford Mines, rather than in the asbestos dose; that dust exposures were heavier there may well have been only coincidental.

"Other" respiratory diseases. Relative Risks of these conditions were very high for men in Cohort "B" with large opacities, un-calcified pleural changes and small opacities; they were also high for "additional symbols", and in men with heavier dust exposures. In Cohort "A", on the other hand, the factors with the highest Relative Risks were depressed MMF and FVC. It may be that the "mixes" of diseases included under this heading were rather different in the two cohorts, because of the different eras in which the deaths occurred, i.e. only after 1967 in Cohort "A", but as far back as 1951 in Cohort "B".

Heart disease. Because of the definition of Cohort "A" that men had been interviewed and tested at least six months and often over two years after the x-ray had been taken, sudden death closely following that event would exclude from this cohort, but not from Cohort "B". Thus, for this cause of death also, different patterns would not be surprising. In Cohort "A", the highest Relative Risk was for dyspnoea; all radiographic features were also associated with enhanced risk, as were dust exposure and cigarette smoking. The lung function measurements showed little association with mortality. In Cohort "B", the most significant Relative Risk was for cigarette smokers, but heavy accumulated dust exposure, small opacities, pleural changes and "add-

itional symbols" were all associated with excess mortality.

Holman (1976) states that: "Numerous epidemiological studies have indicated that cigarette smokers have increased mortality ratios for Coronary Heart Disease (CHD); that is, cigarette smokers show significantly increased death rates compared with non-smokers. The risk incurred by cigarette smoking increased with increasing dosage and, as measured by mortality ratios, is more marked for men in the younger age groups, under age 60, although the absolute increment in death rates experienced by smokers over that of non-smokers continues to increase with increasing age." Her most reliable sources appear to be Hammond and Horn (1958), Doll and Hill (1964), Best (1966), Kahn (1966), Hammond and Garfinkel (1969) and Weir and Dunn (1970). The studies varied in size, from 41 thousand British doctors to 359 thousand US males, in ages at entry, in length of follow-up (three-and-a-half years to ten years) and in categorization of smoking habits. This categorization is not always entirely clear in Holman's Table 3, but the highest category was never less than 20 cigarettes a day. The Relative Risks of death from CHD for those who smoked most, compared with non-smokers, were, for the six studies in the order given above:- 2.41; 1.43; 1.78; 2.00; 1.77; and 1.74. The basic finding that cigarette smokers have increased mortality ratios compared with non-smokers is fully supported by Relative Risks of 1.38 and 1.78, in our two cohorts (Table 11.17).

However, CHD accounts for by no means all the mortality ascribed to diseases of the heart; a substantial proportion of deaths of this nature are in fact secondary to lung disease, and there is likely to

be some mortality in an asbestos-exposed population that is coded on death certification as due to heart disease which has arisen as a consequence of the dust exposure. This is confirmed by the high Relative Risks in both cohorts for men with heavier dust exposure and for each radiographic feature, although the "additional symbols", so prominent in Cohort "B", may be to some extent at least a direct record of heart disease unrelated to dust exposure.

14.6 Neoplasia

Chest cancer is undoubtedly associated with smoking and dust exposure. The illness, once diagnosed, has short duration. Thus, if the interval between x-ray and death is short, the cancer itself might be detected; if the interval is longer, it is possible that there would be signs of dust retention.

Parenchymal changes were seen in about a third of the chest cancer cases in both cohorts, with pleural thickening and calcification in a further eighth; in Cohort "B", one-tenth more showed only "additional symbols". The parenchymal changes were quite different compared with those in pneumoconiosis deaths; there were rather more rounded opacities, profusion was rather lower and there were several cases of "large opacities", mainly poorly-defined, often on a low or even non-existent background of small opacities. In the 118 cases, some radiographic change was seen in 70 (sensitivity 59 per cent); among 118 controls, films were normal for 80 (specificity 68 per cent).

It must be counted a "failure" when the radiograph was assessed as normal despite substantial dust exposure, say greater than 300

mpcf.y. In 62 men who died from chest cancer after exposure to at least this amount of dust, only 36 showed any radiographic change and in only twenty of these cases was the finding of small opacities. Indeed, the proportion of cases whose films showed small opacities was independent of smoking habit and dust exposure (Table 11.12). However, there is insufficient evidence at this stage to answer the question whether cancer of the lung is a complication of asbestosis or an independent reaction to the retention of asbestos dust, i.e. unrelated except by chance to fibrotic reaction.

However, some of what have been called "failures" were due to long intervals between x-ray and death. When this interval was substantial, the proportion of "normals" was considerably higher than when the interval was short (see section 11.3). Nevertheless, there was another form of "failure" of the radiological system when death was not long after the x-ray: a considerable proportion of the radiographic changes that were recorded were of "large opacities", i.e. an apparent recognition of the malignancy itself, but classifying it as though it were pneumoconiotic.

Mesothelioma. Intervals between x-ray and death were either greater than five years (three deaths) or a year or less (the other three deaths). In the former situation, only indirect evidence could be found, because of the very short duration of the disease; the three films were recorded as (1) with pleural calcification (by all six readers for the one case in Cohort "A"); (2) with small opacities of type "p" and profusion 1/0; and (3) normal. In the shorter intervals, it would not have been impossible that the tumour itself was recog-

nized, but the readings were (4) pleural calcification associated with irregular diaphragm; (5) small opacities type "t" of minimal profusion, 0/1; and (6) an "additional symbol" - the only reading that might have been a correct diagnosis of the mesothelioma.

Cancer of oesophagus or stomach is thought to be dust-related but could not be seen directly on a radiograph of the chest; there were, however, pneumoconiotic signs in a substantial proportion of cases. With *other cancers of the gastro-intestinal tract*, the signs were less marked, being weak for cancer of colon or rectum and particularly so for other abdominal cancers.

There is little evidence that *laryngeal cancer* is related to chrysotile exposure, and there were no indications to that effect in this study. There were very few deaths from this cause and all the men had been smokers; there had been too few to provide any measure of statistical confidence in the association with smoking from this study alone, but the main mortality investigation gave clear evidence of a smoking effect.

With *other cancers*, there was little indication of association with radiographic change.

14.7 Other causes of death

There is little reason to believe that the remaining cause groups could be realistically related to asbestos exposure, and so the effects that were observed are surprising and difficult to rationalize. Deaths from strokes appeared to be predictable from depressed FVC, the pres-

ence of large opacities on the radiograph and heavy dust exposure; accidental death from small opacities and smoking. As to "other" causes, higher risks in both cohorts in relation to radiographic changes could only be elucidated by examination cause by specific cause, even although it had been thought that all *relevant* causes had been included in one or other of the groups already discussed.

14.8 Validation of the radiographic classification

This research has provided clear validation of the U/C classification for those diseases which are both asbestos-related and distinguishable on x-ray. There was similar validation for those conditions only indirectly detectable on the radiograph.

The importance of *small irregular opacities* and *pleural changes*, introduced into radiographic classifications for the first time in 1967, requires emphasis. The reason for including these features was that they were frequently seen in the x-ray films of asbestos workers although no need for a classification of them had arisen for those exposed to silica or coalmine dust. Nevertheless, three recent studies have to be mentioned.

Amandus *et al.* (1976) stated that Carilli *et al.* (1973) had demonstrated much more frequent occurrence of "small irregular opacities" in smoking than in non-smoking females. However, the radiographic classification in the earlier study was non-standard, having been devised with the aim of seeing whether two particular readers could identify which subjects were smokers and which not in terms of x-ray appearances. A little later, Theriault *et al.* (1974) claimed to have shown

an association between smoking and small irregular opacities in granite shed workers. Here, a routine chest x-ray film of each of 784 workers had been assessed into the U/C classification (Bohlig *et al.*, 1970); but, unfortunately, only one reader was involved. He found small opacities in 233 films (29.7 per cent), mostly rounded (166 films); the prevalence of irregular small opacities of profusion category 1 or more was 67 of 784 men, or 8.5 per cent. Interpretation of the findings is difficult, but the so-called direct relationships between smoking and both the profusion and type of small irregular opacities appear to be no more than a "confounding" with an effect of age. Finally, it is particularly hard to disentangle the results of Amandus *et al.* (1976), because of oddly selected samples, of smoking and non-smoking coal miners, chosen in terms of *earlier* radiographic assessments, once more by a single reader; in particular, subjects in whom profusion of 0/1 had been read were excluded. In both smokers and non-smokers, just 87 per cent of the selected films had been placed in category 0 of small opacities. Among the 4,479 smokers included in the study, irregular small opacities, with or without rounded opacities, had been seen in 287, or 6.4 per cent; in the 1,687 non-smokers, 59 had had irregular small opacities (3.5 per cent).

Whether any of these findings would have been repeated with other film readers remains a matter of speculation. The findings from the present research were much more positive, and it must be stressed that they are based on the radiological assessments of six readers who had helped to devise the classification they used. Nevertheless, they showed the usual degree of inter-observer variation, and there was some evidence of differences between them in their ability to predict

mortality (see, for example, Table 10.3).

Although only one reader made substantial use of the *0/- category of profusion* of small opacities, there was some suggestion that it indicated a truly exceptional normality associated with good prognosis. More attention should be paid to this category; it does not appear to be purely a reflection of youth, nor is it a mask for emphysema which has obscured lung markings.

Instructions on *averaging the profusion of small opacities*, particularly when those of both types co-exist, have not remained standard with the various classifications. The 1967 notes in the Appendix state that: "As in the case of rounded small opacities, the profusion of the irregular small opacities is based on an averaging over *the whole lung* and by comparison with the standard films", but ILO (1972, p. 9) has it that: "The category of profusion of both types of small opacities is determined by averaging the profusion in *the affected zones*", and appears to add confusion by continuing: "When there is marked difference in profusion in different zones of the lung, the *zones predominantly affected* are the ones over which averaging is made". Although almost immediately there is an exhortation to state the method of averaging in publications using the classification, such a statement seems never to have been made. It is now not possible to determine exactly how averaging was carried out in 1967 during the reading described by Rossiter *et al.* (1972) and used as the basis for the present research. Thus, whether the scoring system described in Table 8.1 was the best that could have been devised cannot be known.

However, it did allow some *grading of the numbers of small opacities*, rounded and irregular combined, in both cohorts. In Cohort "B", the SC scores were placed in three groups:- 0 ("absent"); 1 through 3 ("slight"); and 4 or greater ("positive"). Bearing in mind the method of obtaining SC, the "slight" group had no more than profusion 0/1 in half the lung zones. In Cohort "A", the sums of the 6 SC scores were also placed in three groups:- 0 ("absent"); 1 through 6 ("slight"); and 7 or greater ("positive"). Here, the "slight" group represents even lower profusion averaged over the six readers. The SMRs for all causes of death in the two cohorts were:-

Small opacities	Cohort "A"	Cohort "B"
"Absent"	.78	1.30
"Slight"	.96	2.08
"Positive"	1.32	2.48

Although not of "statistical significance" at a conventional level, the gradient in both cohorts is suggestive. It was maintained for several causes of death, indicating that even the very slight parenchymal changes ("normal" in the *Short* U/C or ILO U/C classifications) *may* have some clinical significance.

Further investigation is required of methods of scoring, as well as of averaging; advice is also needed on how to record *combined profusion* when both rounded and irregular forms exist together. The possibility mentioned by Liddell (1977, p. 94) for each lung zone to be treated separately for purposes of categorization would appear to deserve exploration. Although, when it was first proposed, it was thought unlikely to recommend itself to readers, several experts have since expressed interest in such a procedure. This would probably

require, first, scrutiny of the whole film to aid identification of the changes seen zone by zone; thereafter, it should be possible to record *for each zone as a unit* whether small opacities exist and, if so, of what type(s) (p, q, r; s, t, u) and profusion(s), with a final assessment of how much of each zone is affected *in toto*.

It is also desirable to reduce the "middling tendency" (Morgan *et al.*, 1974) and help might well be given by the use of *standard films on the border-lines* between categories, instead of films representing the mid-points of categories, as at present.

There are, no doubt, other ways of improving the present classification, but change should not be made for one purpose without considering the effects for other purposes. It now appears (Dr. Robert N. Jones, personal communication) that the meeting to be held in Washington in September 1978, to make recommendations to the ILO's meeting of experts in Caracas the following month, is to be concerned mainly with the classification for purposes of compensation. Such purposes are undoubtedly important, but differ for each compensation system, even within one country's administration, depending on the mineral to which the claimants have been exposed; they may differ greatly from one country to another. It was a great strength of the ILO U/C (1971) classification that it could be used for compensation, clinical and epidemiological purposes, with variation only of emphasis. A change of the classification to facilitate its use within compensation schemes that is not compatible with its use in other circumstances, with concern also for historical comparisons, would be a grave error.

14.9 Surveillance of the asbestos worker

Sensitivity and specificity of various tests which might be used for surveillance of workers are, as always, conflicting aims. Smoking, dust exposure, some function tests, respiratory symptoms, early radiographic changes can all be made sensitive, but in certain conditions it would appear that radiographic changes are the most specific in relation to the forecasting of mortality in asbestos-exposed populations. There follows an example of the way in which these measures of a test vary with the level at which a decision is taken: it deals with small irregular opacities in predicting death from pneumoconiosis. Using profusion of category 0/1 as the cut-off point yielded sensitivity 64.5 per cent and specificity 80.6 per cent, and there would have been 714 false positives among a total of 734, or 97.3 per cent. However, with 1/0 as cut-off, sensitivity was reduced to 58.1 per cent, while specificity increased considerably to 96.8 per cent, and the proportion of false positives was reduced to 95.4 per cent.

Little is yet known about progression of radiographic appearances while workers are still employed or after withdrawal from exposure, when consideration is concentrated on the problems of prognosis. Serial assessments are required on radiographs and of symptoms, particularly breathlessness, perhaps assessed by a simple standardized exercise test to replace the reliance on answers to a questionnaire. Study should also be made of how the reliability of predicting mortality is changed by variation in the length of the study interval.

Specific recommendations would be to extend the tracing of men in Cohort "A" for several more years, perhaps in the first place to the

end of 1978; by this time there will have been substantially more deaths and it should be possible to make more reliable statements on the relative importance of radiological and other signs and symptoms, particularly if there have been enough deaths to justify case-control studies, or other *a posteriori* methods. Further, there were 277 men in this cohort who were subjected in 1974 to a second set of measurements, including chest x-ray. Follow-up of these men for a rather longer period - to allow adequate mortality for investigation - might cast light on the problems.

Further possibilities arise in another group of men, those in the "radiographic progression cohort" described in section 4.9. Although they numbered only 283, and almost all were still alive at the end of 1975, in a few years there should have been sufficient mortality to justify detailed study. One advantage of this group is that x-ray films spanning an average of twenty years have already been assessed by a group of experienced readers into the ILO U/C (1971) classification by two methods, independent randomized reading and side-by-side reading, the latter with certain scales of abnormality elaborated four-fold beyond even the twelve points of the complete classification of profusion in the current international classification.

14.10 Other possible developments

The recent (U/C, 1968) classification of the pneumoconioses has been almost completely justified in its ability, when used by the six readers who formed the McGill University panel, to predict mortality from asbestos-related disease and even from other causes. That is not to say that sensitivity and specificity were perfect; they were far

from that ideal, but very much higher than in studies of the earlier (ILO, Geneva, 1958) classification in relation to the mortality of coal miners. Nor is it to be thought that the present, ILO U/C (1971), classification is itself ideal. However, the principal need is to build from this essentially valid system.

In the first place, the important questions concern generalizability: can other readers do as well, or better, than the six whose assessments were used in this research? can their reading be improved for use in the prediction of mortality, either generally or by bringing the less successful up to the levels of the more successful?

In our own cohorts, some of these questions could be answered as follows:-

1. In Cohort "A", two hundred or so men of those originally selected for clinical examination but who were not included because of death, illness, refusal, etc., should be incorporated.

2. The date on which each x-ray was taken should be ascertained, so that information could be gleaned on asbestos exposure to that point and afterwards, particularly for those men who continued employment after November 1966.

3. The study intervals should be divided into several periods, short to start with and then of increasing length, in order to learn more about the effects of length of follow-up on

prediction of mortality. If the follow-up is too short, not only will there be few deaths but there would be little evidence to assist in surveillance. When the period of follow-up is long, there will be many deaths, but only indirect effects are likely to be apparent on the x-ray.

4. Work histories should be reviewed, probably in case-control studies, to reduce the workload substantially; such studies could be extended to as many cause groups as might be considered of interest.

5. The radiographs of all men included in the case-control studies just mentioned should be re-examined by the same six readers, still working independently, and, more importantly, by other readers, to allow generalization. In this regard, it would be essential to follow the principles enumerated by the Workshop on the Chest Roentgenogram as an Epidemiologic Tool (Weill and Jones, 1975) by having at least three readers, working independently and "blind" to the provenance of the films, which should include some of unexposed workers; possibilities of repeat reading should also be examined.

6. Purposive study should be made of films which showed abnormality not "justifiable" by the provenance of the film. E.g. what are the appearances recorded as "large opacities" which arose in lung cancer, stroke, etc.? is there any way that stroke, for example, could possibly be predicted from

x-ray?

It might be argued that a radiological classification which has been so well validated in chrysotile miners and millers would not require further study where both radiographic and health effects are known to be much more dramatic. However, it would seem important to extend the questions, asking whether the system works as well in populations exposed to other fibres, either chrysotile in the manufacturing processes, or amphibole in production or manufacture, or in mixed situations.

Postscript

ORIGINALITY; IMPORTANCE; RESPONSIBILITIES; ACKNOWLEDGEMENTS

My interests in relationships between radiology and mortality arose while I was developing the NCB elaboration of the profusion of small opacities and studying the morbidity and mortality of coal miners - remaining disappointed that the prediction of mortality from x-ray findings among the miners of the Rhondda Fach had been so poor. In mid-1976, when Professor McDonald's team reviewed gaps in epidemiological knowledge, the research described in this thesis became feasible: the question that had intrigued me for so long had also been posed by Dr. George Wright, chairman of the Scientific Committee of the Institute of Occupational and Environmental Health; appropriate information could be obtained from the population already under study in Quebec; and I could take day-to-day responsibility for the project.

There was never any doubt about the importance of the project, but the recent confirmation from the 1977 Johannesburg Asbestos Symposium was particularly encouraging. The research has substantially validated the current international radiological classification, but generalization is still required. Some light has been cast on the use of the chest x-ray in the surveillance of the asbestos worker, but here too further research is needed.

The "buff card" register of employees was initiated by Mr. Charles Rossiter, of the MRC Pneumoconiosis Unit, during secondment to McGill University, and he and Dr. Graham Gibbs devised means for calculating the various indices of exposure. The tracing of subjects and, almost as difficult, the ascertainment of causes of death were carried out under the supervision of Professor Alison McDonald; credit for the very few losses and the excellent standard of linkage is due first to her, and also to her two devoted colleagues, Mesdames

Beauchemin and Proulx, in the Eastern Townships. Most of the tracing to the end of 1975 had been completed by the time the present research was under way, but some was still in hand, while men not in the "main mortality cohort" had to be traced and causes of death found; these tasks were completed by the same team, to whom I am extremely grateful.

Although the radiological studies reported by Mr. Rossiter and his colleagues had been largely completed before I started work at McGill University, the 42 thousand readings had been the first major use of the NCB elaboration outside the National Coal Board itself. Mr. Rossiter's contributions, not only of the statistical nature reflected in his publications, but also, and perhaps more important in the present context, of data processing, were quite invaluable. I also gained greatly from discussions with all six film readers, particularly during the project reported by Dr. Gail Eyssen; especial thanks are due to Dr. John C. Gilson, CBE, FRCP, formerly Director of the MRC Pneumoconiosis Unit, who has been a source of great stimulation over many years.

Because so many changes had become necessary for the main mortality investigation, it was decided in 1975 to devise a new system of data processing, rather than attempt to up-date files and programs that had already been extensively patched. The many necessary programs for this new, more flexible, system were written to my specifications by Mr. Mario Rodrigues, who also applied them conscientiously to the several vast bodies of data, requiring many iterations before we could consider the data files to be truly "clean". It is a pleasure to record the gratitude of the entire team to Mr. Rodrigues for this work, which led to a particularly meritorious M.Sc. At all stages, the problems of record linkage have been great; my intimate knowledge of the procedures and practices adopted in the main mortality enquiry made it possible to apply the same standards in the present research.

My concern with methods of cohort analysis has been intensive since shortly before the meeting of statisticians at McGill University

in June 1974, through the presentation to the Royal Statistical Society in June 1977, to the present. My thanks are due to many statistical colleagues who have helped, a few "formally" in 1974, but most quite informally over the years. They include: Professor Peter Armitage; Mr. Geoffrey Berry; Professor David Cox; Dr. Gerald Draper; Professor Phil Enterline; Dr. Gail Eyssen; Professor Michael Healy; Dr. David Hill; Dr. Larry Muenz; Dr. David Oakes; Dr. Peter Oldham; Mr. Charles Rossiter; Dr. Peter Smith; Mrs. Joyce Snell; Dr. "Babs" Solari; and Dr. Duncan Thomas.

Without access to the current findings of the main mortality investigations, this thesis would have been much less satisfactory. I supervised Mr. Rodrigues, in 1976-77, in the analysis of deaths to the end of 1973, and thereafter in the up-date and re-analysis to end-1975. However, in interpretation, my contribution has been essentially co-operative. In particular, the recent review paper (McDonald and Liddell, 1978) was prepared principally to show how results had been essentially unchanged since the outset, and frequent reference to it should not be construed as suggesting that I had any role other than that indicated here. However, this paper has provided many useful up-to-date results and has already been presented, so that it should appear in print before "McDonald *et al.* (1979)", which is still in preparation. Nevertheless, it is important to emphasize that the results of our main mortality enquiries are the fruits of team effort.

I wish to thank all members of the research team at McGill University, i.e. Professor Margaret Becklake; Dr. Gail Eyssen; Dr. Graham Gibbs; Professors Alison and Corbett McDonald; and Dr. Duncan Thomas, for permission to use data and for willingly-given advice. Data processing and other computing, all to my specifications, were entrusted to Mr. Rodrigues, and I owe him an enormous debt of gratitude which I am very pleased to acknowledge; I also thank Ms. Marielle Olivier who assisted from time to time. Thanks are also due to the Institute of Occupational and Environmental Health for their financial support to Professor McDonald for this research.

Two others deserve especial mention. The first is Mrs. Ann Yaxley, who has assisted cheerfully, often well "beyond the call of duty". It would be impossible to describe all the ways in which she has helped, and I am enormously grateful to her.

Finally, Professor Corbett McDonald, friend and colleague for many years, has been an inspiring supervisor. He has criticized constructively from his encyclopaedic knowledge of the subject, yet without interfering, and has shown me how to extend my reading much more widely than would otherwise have been possible. He is the Principal Investigator of "the only really grand study" of which my project has formed but a part, and it was only with his permission and under his aegis that I was able to use the data and conduct this research. The gratitiude I owe him is clearly unrepayable.

In conclusion, I must take full responsibility for any errors in this thesis (in particular for those concerning taped information on certain symptoms), and for all opinions expressed.

B I B L I O G R A P H Y

AMANDUS, H E, LAPP, N L, JACOBSON, G and REGER, R B (1976)
Significance of irregular small opacities in radiographs of coalminers in the USA
Brit. J. industr. Med. 33: 13

ARMITAGE, P (1971)
Statistical methods in medical research
Oxford and Edinburgh: Blackwell

ARMITAGE, P (1977)
In discussion of Liddell, McDonald and Thomas (1977), p. 488

ASBESTOS (1970)
The asbestos factbook
Willow Grove, Pennsylvania: *Asbestos* magazine

ASBESTOS TEXTILE INSTITUTE, AIR HYGIENE AND MANUFACTURING COMMITTEE (1963)
Asbestos Textile Institute method for determining asbestos dust concentration approved by the Asbestos Textile Institute
Pompton Lakes, NJ: Asbestos Textile Institute

ASHLEY, F, KANNEL, W B, SORLIE, P D and MASSON, R (1975)
Pulmonary function: relation to aging, cigarette habit and mortality
Ann. internal Med. 82: 739

AYER, H E, LYNCH, J R, and FANNEY, J H (1965)
A comparison of impinger and membrane filter techniques for evaluating air samples in asbestos plants
Ann. New York Acad. Sci. 132: 274

BARIS, Y I, ARTVINLI, M and ALTAY SAHIN, A (1978)
Environmental mesothelioma in Turkey
Ann. New York Acad. Sci. (in press)

BECKLAKE, M R (1976)
Asbestos-related diseases of the lung and other organs: their epidemiology and implications for clinical practice
Amer. Rev. Resp. Disease 114: 187

BECKLAKE, M R, FOURNIER-MASSEY, G, McDONALD, J C, SIEMIATYCKI, J and ROSSITER, C E (1970)
Lung function in relation to chest radiographic changes in Quebec asbestos workers
Bull. Physio-path. Resp. 6: 637

BECKLAKE, M R, FOURNIER-MASSEY, G, ROSSITER, C E and McDONALD, J C (1972)
Lung function in chrysotile asbestos mine and mill workers in Quebec
Arch. environ. Health 24: 401

BECKLAKE, M R, LIDDELL, F D K, MANFREDA, J and McDONALD, J C (1978)
Radiological changes after withdrawal from asbestos exposure
Brit. J. indust. Med. (in press)

BERRY, G (1970)
Parametric analysis of disease incidences in multiway tables
Biometrics 26: 572

BERRY, G (1977a)
In discussion of Liddell, McDonald and Thomas (1977), p. 485

BERRY, G (1977b)
Is there a dose-effect relation for cancers related to occupational exposure to asbestos fibres? Is a zero-effect threshold value meaningful?
Chambre Syndicale de l'Amiante et le Syndicat de l'Amiante-Ciment: 43

BEST, E W R (1966)
A Canadian study of smoking and health
Ottawa: Department of National Health and Welfare

BILLIEWICZ, W Z, KEMSLEY, W F F and THOMSON, A M (1962)
Indices of adiposity
Brit. J. prev. soc. Med. 16: 183

BOGOVSKI, P, GILSON, J C, TIMBRELL, V and WAGNER, J C (Eds) (1973)
Biological Effects of Asbestos
Lyon: IARC

BOHLIG, H (1965)
Radiological classification of pulmonary asbestosis
Ann. New York Acad. Sci. 132: 338

BOHLIG, H, BRISTOL, L J, CARTIER, P H, FELSON, B, GILSON, J C, GRAINGER, T R, JACOBSON, G, KIVILUOTO, R, LAINHART, W S, McDONALD, J C, PENDERGRASS, E P, ROSSITER, C E, SELIKOFF, I J, SLUIS-CREMER, G K and WRIGHT, G W (1970)
UICC/Cincinnati classification of the radiographic appearances of pneumoconioses
Chest 58: 57

BONSER, G M, FAULDS, J S and STEWART, M J (1955)
Occupational cancer of the urinary bladder in dyestuffs operatives and of the lungs in asbestos textile workers and iron-ore miners
Amer. J. clin. Path. 25: 126

BRAUN, D C and TRUAN, T D (1958)
An epidemioligical study of lung cancer in asbestos miners
A.M.A. Arch. industr. Health 17: 634

CARILLI, A D, KOTZEN, L M and FISCHER, M L (1973)
The chest roentgenogram in smoking females
Amer. Rev. of Resp. Disease 107: 133

CASE, R A M and LEA, A J (1955)
Mustard gas poisoning, chronic bronchitis and lung cancer
Brit. J. prev. soc. Med. 9: 62

CLIFTON, R A (1974)
Asbestos In: *1974 Bureau of Mines Minerals Yearbook*
Washington: US Government Printing Office

COCHRAN, W G (1954)
Some methods for strengthening the common χ^2 tests
Biometrics 10: 417

COCHRAN, W G (1965)
The planning of observational studies of human populations, with discussion
J. Roy. Statist. Soc. A 128: 234

COCHRANE, A L (1973)
Relation between radiographic categories of coalworkers' pneumoconiosis and expectation of life
Brit. Med. J. 2: 532

COCHRANE, A L, CARPENTER, R G, MOORE, F and THOMAS, J (1964)
The mortality of miners and ex-miners in the Rhondda Fach
Brit. J. industr. Med. 21: 38

COCHRANE, A L, DAVIES, I and FLETCHER, C M (1951)
"Entente radiologique": a step towards international agreement on the classification of radiographs in pneumoconiosis
Brit. J. industr. Med. 8: 244

COLE, T J, GILSON, J C and OLSEN, H C (1974)
Bronchitis, smoking and obesity in an English and a Danish town
Bull. Physio-path. Resp. 10: 657

COOKE, W E (1924)
Brit. Med. J. 2: 147

COX, D R (1972)
Regression models and life tables
J. Roy. Statist. Soc. B 34: 187

DAGBERT, M (1976)
Etude de corrélation des mesures d'empoussièrage dans l'industrie de l'amiante
Document 5. Quebec: Comité d'étude sur la salubrité dans l'industrie de l'amiante (Président: René Beaudry, j.c.p.)

DIEM, K (Ed) (1962)
Documenta Geigy: Scientific Tables, 6th ed.
Montreal: Geigy Pharmaceuticals

DOLL, R S (1955)
Mortality from lung cancer in asbestos workers
Brit. J. industr. Med. 12: 81

DOLL, R (1964)
Retrospective and prospective studies in WITTS, L J (Ed) (1964)
Medical surveys and clinical trials, 2nd ed.
London: Oxford University Press

DOLL, R and HILL, A B (1964)
Mortality in relation to smoking: 10 years observations of British doctors (Part 1)
Brit. Med. J. 1: 1399

DREESSEN, W C, DALLAVALLE, J M, EDWARDS, T I, MILLER J W, SAYERS, R R, EASOM, H F and TRICE, M F (1938)
A study of asbestosis in the asbestos textile industry
Public Health Bull. 241 Washington: US Public Health Service

ECK, M and HANAUT, A (1944)
Arch. Mal. Prof. 6: 74 cited by Van Mechelen and McLaughlin (1962)

ELMES, P C and SIMPSON, M J C (1971)
Insulation workers in Belfast 3. Mortality 1940-66
Brit. J. industr. Med. 28: 226

ELMES, P C and SIMPSON, M J C (1977)
Insulation workers in Belfast: a further study of mortality due to asbestos exposure (1940-75)
Brit. J. industr. Med. 34: 174

ELWOOD, P C and COCHRANE, A L (1964)
A follow-up study of workers from an asbestos factory
Brit. J. industr. Med. 21: 304

ENTERLINE, P E (1976)
Pitfalls in epidemiological research: an examination of the asbestos literature
J. occup. Med. 18: 150

ENTERLINE, P E (1978)
Epidemioligical methods for the establishment of dose-response relationships in asbestos-dust-related diseases
In: Glen (1978), pp. 39-41

ENTERLINE, P E, DECOUFLE, P and HENDERSON, V (1972a)
An epidemiological study of respiratory cancer among retired asbestos workers to establish standards for occupational exposures
Presented at the Annual Meeting of the American Academy of Occupational Medicine, 9 February, 1972

ENTERLINE, P E, DECOUFLE, P and HENDERSON, V (1972b)
Mortality in relation to occupational exposure in the asbestos industry
J. occup. Med. 14: 897

ENTERLINE, P E, DECOUFLE, P and HENDERSON, V (1973)
Respiratory cancer in relation to occupational exposures among retired asbestos workers
Brit. J. industr. Med. 30: 162

ENTERLINE, P E and HENDERSON V (1973)
Type of asbestos and respiratory cancer in the asbestos industry
Arch. environ. Health 27: 312

EYSSEN, G E (1975)
Methods of assessing radiographic progression in the pneumoconioses
Ph.D. thesis, McGill University

EYSSEN, G E and LIDDELL, F D K (1974)
Lung cancer mortality in asbestos workers: an approach through multiple controls
In McDonald *et al.* (1974)

FAY, J W J and ASHFORD, J R (1964)
Environmental exposure of British coal miners
Arch. environ. Health 9: 144

FAY, J W J and RAE, S (1959)
The Pneumoconiosis Field Research of the National Coal Board
Ann. occup. Hygiene 1: 149

FLETCHER, C M, MANN, K J, DAVIES, I, COCHRANE, A L, GILSON, J C and HUGH-JONES, P (1949)
J. Fac. Radiol. Lond. 1: 40

FOX, A J (1977)
In discussion of Liddell, McDonald and Thomas (1977), pp.487-488

FOX, A J and COLLIER, P F (1977)
Low mortality rates in industrial cohort studies due to selection for work and survival in the industry
Brit. J. prev. soc. Med. 30: 225

FRIEDRICHSEN, G W S (1963)
in *The Concise Oxford Dictionary, 5th ed.*, 1964, reprinted 1974
London: Oxford University Press

GAFAFER, W M (Ed) (1964)
Occupational Diseases: a guide to their recognition
Washington: Public Health Service, US Department of Health, Education and Welfare

GARDNER, L V, MIDDELTON, E L and ORENSTEIN, A J (1930)
Report of the International Conference on Silicosis, Johannesburg, 1930
ILO: Geneva, p. 88

GAZE, R (1965)
The physical and molecular structure of asbestos
Ann. New York Acad. Sci. 132: 23

GHEZZI, I, ARESINI, G and VIGLIANI, E C (1972)
The risk of asbestosis in a chrysotile asbestos mine
Medna Lav. 63: 189

GIBBS, G W and DuTOIT, R S T (1978)
Environmental considerations in surveillance of asbestos miners and millers
Ann. New York Acad. Sci. (in press)

GIBBS, G W and LACHANCE, M (1972)
Dust exposure in the chrysotile asbestos mines and mills of Quebec
Arch. environ. Health 24: 189

GIBBS, G W and LACHANCE, M (1974)
Dust-fiber relationships in the Quebec chrysotile industry
Arch. environ. Health 28: 69

GILSON, J C (1965)
Man and asbestos
Ann. New York Acad. Sci. 132: 9

GILSON, J C (1973)
Progress in epidemiology
In Bogovski *et al.* (1973), p. 5

GLEN, H W (Ed) (1978)
Proceedings of Asbestos Symposium, Johannesburg, South Africa, 3rd - 7th October, 1977
Randburg: National Institute for Metallurgy

GROSS, P (1974)
Is short-fibered asbestos dust a biological hazard?
Arch. environ. Health 29: 115

HAMMOND, C E and GARFINKEL, L (1969)
Coronary heart disease, stroke and aortic aneurysm: factors in the etiology
Arch. environ. Health 19: 167

HAMMOND, E C and HORN, D (1958)
Smoking and death rates: report on forty-four months of following up 187,783 men
J. Amer. Med. Assoc. 166: 1159-1172; 1294-1308

HARRIES, P G (1971)
The effects and control of diseases associated with exposure to asbestos in Devonport dockyard
Report CRWP 1/71. Gosport: Institute of Naval Medicine

HENDRY, N W (1965)
The geology, occurrences and major uses of asbestos
Ann. New York Acad. Sci. 132: 12

HIGGINS, M W and KELLER, J B (1970)
Predictors of mortality in the adult population of Tecumseh
Arch. environ. Health 21: 418

HILL, I D (1972)
Computing man years at risk
Brit. J. prev. soc. Med. 26: 132

HOLMAN, P B (Ed) (1976)
The health consequences of smoking
Atlanta: Centre for Disease Control, US Department of Health, Education and Welfare

HOWARD, S, KINLEN, L J, LEWINSOHN, H C, PETO, J and DOLL, R (1975)
A mortality study among workers in an English asbestos factory
Presented at the XVIII International Congress on International Health, Brighton, 16 September 1975.

HUGHES, J, WAGGENSPACK, C and WEILL, H (1978)
Mortality study of workers engaged in manufacture of asbestos-cement products (abstract)
Amer. Rev. Resp. Disease 117: Number 4, Part 2, p. 242

HUNTER, D (1975)
The Diseases of Occupations, 5th Ed.
London: English Universities Press

ILO (1953)
Third international conference of experts on pneumoconiosis (Sydney, 1950)
Geneva: ILO

ILO (1959)
Meeting of experts on the international classification of radiographs of the pneumoconioses
Occup. Safety and Health 9: no. 2

ILO (1970)
International classification of the radiographs of pneumoconioses (revised 1968)
Occup. Safety and Health Series no. 22 Geneva: ILO

ILO (1972)
ILO U/C international classification of radiographs of the pneumoconioses, 1971
Occup. Safety and Health Series no. 22 (revised) Geneva: ILO

INTERNATIONAL LABOUR OFFICE *see* ILO

IRVINE, - (1934)
Cited by Van Mechelen and McLaughlin (1962), pp. 238-239

IRWIG, L (1978)
A study of variations in the radiological assessment of pneumoconiosis
In: Glen (1978), pp. 139-143

JACOBSEN, M (1976)
Dust exposure, lung diseases and coalminers' mortality
Ph.D. thesis, University of Edinburgh

JACOBSON, G and GILSON, J C (1972)
Present status of the UICC/Cincinnati classification of radiographic appearances of the pneumoconioses: report of meeting held at Pneumoconiosis Research Unit, Cardiff, Wales, April 13-15, 1971
Ann. New York Acad. Sci. 200: 552

JACOBSON, G and LAINHART, W S (Eds) (1972)
ILO U/C 1971 international classification of radiographs of the pneumoconioses
Med. Radiogr. Photogr. 48: 67

JONES, J S P, POOLEY, F D and SMITH, P G (1976)
Factory populations exposed to crocidolite asbestos - a continuing survey
IARC Scientific Publications no. 13, INSERM, 1976 52: 117

KAHN, H A (1966)
The Dorn Study of smoking and mortality among US veterans: report on 8½ years of observation
In: HAENSZEL, W (Ed) (1966) *Epidemiological Approaches to the Study of Cancer and Other Chronic Diseases* National Cancer Institute Monograph 19: 1-125 Bethesda: US Public Health Service

KAUFFMANN, F, BRILLE, D and LELLOUCH, J (1975)
Evaluation de la valeur pronostique de la toux, de l'expectoration chroniques et de valeurs spirographiques par l'étude de la mortalité chez 1,487 hommes au travail en 1960-1961.
Bull. Physio-path. Resp. 11: 45

KEAL, E E (1960)
Asbestosis and abdominal neoplasms
Lancet 2: 1211

KEATINGE, G F (1973)
Review of Ghezzi *et al.* (1972)
Abstracts on Hygiene (1973) no. 1371

KLEINFELD, M, MESSITE, J and KOOYMAN, O (1967)
Mortality experience in a group of asbestos workers
Arch. environ. Health 15: 177

KLEINFELD, M, MESSITE, J, KOOYMAN, O and ZAKI, M H (1967)
Mortality among talc miners and millers in New York State
Arch. environ. Health 14: 663

KNOX, J F, DOLL, R S and HILL, I D (1965)
Cohort analysis of changes in incidence of bronchial carcinoma in a textile asbestos factory
Ann. New York Acad. Sci. 132: 526

KNOX, J F, HOLMES, S, DOLL, R and HILL, I D (1968)
Mortality from lung cancer and other causes among workers in an asbestos textile factory
Brit. J. industr. Med. 25: 293

KOGAN, F M, GUSEL'NIKOVA, N A and GULEVSKAYA, M R (1972)
The cancer mortality rate among workers in the asbestos industry of the Urals
Gig. Sanit. 37: 29

KOGAN, F M, TROITSKY, S K and GULEVSKAYA, M R (1966)
On the carcinogenic effect of asbestos dust
Gigiena Truda i Professional'nye Zabolevaniya 8: 28

LANCET (1977)
Asbestos (Editorial)
Lancet, 10 December 1977, p. 1211

LEE, P D (1966)
Periodic X-ray Scheme: computer processing
Cannock: National Coal Board Computing Services

LEWINSOHN, H C (1977)
Asbestosis - a diagnostic dilemma
J. occup. Med. 19: 607

LEXIS, W (1875)
Einleiting in die Theorie der Bevölkerungs Statistik
Strasbourg: Trulner *Cited in:* WILSON, A and REES, P (1976)
Spatial demography: some comments *Statistician* 25: 59

LIDDELL, F D K (1960)
The measurement of occupational mortality
Brit. J. industr. Med. 17: 228

LIDDELL, F D K (1961)
The effect of film quality on reading radiographs
Brit. J. industr. Med. 18: 165

LIDDELL, F D K (1963)
An experiment in film reading
Brit. J. industr. Med. 20: 300

LIDDELL, F D K (1972)
Validation of classifications of pneumoconiosis
Ann. New York Acad. Sci. 200: 527

LIDDELL, F D K (1974)
Methods of analysing mortality in relation to occupational exposure
Report of a symposium, 10-11 June, 1974 at McGill University (privately circulated)

LIDDELL, F D K (1975a)
The Ontario chest x-ray classification
Report to the Royal Commission on the Health and Safety of Workers in Mines (Ontario) (privately circulated)

LIDDELL, F D K (1975b)
Occupational mortality in relation to exposure
Arch. environ. Health 30: 266

LIDDELL, F D K (1975c)
Health and safety in mines
Report to the Royal Commission on the Health and Safety of Workers in Mines (Ontario) (privately circulated)

LIDDELL, F D K (1977)
Radiological assessment of small pneumoconiotic opacities
Brit. J. industr. Med. 34: 85

LIDDELL, F D K, EYSSEN, G E, THOMAS, D C and McDONALD, J C (1977)
Radiological changes over 20 years in relation to chrysotile exposure in Quebec
In: WALTON, W H (Ed) (1977), *Inhaled Particles IV*, Pergamon Press: Oxford and New York, pp. 799-812

LIDDELL, F D K and FINCH, D J (1958)
Syllables of recorded time
Incorp. Statistician 8: no. 3

LIDDELL, F D K and LINDARS, D C (1969)
An elaboration of the ILO classification of simple pneumoconiosis
Brit. J. industr. Med. 26: 89

LIDDELL, F D K, McDONALD, J C and THOMAS, D C (1977)
Methods of cohort analysis: appraisal by application to asbestos mining
J. Roy. Statist. Soc. A 140: 469

LIDDELL, F D K and MAY, J D (1966)
Assessing the radiological progression of simple pneumoconiosis
Med. Res. Mem. 4 London: National Coal Board

LINCOLN, B (1972)
Mining and milling (of asbestos)
Review 1972/2 Basle: Ciba-Geigy, pp. 9-13

McDONALD, A D and McDONALD, J C (1978)
Mesothelioma after crocidolite exposure during gas mask manufacture
Environ. Res. (in press)

McDONALD, J C (1973)
Cancer in chrysotile mines and mills
In: Bogovski *et al.*(1973), pp. 189-194.

McDONALD, J C (1975)
Health risks in asbestos production
Presented at the International Conference on Lung Diseases, Montreal, May 18th, 1975.

McDONALD, J C, BECKLAKE, M R, FOURNIER-MASSEY, G and ROSSITER, C E (1972)
Respiratory symptoms in chrysotile asbestos mine and mill workers of Quebec
Arch. environ. Health 24: 358

McDONALD, J C, BECKLAKE, M R, GIBBS, G W, McDONALD, A D and ROSSITER, C E (1974)
The health of chrysotile asbestos mine and mill workers of Quebec
Arch. environ. Health 28: 61

McDONALD, J C, GIBBS, G W, MANFREDA, J and WHITE, F M M (1972)
Storage as a factor in disease due to mineral dusts
In: LEE, D H K and KOTIN, P (Eds) (1972) *Multiple factors in the causation of environmentally induced disease* New York and London: Academic Press, pp. 186-201

McDONALD, J C and LIDDELL, F D K (1978)
Mortality in Canadian miners and millers exposed to chrysotile
Ann. New York Acad. Sci. (in press)

McDONALD, J C, LIDDELL, F D K, GIBBS, G W, EYSSEN, G E and McDONALD, A D (1979)
Dust exposure and mortality in chrysotile mining, 1910-75
Brit. J. industr. Med. (in preparation)

McDONALD, J C and McDONALD, A D (1977)
Epidemiology of mesothelioma from estimated incidence
Preventive Med. 6: 426

McDONALD, J C, McDONALD, A D, GIBBS, G W, SIEMIATYCKI, J and ROSSITER, C E (1971)
Mortality in the chrysotile asbestos mines and mills of Quebec
Arch. environ. Health 22: 677

McDONALD, J C, ROSSITER, C E, EYSSEN, G and McDONALD, A D (1973)
Mortality in the chrysotile producing industry of Quebec: a progress report
In: Proceedings of the IVth International Pneumoconiosis Conference, Bucharest, 1971 Bucharest: Apimondia, pp. 234-237

McKINLAY, S M (1975)
The effect of bias on estimators of relative risk for pair-matched and stratified samples
J. Amer. Statist. Assoc. 70: 859

McKINLAY, S M (1977)
Pair-matching - a repraisal of a popular technique
Biometrics 33: 725

McMAHON, B, PUGH, T F and IPSEN, J (1960)
The strategy of epidemiology
Chapter 4 in *Epidemiologic Methods*, pp. 32-50 Boston: Little, Brown

McNEMAR, Q (1947)
Note on the sampling error of the differences between correlated proportions or percentages
Psychometrika 12: 153

McVITTIE, J C (1965)
Asbestosis in Great Britain
Ann. New York Acad. Sci. 132: 128

MANCUSO, T F and COULTER, E J (1963)
Methodology in industrial health studies: the cohort approach, with special reference to an asbestos company
Arch. environ. Health 6: 210

MANCUSO, T F and EL ATTAR, A (1967)
Mortality pattern in a cohort of asbestos workers
J. occup. Med. 9: 147

MARTISCHNIG, K M, NEWELL, D J, BARNSLEY, W C, COWAN, W K, FEINMANN, E L and OLIVER, E (1977)
Unsuspected exposure to asbestos and bronchogenic carcinoma
Brit. Med. J. 1: 746

MEAD, E D (1966)
Periodic X-ray Scheme:documentation for "frozen" 1401 system
London: National Coal Board Medical Statistics Branch

MEDICAL RESEARCH COUNCIL *see* MRC

MEREWETHER, E R A and PRICE, C W (1930)
Report on effects of asbestos dust in the lungs and dust suppression in the asbestos industry
London: HMSO

MESSEL, M J (1978)
The Quebec asbestos mining industry at the crossroads
Quebec: QAMA

MEURMAN, L O, KIVILUOTO, R and HAKAMA, M (1974)
Mortality and morbidity among the working population of anthophyllite asbestos miners in Finland
Brit. J. industr. Med. 31: 105

MIEKLEJOHN, A (1960)
The origin of the term pneumonokoniosis
Brit. J. industr. Med. 17: 155

MIETTINEN, O S (1969)
Individual matching with multiple controls in the case of all-or-none response
Biometrics 25: 339

MIETTINEN, O S (1970)
Matching and design efficiency in retrospective studies
J. Epidemiology 91: 111

MILLER, R G (1966)
Simultaneous statistical inference
New York: McGraw-Hill

MORGAN, W K C (1975)
The deposition and clearance of dust from the lungs
In: Morgan and Seaton (1975), pp. 20-28

MORGAN, W K C, PETERSEN, M R and REGER, R D (1974)
The "middling" tendency
Arch. environ. Health 29: 334

MORGAN, W K C and SEATON, A (Eds) (1975)
Occupational lung diseases
Philadelphia, London and Toronto: Saunders

MRC COMMITTEE ON RESEARCH INTO CHRONIC BRONCHITIS (1966)
Instructions for the use of the questionnaire on respiratory symptoms (1966)
Dawlish: MRC

MUIR, D F C (1972)
Clinical aspects of inhaled particles, I
London: Heinemann

MURRAY, H M (1907)
Report of the Departmental Committee on Compensation for Industrial Diseases: Minutes of Evidence, Appendices and Index
London: HMSO, p. 127

NELDER, J A (1975)
GLIM (Generalized Linear Interactive Modelling Program)
Appl. Statist. 24: 259

NEWHOUSE, M L (1973a)
Asbestos in the work place and the community
Ann. occup. Hygiene 16: 97

NEWHOUSE, M L (1973b)
Cancer among workers in the asbestos textile industry
In: Bogovski *et al.* (1973), pp. 203-208

NICHOLSON, W (1976)
Evidence presented 27 February 1976, to the Comité d'étude sur la salubrité dans l'industrie de l'amiante (Québec), Président: René Beaudry, j.c.p.

NICHOLSON, W J, LILIS, R and SELIKOFF, I J (1978)
Long-term mortality experience of chrysotile miners and millers in Thetford Mines, Quebec
Ann. New York Acad. Sci. (in press)

NIE, N H, BENT D H and HULL, C H (1970)
Statistical package for the social sciences
New York: McGraw-Hill

NURMINEN, M (1972)
A study of the mortality of workers in an anthophyllite factory in Finland
Work-Environ.-Health 9: 112

PETO, J (1978)
The hygiene standard for chrysotile asbestos
Lancet 1: 484

PETO, J, DOLL, R, HOWARD, S V, KINLEN, L J and LEWINSOHN, H C (1977)
A mortality study among workers in an English asbestos factory
Brit. J. industr. Med. 34: 169

PETTY, T L, PIERSON, D J, DICK, N P, HUDSON, L D and WALKER, S H (1976)
Follow-up evaluation of a prevalence study for chronic bronchitis and chronic airway obstruction
Amer. Rev. Resp. Dis. 114: 881

PIRIE, W R and HAMDAN, M A (1972)
Some revised continuity corrections for discrete distributions
Biometrics 28: 693

POOLEY, F D (1978)
In discussion of Baris *et al.* (1978)

QAMA (1972)
Geological guide to the asbestos-mining region of south-eastern Quebec
Quebec: QAMA

QAMA (1978a)
Annual production (shipments) 1880-1967. Quebec asbestos shipments, and Canadian shipments, 1968 through 1977. Canadian asbestos shipments, by province, 1977
Mimeographed tables privately circulated

QAMA (1978b)
The production of asbestos in 1977
Bulletin 2: no. 2 (February 1978), p. 7

QUEBEC ASBESTOS MINING ASSOCIATION *see* QAMA

RODRIGUES, M J (1976)
Data processing for the mortality study in the chrysotile asbestos mines and mills of Quebec
M.Sc. dissertation, McGill University

ROGAN, J M (1964)
Medical Service and Medical Research: Annual Report 1963
London: National Coal Board (Medical Service), pp. 39-45

ROSATO, D V (1959)
Asbestos - its industrial applications
New York: Reinhold

ROSSITER, C E (1972a)
Initial repeatability trials of the UICC/Cincinnati classification of the radiographic appearances of pneumoconioses
Brit. J. industr. Med. 29: 407

ROSSITER, C E (1972b)
Relation of lung dust content to radiological changes in coal workers
Ann. New York Acad. Sci. 200: 465

ROSSITER, C E (1972c)
Evidence of dose-response relation in pneumoconiosis
J. Soc. occup. Med. 22: 83

ROSSITER, C E, BRISTOL, L J, CARTIER, P H, GIBBS, G W, GILSON, J C, GRAINGER, T R, SIEMIATYCKI, J, SLUIS-CREMER, G K and McDONALD, J C (1971)
Dust exposure and radiographic appearances in Quebec asbestos workers. In: *Proceedings of the Sixteenth International Congress on Occupational Health* Toyoko: Japan Industrial Safety Association, pp. 205-206

ROSSITER, C E, BRISTOL, L J, CARTIER, P H, GILSON, J C, GRAINGER, T R, SLUIS-CREMER, G K and McDONALD, J C (1972)
Radiographic changes in chrysotile asbestos mine and mill workers of Quebec
Arch. environ. Health 24: 388

RUBINO, G F, SCANSETTI, G and PIOLATTO, G (1977)
Asbestos hazards in Italy
Presented at a meeting of the Royal Society of Medicine, London, 28 April 1977

SARACCI, R (1977)
Asbestos and lung cancer: an analysis of the epidemiological evidence on the asbestos-smoking interaction
Internat. J. Cancer 20: 323

SAUPE, E (1938)
Röntgenatlas der Asbestose der Lunge
Leipzig: G. Thieme

SCHALL, E L (1965)
Present threshold limit value in the USA for asbestos dust: a critique
Ann. New York Acad. Sci. 132: 316

SCHNEIDERMAN, M A (1974)
Digestive system cancer among persons subjected to occupational inhalation of asbestos particles: a literature review with emphasis on dose response
Environ. Health Perspectives 9: 307

SEATON, A (1975)
Asbestosis
In: Morgan and Seaton (1975), p. 124

SELIKOFF, I J, CHURG, J and HAMMOND, E C (1964)
Asbestos exposure and neoplasia
J. Amer. Med. Assoc. 188: 22

SELIKOFF, I J, CHURG, J and HAMMOND, E C (1965)
The occurrence of asbestosis among insulation workers in the United States
Ann. New York Acad. Sci. 132: 139

SELIKOFF, I J and HAMMOND, E C (1975)
Multiple risk factors in environmental cancer
In: *Proceedings of conference on persons at high risk of cancer: an approach to cancer etiology and control. 10-12 December, 1964, Key Biscayne, Florida* Published 1975

SELIKOFF, I J, HAMMOND, E C and SEIDMAN, H (1973)
Cancer risk of insulation workers in the United States
In: Bogovski *et al.* (1973), pp. 209-216

SELIKOFF, I J, HAMMOND, E C and SEIDMAN, H (1978)
Mortality experience of insulation workers in the United States and Canada, 1943-1977
Ann. New York Acad. Sci. (in press)

SHETTIGARA, P T and MORGAN, R W (1975)
Asbestos, smoking and laryngeal carcinoma
Arch. environ. Health 30: 517

SLUIS-CREMER, G K and THERON, C P (1965)
A proposed classification of asbestosis
Ann. New York Acad. Sci. 132: 373

STILL, P M and McGILL, T (1973)
Asbestos and laryngeal carcinoma
Lancet 2: 615

SUTHERLAND, R B (1959)
Respiratory cancer mortality, 1930-57
The International Nickel Company of Canada, Limited, Port Colborne Refinery. Private report to Department of Health for Ontario, 27 November 1959

TAYLOR, I and KNOWELDEN, J (1957)
Principles of epidemiology, p. 63
London: Churchill

THERIAULT, G P, PETERS, J M and JOHNSON, W M (1974)
Pulmonary function and roentgenographic changes in granite dust exposure
Arch. environ. Health 28: 23

THOMAS, D C (1977)
Addendum to Liddell, McDonald and Thomas (1977), pp. 483-485

THOMAS, D C (1978)
Matched analysis of case-control studies
Biometrics (in press)

TIMBRELL, V (1973)
Physical factors as etiological mechanisms
In: Bogovski *et al.* (1973), pp. 295-303

UICC WORKING GROUP ON ASBESTOS AND CANCER (1965a)
Report and recommendations of the Working Group convened under the auspices of the Geographical Pathology Committee of the International Union against Cancer (Union Internationale contre le Cancer, UICC)
Arch. environ. Health 11: 221

UICC WORKING GROUP ON ASBESTOS AND CANCER (1965b)
Recommendations on problems requiring epidemiological study
Brit. J. industr. Med. 22: 165

UNION INTERNATIONALE CONTRE LE CANCER *see* UICC

URY, H K (1975)
Efficiency of case-control studies with multiple controls per case: continuous or dichotomous data
Biometrics 31: 643

Van MECHELEN, V and BELAYEW, - (1948)
The Hasselt classification, *cited by* Van Mechelen and McLaughlin (1962), p. 241

Van MECHELEN, V and McLAUGHLIN, A I G (1962)
The new international classification of radiographs of the pneumoconioses
Ann. occup. Hygiene 4: 237

Van ORDSTRAND, H S (1977)
Pneumoconioses and their masqueraders
J. occup. Med. 19: 747

WAGNER, J C, GILSON, J C, BERRY, G and TIMBRELL, V (1971)
Epidemiology of asbestos cancers
Brit. Med. Bull. 27: no. 1, 71

WAGNER, J C, SLEGGS, C A and MARCHAND, P (1960)
Diffuse pleural mesothelioma and asbestos exposure in the Northwestern Cape Province
Brit. J. industr. Med. 17: 260

WARD, E (Ed) (1977)
Asbestos. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Volume 14
Lyon: IARC

WEILL, H and JONES, R (1975)
The chest roentgenogram as an epidemiologic tool
Arch. environ. Health 30: 435

WEILL, H, ROSSITER, C E, WAGGENSPACK, C, JONES, R N and ZISKIND, M M (1977)
Differences in lung effects resulting from chrysotile and crocidolite exposure
In: WALTON, W H (Ed) (1977), *Inhaled Particles IV*, Pergamon Press: Oxford and New York, pp. 789-798

WEILL, H, ZISKIND, M M, WAGGENSPACK, C and ROSSITER, C E (1975)
Lung function consequences of dust exposure in asbestos cement manufacturing plants
Arch. environ. Health 30: 88

WEIR, J M and DUNN, J E Jr (1970)
Smoking and mortality: a prospective study
Cancer 25: 105

WEISS, W (1977)
Mortality of a cohort exposed to chrysotile asbestos
J. occup. Med. 19: 737

WHITE, F M, SWIFT, J and BECKLAKE, M R (1974)
Rheumatic complaints and pulmonary response to chrysotile dust inhalation in the mines and mills of Quebec
Can. Med. Assoc. J. 11: 533

WOOD, W B (1929)
Pulmonary asbestosis - radiographic appearances in Skiagrams of the chests of workers in asbestos
Tubercle 10: 353

YOUDEN, W J (1950)
Index for rating diagnostic tests
Cancer 3: 32

YULE, G U (1934)
On some points relating to vital statistics, more especially statistics of occupational mortality
J. Roy. Statist. Soc. 97: 1

ZENKER, F A (1876)
Diseases of the lungs due to the inhalation of dust
Translated by Mieklejohn (1960)

ZUSSMAN, J (1972)
Nature and history (of asbestos)
Review 1972/2 Basle: Ciba-Geigy, pp. 1-8

Appendix

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION

The following pages (368 through 374) are reproductions of the earliest known notes on the use of the U/C classification, later published in slightly amended form by Bohlig *et al.* (1970). These instructions bear the "imprint" JCG/MAR, the reference 67/27 and the date 29th December, 1967.

The "Appendix II" referred to at the foot of the first page of the instructions is reproduced here as page 376; a reduced version of the reading sheet of "Appendix I", referred to on the second page of the instructions, is on page 375 of the thesis.

The list of Symbols (see page 374) was not attached to the present copy of the original instructions.

CT/2/

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION

29th December, 1967.

Technique

Inspection for technique:

if good or acceptable, record "plus" +

if poor, record "plus/minus" +/-

if very poor but just readable for some features record +-- and add comments on type of defect

if unreadable record "minus" -

Only use unreadable if you think the reading is likely to be too doubtful to convey any appreciable information. If unreadable, make a note of why in "comments".

Classification

Look at the film and decide if any of the changes seen in the pleura or the parenchyma are sufficiently characteristic of pneumoconiosis (including that seen in asbestosis) to be recorded in the classification. If it is probable that all the changes seen are the result of some other aetiology do not classify, but record opinion using symbols, e.g., Tb, Np (neoplasm), etc., and by other notes in the "comments" column. If the changes might be due in part to pneumoconiosis record on the classification scheme but make note in "comments" what other aetiology is likely.

Note: there is no provision in this classification for doubtful pneumoconiosis ('0' used in the I.L.O. 1958 classification and the modification of this by the U. S. Public Health Service). The reader is required to make a decision one way or the other, but there is provision within the classification for recording changes which are less than the first category of "small rounded" and "small irregular opacities".

Small Rounded Opacities

These are classified as on the I.L.O. 1958 scheme as modified by the U. S. Public Health Service (see Appendix II).

07/27

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION, 2

Profusion: The profusion is determined using the I.L.O. standard films and the verbal definitions, with the N.C.B. elaboration to give extra information about where the film lies within the I.L.O. categories 0, 1, 2 & 3. The instructions for using the N.C.B. elaboration are: "Record the I.L.O. category into which you would classify the film following the normal convention. If, in the course of that classification, you considered an adjacent category as a serious possibility, record this after the formal category".

The system of coding is shown at the bottom of the reading sheet (Appendix 1) and is a 12-point scale from 0/- to 3/4.

Notes:

(i) regard the I.L.O. 1958 films as typical (mid-category) films showing 1, 2 and 3.

(ii) within category 0 record as 0/- those films which are indubitably normal at first glance (barn-door normals)*. Those which are normal after a brief inspection are recorded as 0/0. Those in which you seriously considered category 1 before deciding that they were category 0 are recorded as 0/1.

(iii) although there is no formal category 4, record those films which you regard as being above category 3-standard as 3/4.

Type: On the basis of "averaging" for both lung fields record the predominant type as follows -

p = pin-head (I.L.O.) small opacities up to 1.5mm.

q = micronodular (m) (I.L.O.) - opacities with diameters 1.5 to 3mm.

r = nodular (n) (I.L.O.) - diameters 3 to 10mm.

Notes:

(i) 'p', 'q', 'r' which should be in small case not capitals, are used in preference to 'p', 'm' and 'n' on the I.L.O. 1958 scheme, because 'm' and 'n' may get confused in writing and in speaking when recording the classification. Also, with 's', 't' and 'u' they form an alphabetic sequence of coding of the type of small opacities.

* (Barn door, "used joc. of a target too large to be missed" Oxford English Dictionary).

INSTRUCTIONS FOR USING ILO/CINCINNATI CLASSIFICATION, 3

Small Irregular Opacities

This group in the classification is used to record those films in which there is a filling of the rib spaces with irregular opacities of various thicknesses, shapes and densities, but which are not clearly rounded. As in the case of the small rounded opacities, the irregular small opacities tend, particularly when present in profusion, to obscure the normal lung architecture. Hence obscuration of the normal lung pattern is a feature of both those films with small rounded and small irregular opacities.

Small irregular opacities may be present alone or with small rounded opacities. Both should be recorded if it is thought both can be convincingly seen on the same film. It may, for example, be possible to see small rounded opacities in the upper zones and small irregular opacities in the lower zones, or vice versa. If only one type of opacity is present, record this and record 0/0 for the other type.

Profusion: As in the case of rounded small opacities, the profusion of the irregular small opacities is based on an averaging over the whole lung and by comparison with the standard films. However, unlike the small rounded opacities, the profusion of the irregular small opacities is judged purely by reference to the standard films and there is no verbal definition of the extent (number of rib spaces) affected for each category.

Type: The irregular small opacities are divided into three types -

s = fine, irregular or linear opacities

t = thick irregular or linear opacities

u = coarse (blotchy) opacities (not obviously linear)

Notes:

(i) The type should be decided on the basis of predominant feature of the film taken as a whole. Thus, only one type - 's', 't' or 'u' will be recorded for a film. This is the same convention used for classification of 'p', 'q' or 'r'.

(ii) On account of the variation in shape and size of the irregular small opacities no dimensions are specified (cf., 'p', 'q', 'r'). Classification of type depends largely on comparison with the standard film. In general, if in doubt record 't'. 's' is used for films in which the pattern is definitely fine and more linear, 'u' for films in which the shadows are 'blotchy' with little evidence of linearity.

67/27

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION, 4

Site of Small "Rounded" or "Irregular" Opacities: in order to provide information about the predominant site (lung zone) in which the small rounded or small irregular opacities are present the reading sheet provides a box with six partitions for recording which zones the opacities are best seen. These boxes should be completed by putting a tick in the appropirate space.

Notes:

(i) The provision of boxes for recording the zones most affected has been made because, whereas in many types of Pneumoconioses the upper zones are usually affected first, this is not thought to be so in Asbestosis. The added information about the lung zones most affected may help to separate the changes in the lung appearance associated with different types of dusts.

Large Opacities

In order to cover a wider range of features of large opacities than is described in the I.L.O. 1958 scheme, the large opacities are divided into two types: (i) well-defined, (ii) poorly-defined.

Well-defined: These are the large opacities of the I.L.O. 1958 scheme. Their size is classified according to the largest diameter using the standard films, A, B and C, and the verbal and pictorial definitions in the U. S. Public Health Service extension of the I.L.O. scheme (Appendix II).

Poorly-defined: D, E and F, are used to record large opacities in which the edge of the shadow is markedly ill-defined and yet the appearance is one of a large shadow in the lung parenchyma. The size is recorded using the same definitions as A, B and C opacities.

Notes:

(i) It is not certain how useful or frequently recorded this type of ill-defined opacity will be. It was introduced to cover the appearances occasionally seen in the Asbestos-exposed workers where the large opacities may be much less clearly demarcated from the surrounding lung than in other types of Pneumoconioses, but the system may be useful to record the ill-defined larger opacities also seen in other types of Pneumoconioses and which are not well covered by the I.L.O. 1958 scheme.

V/27

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION, 5

Pleural Thickening

The type, severity, and site are recorded using standard films, but in order to simplify the classification and improve its specificity certain conventions are used.

Type: Two types are recognised. "Diffuse" and "plaques". When both are present both are recorded (see Appendix I).

A "plaque" is recorded only when an area of pleural thickening has a sharply defined edge and is plate-like but uncalcified. Plaques are usually limited to the wall but if definite should be recorded when present on the diaphragm or elsewhere.

"Diffuse" pleural thickening covers all other types including the narrow linear bands running parallel to the chest wall.

Standard films are provided to demonstrate the appearances and the grading (severity) of pleural thickening.

Site and Severity

Costophrenic angle: Record this as present or absent, right and/or left. A standard lower limit film is provided. No upper limit film is provided, but the convention is to report "C.P." alone where there is approximately equal length of change along the surface of the diaphragm and up the chest wall. If the thickening extends appreciably further up the chest wall, or along the diaphragm, then the film should be classified as "C.P." and Pleural Thickening (diffuse or plaques) on the wall and diaphragm.

Notes:

(i) Loafing of the diaphragm should not be recorded as 'C.P.' even though it leads to the obscuration of the costophrenic angle.

Walls: Pleural thickening on the chest wall is recorded in three grades. Lower limits of these, 1, 2 and 3 are provided in standard films. The grade is averaged for both lung fields together and also for diffuse and/or plaques. The site is recorded as right and/or left.

Diaphragm: Where there is a definite plaque on the diaphragm, this should be recorded as present, right and/or left, and graded as part of a general pleural thickening, affecting the whole film.

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION. 6

Irregularity of Diaphragm and Cardiac Border

There is uncertainty whether the irregularity of the diaphragm and cardiac border which are not uncommon in pneumoconiosis is due to pleural thickening and/or super-imposition of other shadows. The need to record the appearance and severity of change has been provided for as follows:-

Irregular Diaphragm: This is recorded simply as present or absent, right and/or left, using the standard film as lower limit.

Notes:

(i) The lower limit is intentionally set fairly high as small irregularities of the diaphragm are not thought to be very important epidemiologically.

(ii) The classification is purely descriptive and therefore, the diaphragm is recorded as irregular whatever the cause, whether this is actual thickening of the pleura, or distortion (if marked), or fuzziness, or if the contour is markedly altered as a result of pleural calcification.

(iii) Irregularities, considered to be due to leafing, are not recorded.

Irregular Cardiac Border: This is graded using the lower limit standard films 1, 2 and 3 which are based on extent of irregularity rather than degree of fuzziness.

Notes:

(i) Special attention is given to the left cardiac border.

(ii) The abnormality recorded is fuzziness of the outline whatever the likely cause (as for irregular diaphragm).

(iii) Irregularity, thought simply to be due to cardiac fat casting a double shadow along the border is not classified as cardiac irregularity.

Pleural Calcification

This is graded 1, 2 and 3 using the lower limit standard films provided, and recorded right and/or left on the diaphragm and/or the wall. If present in other sites, for example, the mediastinum or the fissure, this is noted in the appropriate column. The grading is averaged over the whole lung -

67/27

INSTRUCTIONS FOR USING WHO/CINCINNATI CLASSIFICATION, 2

Pleural Calcification (continued)

Grade 1 : less than 3 square inches (approx. 16 sq.cms.)
Grade 2 : less than 9 square inches (approx. 260 sq.cms.)
Grade 3 : 9 square inches and above (approx. 260 sq.cms.)

Notes:

(i) Pleural calcification should be assessed, using both the sharpness of definition of the shadow, as well as its density. The comparison of density with neighbouring rib structures may help to decide whether or not it should be graded as a pleural calcification as opposed to a pleural plaque (uncalcified).

(ii) The total area is estimated by summating the areas as seen on films and allowance is not made for the larger actual area of plaque when it is seen edge on.

(iii) Calcification thought to be in the wall of the aorta is not recorded.

(iv) Avoid recording artefacts due to scratches on the screens etc.

Symbols

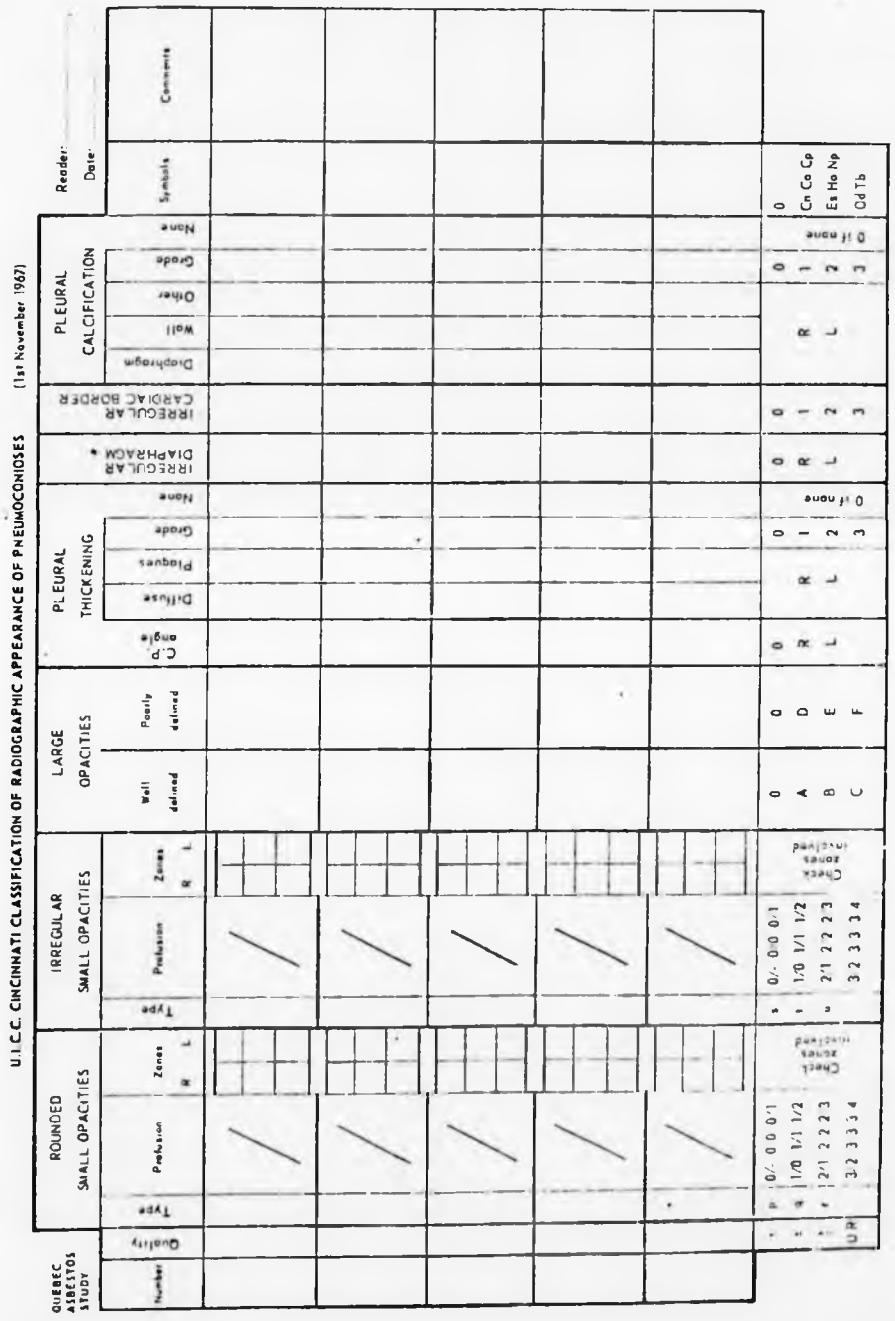
Certain additional features in the film can be recorded in code, using the list of symbols (see attached list). It is impracticable to record systematically all the symbols, but if a selected few are recorded systematically, this should be noted when reporting results, so that valid comparisons may be made with other surveys.

Symbols of special interest in asbestos workers are likely to include:-

Mp - neoplasm, either bronchial tumour, or mesothelioma.
Cn - calcification of nodules.
Co - cardiac abnormality (other than irregularity of cardiac outline reported in the main classification).
Cp - cor pulmonale.
Es - eggshell calcification.
Ho - honeycomb appearance. Note: This is a relatively specific type of appearance which will have already been recorded in the irregular small opacities column under 's', 't' or 'u', but if present to a marked degree may be usefully noted in the symbols.
Od - other diseases.
Tb - clinically significant tuberculosis, but excludes primary complex.

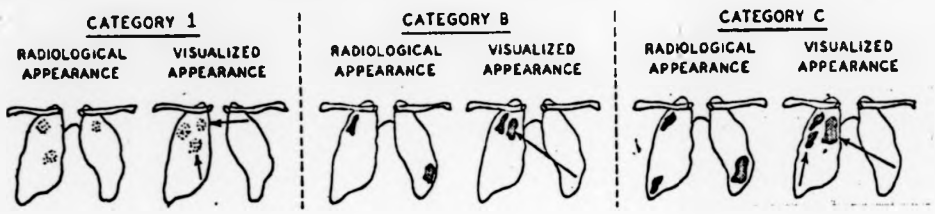
"Appendix I" to

INSTRUCTIONS FOR USING UICC/CINCINNATI CLASSIFICATION



PNEUMOCONIOSIS		
SMALL OPACITIES	THE CATEGORIZATION DEPENDS ON THE EXTENT AND PROFUSION OF THE OPACITIES. 1 A NUMBER OF OPACITIES IN AN AREA EQUIVALENT TO AT LEAST THE SECOND AND THIRD ANTERIOR RIB SPACES OF EITHER SIDE, AND AT THE MOST, NOT GREATER THAN ONE THIRD OF THE TWO LUNG FIELDS COMBINED. 2 OPACITIES MORE DIFFUSE THAN IN CATEGORY 1 WHICH MAY BE DISTRIBUTED OVER THE WHOLE OR NEARLY THE WHOLE OF THE LUNG FIELDS. 3 VERY NUMEROUS OPACITIES DISTRIBUTED OVER THE WHOLE, OR NEARLY THE WHOLE OF THE LUNG FIELDS.	THESE ARE CLASSIFIED ACCORDING TO THE GREATEST DIAMETER OF THE PREDOMINANT OPACITIES AND DENOTED BY THE FOLLOWING SYMBOLS: p - GREATEST DIAMETER UP TO AND INCLUDING 1.5 mm. q - GREATEST DIAMETER FROM 1.5 mm UP TO AND INCLUDING 3 mm. r - GREATEST DIAMETER FROM 3 mm UP TO AND INCLUDING 1 cm 
LARGE OPACITIES	A - AN OPACITY HAVING A GREATEST DIAMETER EXCEEDING 1 cm. AND UP TO AND INCLUDING 5 cm. OR SEVERAL OPACITIES EACH GREATER THAN 1 cm., THE SUM OF WHOSE GREATEST DIAMETERS DOES NOT EXCEED 5 cm. B - ONE OR MORE OPACITIES LARGER OR MORE NUMEROUS THAN THOSE IN CATEGORY A WHOSE COMBINED AREA DOES NOT EXCEED ONE THIRD OF THE VISIBLE RIGHT LUNG. C - ONE OR MORE OPACITIES WHOSE COMBINED AREA EXCEEDS ONE THIRD OF THE VISIBLE RIGHT LUNG FIELD.	

* THE BACKGROUND OF SMALL OPACITIES SHOULD BE SPECIFIED AS FAR AS POSSIBLE.



MORTALITY OF QUEBEC CHRYSOTILE WORKERS IN RELATION TO RADIOLOGICAL FINDINGS WHILE STILL EMPLOYED

Francis Douglas Kelly Liddell

Thesis submitted for the degree of

PhD

Volume 2: Annex

TUC Centenary Institute of Occupational Health
London School of Hygiene and Tropical Medicine

July 1978

CONTENTS OF VOLUME 2 (ANNEX)

This Annex contains the leading data for all subjects in Cohorts "A" and "B". The contents are as follows:-

RECORD LAY OUT: COHORT "A"

#	Length	Item, including units and "format"
1	6	Identity number
2	4	Height (cm) (F4.1)
3	4	Weight (kg) (F4.1)
4	4	$FEV_{1.0}$ (litres) (F4.2)
5	4	FVC (litres) (F4.2)
6	1	Wheezing
7	1	Number of chest illnesses
8	5	Film reading sequence number
9	1	Status (Alive, Dead or Lost to view)
10	2	Year of death, or loss (blank if alive)
11	3	Cause of death * (blank if alive or lost to view)
12	4	Date of start of first job (year/month)
13	4	Recorded end of last job (year/month = 66/11)
14	2	Net service (years: truncated) (I2)
15	5	Accumulated dust exposure (mpcf.y: truncated) (I5)
16	1	Mining area (Asbestos or Thetford Mines)
17	1	Smoking code (see p. 172)
18	1	"Normal" or "Less-than-normal"
19	6	Date of birth (day/month/year)
20	4	Age at test (years) (F4.2)
21	2	Persistent cough/phlegm (unreliable)
22	1	Breathlessness
23	43	X-ray readings (see next page)

* First character R or S for accidents at asbestos work

LAY-OUT OF X-RAY READINGS: COHORT "A"

Each line (columns 87-129) refers to a specific reader

#	Length	Print cols.	Item
1	1	87	"6"
2	1	88	Film quality (+; +/-; +/--)
3	9		Small rounded opacities
		90-92	type; profusion
		93-98	zones (RU; RM; RL; LU; LM; LL)
4	9		Small irregular opacities
		100-102	type; profusion
		103-108	zones (RU; RM; RL; LU; LM; LL)
5	2		Large opacities
		110-111	well defined; poorly defined
6	1	113	Costophrenic angle(s)
7	3		Pleural thickening
		114-116	diffuse; plaques; grade
8	1	118	Irregular diaphragm
9	1	120	Irregular cardiac border
10	4		Pleural calcification
		122-125	diaphragm; wall; other; grade
11	1	127	"Additional symbols" (count)
12	1	129	"Comments" (1 = Yes)

COHORT "A"

"Normals": Alive

pp. 6 - 46

140246	256 000	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
134470	341 000	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
129745	376 100	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
128179	393 300	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
129814	385 000	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
128760	395 000	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
136410	412 300	61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0
		61	000000	000000	0	0	0 0

10038	1732	674	363	389	00	12364	A		5107	6611	5		28	T	A
10343	1753	590	430	472	00	1981	A		5606	6611	1		2	T	A
10433	1646	530	307	357	00	14467	A		4601	6611	9		20	T	S
10496	1791	792	408	504	00	6254	A		4706	6611	12		9	T	D
10556	1587	569	355	396	00	15568	A		5404	6611	12		25	T	T
10527	1605	796	330	352	00	11775	A		4735	6611	14		213	T	S
10653	1429	834	454	553	01	6464	A		5035	6611	9		44	T	S

10690	1595	702	259	347	00	10615	A	4505	6611	17	45	1	1	8
10709	1753	990	321	337	00	11236	A	5105	6611	9	57	1	5	8
10406	1691	693	262	769	00	4732	A	5509	6611	11	47	1	0	8
10409	1727	766	463	527	00	9993	A	5605	6611	4	34	1	1	8
10410	1676	524	275	167	00	1316	A	4114	6611	21	5111	1	5	[illegible]
10417	1749	740	411	530	00	12537	A	5205	6611	14	41	1	4	[illegible]
10495	1691	693	243	760	00	4600	A	5034	6611	24	1282	1	1	[illegible]

4

10896	1664	653	304	334	10	11484	A	3635	6611	17	78	T	5	1	118268	490	100	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
10907	1631	626	335	402	10	14970	A	3734	6611	23	737	T	4	1	121265	460	010	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
10913	1562	653	243	371	00	13709	A	4405	6611	17	104	T	2	1	115765	516	001	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
10934	1631	755	334	371	00	3356	A	5637	6611	3	32	T	0	1	126501	436	001	61	000000	000000	0	0	0 0
																		62	000000	000000	0	0	0 0
																		62	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		62	000000	000000	0	0	0 0
11025	1779	695	374	473	10	2036	A	6203	6611	2	10	T	5	1	136845	304	002	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	0-000000	0-000000	0	0	0 0
11039	1714	701	238	421	00	15500	A	5309	6611	13	90	T	4	1	120521	466	001	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
11065	1779	676	420	501	00	12432	A	5626	6611	4	22	T	4	1	137867	248	000	61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	0-000000	0-000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0
																		61	000000	000000	0	0	0 0

00

113857	476	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
134139	245	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
117849	436	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
109570	578	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
120187	473	002	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
113195	544	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
113297	477	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0

11048	1714	536	461	517	00	9756	A		3701	6611	23		89	T	9
11361	1464	816	336	417	00	7291	A		6130	6611	3		15	T	3
90351	1413	524	274	324	15	4297	A		4305	6611	23		173	T	3
90101	1707	653	276	411	20	7331	A		2704	6611	17		106	T	1
90112	1707	777	347	340	10	11520	A		3703	6611	3		23	T	5
90234	1562	581	246	335	00	3314	A		4305	6611	23		157	T	0
93280	1468	832	265	352	00	14063	A		4701	6611	4		15	T	1

139359	582	000	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
136303	610	011	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
128370	390	00[illegible]	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
140626	268	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
138064	296	202	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
141512	751	[illegible]	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
[illegible]	150	[illegible]	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			[illegible]	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	

90244	1903	940	327	428	10	8725	A	2302	6611	1		S	T	T
93256	1513	584	263	317	01	4911	A	2603	6611	21	135	T	T	T
100015	1476	866	371	436	00	4519	A	4503	6611	12	136	A	S	T
100034	1903	643	416	567	00	8826	A	6436	6611	2		S	A	S
100075	1476	871	324	432	10	11517	A	5806	6611	2		S	A	S
100087	1664	613	355	438	00	2572	A	5605	6611	10	21	A	A	T
100132	1722	683	394	534	00	12[illegible]	A	6308	6611	2		S	A	S

137301	335 001	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	1
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
133542	377 000	61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
132545	390 000	42	000000	000000	0	0	0	0	
		41	000000	000000	0	0	0	0	
		42	000000	000000	0	0	0	0	
		41	000000	000000	0	0	0	0	
		41	000000	000000	0	0	0	0	
		42	000000	000000	0	0	0	0	
123209	476 101	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
104140	696 112	61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		63	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
132518	357 000	61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	1
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
126506	417 050	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	

100195	1697	792	406	495	00	10746	A	6505	6611	1	3	A	1	1
100139	1651	703	341	380	00	14905	A	5007	6611	16	41	A	0	1
100141	1646	762	347	405	00	15645	A	5206	6611	14	39	A	4	1
100161	1671	535	366	517	00	11106	A	4311	6611	16	40	A	4	1
100164	1697	937	252	311	10	8650	A	2909	6611	26	156	A	1	
100179	1707	661	456	325	00	2325	A	5503	6611	5	9	A	4	
100193	1631	562	253	175	00	11945	A	3504	6611	23	175	A	5	

=

100222	1431	813	307	356	13	3631	A	3002	6611	34	551	A	3	1	113800	540	032	61	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
100247	1476	574	253	361	20	1101	A	2507	6611	16	75	A	4	1	107379	610	031	31	000000	000000	0 0 0 0
																		31	000000	000000	0 0 0 0
																		32	000000	000000	0 0 0 0
																		32	000000	000000	0 0 0 0
																		31	000000	000000	0 0 0 0
																		31	000000	000000	0 0 0 0
100258	1727	469	375	422	00	3064	A	5104	6611	15	45	A	5	1	131921	357	000	61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
100264	1471	669	335	352	13	6134	A	3702	6611	27	158	A	5	1	115064	527	001	61	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		62	000000	000000	0 0 0 0
100267	1737	683	415	517	10	3421	A	5013	6611	15	40	A	5	1	119664	491	032	61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
100329	1433	733	544	604	00	11464	A	6337	6611	1	7	A	3	1	143862	236	030	61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
																		61	000000	000000	0 0 0 0
100331	1434	997	463	556	00	15665	A	6602	6611			A	4	1	140962	268	030	42	000000	000000	0 0 0 0
																		41	000000	000000	0 0 0 0
																		42	000000	000000	0 0 0 0
																		41	000000	000000	0 0 0 0
																		41	000000	000000	0 0 0 0
																		42	000000	000000	0 0 0 0

105279	630 000	37	0000000	0000000	0	0	0	0	0	1
		36	0000000	0000000	0	0	0	0	0	1
		35	0000000	0000000	0	0	0	0		
		34	0000000	0000000	0	0	0	0		
		33	0000000	0000000	0	0	0	0		
		33	0000000	0000000	0	0	0	0		
		33	0000000	0000000	0	0	0	0		
106598	619 001	32	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		32	0000000	0000000	0	0	0	0	1	
		31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		32	0000000	0000000	0	0	0	0		
110153	577 002	61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		63	0000000	0000000	0	0	0	0		
		62	0000000	0000000	0	0	0	0	1	
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
102501	252 000	61	0000000	0000000	0	0	0	0		
		62	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0	1	
		62	0000000	0000000	0	0	0	0		
		62	0000000	0000000	0	0	0	0		
103103	597 001	61	0000000	0000000	0	0	0	0		
		62	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
107302	510 002	31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		31	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		
		61	0000000	0000000	0	0	0	0		

100447	1631	738	274	339	10	1169	A		2511	6611	43	136	A	4	1
100497	1740	475	307	360	00	13191	A		2707	6611	34	67	A	1	1
100520	1714	872	236	314	20	14240	A		4119	6611	23	221	A	5	1
100523	1740	650	471	524	10	15073	A		4507	6611	1	2	A	4	1
100534	1664	765	244	328	00	5816	A		2710	6611	16	1355	A	1	1
100549	1714	819	337	402	10	6980	A		4503	6611	21	85	A	1	
100580	1626	451	131	195	00	3135	A		4402	6611	21	131	A	4	

133604	282	030	61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			63	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
137501	609	130	31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			32	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
125817	463	002	62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			63	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
106588	517	001	32	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			33	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			32	000000	000000	0	0	0	0
120237	476	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
122414	454	331	62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			63	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
125707	415	332	31	000000	000000	0	0	0	0
			32	000000	000000	0	0	0	0
			32	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			33	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0

133631	1727	679	416	624 10	7209	A		5435	6611	2		5	A	5	1
133634	1783	776	131	484 00	7479	A		3735	6611	23		45	A	1	1
133636	1646	1008	293	347 30	12396	A		4536	6611	21		59	A	4	1
133653	1732	720	309	437 00	9752	A		4303	6611	17		136	A	5	1
133657	1707	542	292	465 00	1439	A		4307	6611	24		53	A	4	1
133672	1727	704	333	362 20	2959	A		4603	6611	20		180	A	4	1
133678	1595	777	276	327 10	7100	A		4739	6611	13		161	A	5	1

1	137820	219	000	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
1	139584	233	000	61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
1	136693	617	011	31	000000	000000	0	0	0	0	
				31	000000	000000	0	0	0	0	
				32	000000	000000	0	0	0	0	
				31	000000	000000	0	0	0	0	1
				31	000000	000000	0	0	0	0	
				32	000000	000000	0	0	0	0	
1	133014	377	000	62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				63	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
1	133048	347	000	61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				63	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
1	124995	428	000	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	1
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
1	124906	[illegible]	000	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				63	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	

100679	1718	639	402	427	00	13018	A		5503	6611	13	56	A	A
100687	1707	678	402	547	10	230	A		5505	6611	1	3	A	A
100704	1531	563	259	367	00	7044	A		4302	6611	12	206	A	A
100711	1737	797	352	464	00	12305	A		4712	6611	14	130	A	A
100743	1727	640	307	350	00	14218	A		5503	6611	4	8	A	A
100764	1753	777	361	405	00	12204	A		4212	6611	23	282	A	S
100769	1526	479	338	335	11	12276	A		4534	6611	21	99	A	1

SI

137012	614	001	71	000036	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
			42	000000	000000	0	0	0	0	1
			31	000000	000000	0	0	0	0	
			31	000037	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
135398	324	001	62	000000	000000	0	0	0	0	
			52	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
129591	342	000	42	000000	000000	0	0	0	0	
			41	000000	000000	0	0	0	0	
			42	000000	000000	0	0	0	0	1
			41	000000	000000	0	0	0	0	
			41	000000	000000	0	0	0	0	
			41	000000	000000	0	0	0	0	
113018	577	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
137529	534	003	32	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
			31	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
113693	571	002	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	0-000000	0-000000	0	0	0	0	
113141	555	001	62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	

133890	1580	549	212	274	23	8178	A		1334	6611	17		94	A	3	1
133362	1646	684	337	385	00	8714	A		5405	6611	3		7	A	3	1
133976	1774	727	371	523	10	15659	A		4734	6611	13		170	A	4	1
130989	1714	871	134	325	00	13323	A		4409	6611	32		231	A	5	1
131311	1714	764	649	506	00	9118	A		3797	6611	29		61	A	1	
131334	1581	649	902	392	10	2939	A		1796	6611	31		71	A	2	
131115	1581	305	240	281	02	3684	A		1735	6611	27		648	A	4	

129937	370	001	62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
141734	260	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			51	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
107954	593	002	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			63	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
128279	395	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
113601	542	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
141762	261	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
117941	544	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	

101167	1707	980	351	481	22	1349	A		4739	6611	14		104	A	A	1		
101198	1727	366	412	588	00	6066	A		6493	6611	2		5	A	S	1		
101205	1714	903	343	480	30	2647	A		2305	6611	37		115	A	A	1		
101308	1740	903	442	472	00	3072	A		4736	6611	19		92	A	A	1		
101336	1702	782	135	428	10	3161	A		4501	6611	20		140	A	A	1		
101384	1722	1033	340	669	30	18869	A		6505	6611	1		2	A	D	1		
101431	1531	677	371	113	03	13099	A		6311	6611	14		73	A	D	1		

131479	1676	767	258	297	12	6290	A	2803	6611	43	161	A	A	1	106515	519	000	32	0000000	0000000	0	0	0	0	
																		42	0000000	0000000	0	0	0	0	
																		43	0000000	0000000	0	0	0	0	1
																		32	0000000	0000000	0	0	0	0	
																		32	0000000	0000000	0	0	0	0	
																		33	0000000	0000000	0	0	0	0	
131485	1646	760	340	471	13	14355	A	5636	6611	4		A	A	1	138105	237	001	61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		61	0-0000000	0-0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
131487	1589	817	154	274	20	6233	A	2909	6611	37	882	A	S	1	106501	513	002	61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	1
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
131496	1664	1224	278	334	20	6362	A	5013	6611	15	94	A	S	1	118087	497	000	63	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	1
																		63	0000000	0000000	0	0	0	0	1
																		62	0000000	0000000	0	0	0	0	
																		63	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
131531	1566	816	345	441	11	12711	A	4806	6611	18		34	A	S	1	121806	460	001	61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
131544	1748	916	158	238	10	14906	A	7233	6611	71		763	A	1	1	116105	515	002	61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
																		63	0000000	0000000	0	0	0	0	1
																		61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
131555	1581	811	240	173	20	15458	A	3511	6611	43		117	A	A	1	133805	574	001	61	0000000	0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	
																		61	0-0000000	0-0000000	0	0	0	0	
																		61	0000000	0000000	0	0	0	0	
																		62	0000000	0000000	0	0	0	0	

115466	521	331	61	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000						
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000						
1D227A	475	030	62	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000						
			62	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000	0	0	0	0	0	0
			62	0000000	0000000						
117411	704	030	61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
12AA0A	730	001	61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
1A50A0	227	301	61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0	
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
1D7D7D	413	021	31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
			31	0000000	0000000	0	0	0	0	0	0
11747F	741	000	61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0
			61	0000000	0000000	0	0	0	0	0	0

101621	1646	654	295	369	03	10238	A		3311	6611	33	27	A	4	
131642	1697	714	378	469	09	1131	A		4333	6611	3	7	A	1	
131656	1727	749	369	452	03	4366	A		5538	6611	2	5	A	0	1
131673	1748	776	364	413	00	4206	A		4732	6611	19	74	A	3	1
131686	1727	749	478	572	00	15190	A		4504	6611	1	3	A	4	1
131688	1646	665	239	311	23	4331	A		2134	6611	43	683	A	4	
230333	1676	725	414	442	03	1620	A		4734	6611	5	11	A	0	1

123607	331	002	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
124863	610	001	62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
125646	422	013	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
105515	622	002	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
114814	529	010	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
114007	537	001	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
123341	475	030	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	

200334	1714	653	533	373	20	6449	A	4738	6611	19	92	A	4	1
200335	1613	725	325	394	12	15127	A	4639	6611	23	44	A	4	1
200052	1638	484	310	388	00	11933	A	4304	6611	24	206	A	4	1
200374	1575	694	150	274	20	6548	A	4538	6611	21	36	A	4	1
200382	1703	639	244	347	00	15265	A	4137	6611	25	160	A	4	1
200084	1778	763	435	519	00	1593	A	4633	6611	12	66	A	3	1
200103	1707	729	523	385	10	7775	A	4313	6611	25	114	A	3	1

126728	411	003	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
133846	364	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
104081	437	021	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
132534	752	000	62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
132045	344	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
121228	456	000	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
121059	464	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			[illegible]	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	

230105	1707	897	348	423	03	11351	A	5131	6611	13	92	A	3	[illegible]
230119	1704	813	357	407	00	1995	A	4936	6611	16	29	A	4	[illegible]
230123	1689	695	105	205	20	6404	A	4312	6611	21	59	A	5	[illegible]
230141	1702	767	360	432	00	7864	A	5011	6611	16	63	A	3	[illegible]
230145	1707	723	428	522	02	12033	A	3636	6611	10	29	A	4	[illegible]
230193	1689	610	287	402	10	14301	A	5502	6611	11	22	A	5	[illegible]
230199	1513	705	303	260	10	12891	A	4534	6611	21	132	A	4	[illegible]

0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1122947	345 001	0
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1844804	224 002	0
0	0	0	0	0000000-0	0000000-0	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1174450	301 000	0
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1290721	471 000	0
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1199495	204 001	0
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1295665	411 201	0
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10			
0	0	0	0	0000000	0000000	10	1295340	475 001	0

200236	1671	604	135	450	00	6474	A		6237	6611	14		43	A	0				
233219	1732	656	384	442	20	3410	A		6634	6611				A	0				
200228	1748	770	401	458	00	3002	A		5435	6611	9		18	A	5				
233217	1656	734	308	416	20	8419	A		4438	6611	33		49	A	A				
230242	1587	506	107	352	10	15561	A		5211	6611	4		8	A	A				
200243	1722	645	334	477	00	2190	A	•	4238	6611	21		100	A	5				
200244	1658	585	285	404	10	13167	A		4434	6611	14		45	A	A				

135312	625	003	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
139139	248	002	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
129794	191	003	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
138368	588	001	62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
123195	476	003	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			63	000000	000000	0	0	0	0	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
134576	329	001	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
127291	444	003	61	0-000000	0-000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	

200250	1697	734	263	312	00	5344	A		4133	6611	21		52	A	1	1		
200330	1722	748	430	492	10	10202	A		6536	6611	1		2	A	3	1		
200363	1664	708	380	456	10	11360	A		5105	6611	15		33	A	4	1		
200379	1676	788	297	372	00	3973	A		3307	6611	36		165	A	3	1		
200393	1829	831	377	480	10	14905	A		4604	6611	20		32	A	5	1		
200395	1765	751	273	403	10	11918	A		5405	6611	2		5	A	4	1		
300019	1714	753	335	437	20	1059	A		4105	6611	16		112	T	5	1		

127545	438 003	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
142518	251 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	0-000000	0-000000	0	0	0	0
131171	363 002	61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
141751	258 101	61	0-000000	0-000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	0-000000	0-000000	0	0	0	0
		61	000000	100000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
125260	428 003	61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
129669	396 001	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
114069	476 011	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	0-000000	0-000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0

330041	1631	513	344	419	00	9601	A	4337	6611	21	401	T	5	1
330344	1707	733	411	469	00	5289	A	5406	6611	3	4	T	4	1
330094	1807	448	341	435	10	5046	A	5402	6611	12	268	T	3	1
330191	1681	712	474	558	00	6911	A	6202	6611	2	9	T	0	1
330237	1603	758	225	388	00	7872	A	5637	6611	10	40	T	3	1
330309	1732	640	361	413	00	12391	A	4739	6611	12	855	T	4	1
330311	1816	633	349	421	00	10910	A	4305	6611	21	115	T	4	1

125244	421 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
142563	279 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
142671	240 001	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
122090	454 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
138343	287 001	61	000000	000000	0	0	0	0
		61	0-000000	0-000000	0	0	0	0
		61	0-000000	0-000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
1[illegible]48[illegible]	327 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
13[illegible]237	426 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0

333336	1758	714	370	504	00	10244	A		4107	6611	23		211	T	A
333343	1681	758	342	435	00	12023	A		6312	6611	5		19	T	3
333582	1759	958	418	500	00	1666	A		4207	6611	2		9	T	D
300632	1683	672	340	436	00	8891	A		5207	6611	14		28	T	D
333642	1626	572	322	394	13	10571	A		5636	6611	3		13	T	A
333665	1798	835	430	521	00	13934	A		5107	6611	11		69	T	A
333711	1421	565	258	402	00	11174	A		2435	6611	37		2814	T	S

```
139331   322 000 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 62      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 62      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

136042   316 000 61      000010     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

141220   263 000 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

171055   362 002 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

137584   297 101 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

138623   345 001 61      000000     000000       0    0     0 0 1
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0 1
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

135751   302 000 61      000000     000000       0    0     0 0
                 61    0-000000   0-000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61    0-000000   0-000000       0    0     0 0
                 61      000000     000000       0    0     0 0
```

330936	1740	785	182	425	00	2490	A		4737	6611	13	226	T 0
330939	1737	636	431	433	13	11585	A		6331	6611	A	9	T 4
330908	1738	915	471	442	13	11519	A		6306	6611	A	27	T 4
330933	1742	762	368	389	00	12571	A		3333	6611	13	223	T 4
330931	1693	364	372	417	00	6975	A		6517	6611	13	37	T 4
330342	1564	618	258	106	00	4832	A		2331	6611	A1	213	T 1
330373	1613	522	501	436	00	565	A		5133	6611	A	28	T 4

```
143599   239 000 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 62       000000      000000          0     0       0 0

131792   359 000 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0

112923   545 001 61       000000      000000          0     0       0 0
                 62       000000      000000          0     0       0 0
                 62       000000      000000          0     0       0 0  1
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0

112449   550 001 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0

135650   514 001 31       000000      000000          0     0       0 0
                 31       000000      000000          0     0       0 0
                 31       000000      000000          0     0       0 0
                 31       000000      000000          0     0       0 0
                 31       000000      000000          0     0       0 0
                 31       000000      000000          0     0       0 0

142460   240 000 41       000000      000000          0     0       0 0
                 41       000000      000000          0     0       0 0
                 41       000000      000000          0     0       0 0
                 41     0-000000    0-000000          0     0       0 0
                 41       000000      000000          0     0       0 0
                 41       000000      000000          0     0       0 0

121271   463 001 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
                 61       000000      000000          0     0       0 0
```

333984	1714	663	825	483	10	2263	A		6336	6611		1	T	4 1
331166	1689	621	337	445	20	15121	A		5436	6611	11	76	T	4 1
331217	1714	361	444	459	00	5870	A		1636	6611	12	177	T	0 1
331233	1651	649	267	431	10	14924	A		4137	6611	35	259	T	4 1
331274	1529	599	171	264	10	8969	A		2531	6611	41	436	T	4 1
331313	1593	731	473	543	10	15652	A		5336	6611	2	15	T	4 1
331416	1765	444	311	426	10	5066	A		3634	6611	29	285	T	4 1

105926	626	002	31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
			31	000000	000000	0	0	0	0
138365	229	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
131179	364	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
109384	582	002	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
143079	245	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
140434	273	000	62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
104012	628	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0

331459	1613	519	215	304	10	11472	A		3902	6611	23	2622	T	4	1	
331526	1758	904	443	523	00	11774	A		5436	6611	13	7	T	0	1	
331565	1765	755	434	555	10	3441	A		4705	6611	14	39	T	5	1	
331625	1707	953	241	359	00	9238	A		4207	6611	23	578	T	3	1	
331639	1773	701	407	571	00	9553	A		6635	6611	1		T	5	1	
331662	1676	916	447	540	33	9131	A		6235	6611	2	19	T	5	1	
331724	1676	737	133	200	10	12442	A		2303	6611	76	323	T	4	1	

101773	655	002	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
112562	649	000	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
100959	266	003	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
126870	405	001	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
111112	565	000	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
118441	497	000	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
113148	171	000	61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0
			61	000000	000000	0	0	0 0

301804	1580	594	131	173	10	11657	A		1305	6611	34	074	T	0 1
301990	1740	812	298	374	00	11665	A		3536	6611	20	416	T	1 1
301996	1778	850	328	516	20	2584	A		6003	6611	6	40	T	5 1
302009	1664	671	373	431	10	11980	A		4037	6611	17	42	T	5 1
302048	1702	693	232	353	10	5850	A		1503	6611	30	57	T	3 1
302051	1671	689	324	427	00	9350	A		4437	6611	22	86	T	5 1
302063	1683	743	321	440	00	2205	A		4633	6611	20	60	T	5 1

1	135015	323	102	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	1
				19	000000	000000	0	0	0	0	
				29	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
1	112120	555	001	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	1
				19	000000	000000	0	0	0	0	1
				19	000000-0	000000-0	0	0	0	0	
				19	000000	000000	0	0	0	0	
1	134965	324	000	19	000000	000000	0	0	0	0	
				19	000000-0	000000-0	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
1	120659	470	000	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	1
				19	000000	000000	0	0	0	0	1
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
1	142891	247	000	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				29	000000	000000	0	0	0	0	
1	141381	239	000	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
1	120969	167	100	19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	
				19	000000	000000	0	0	0	0	

302102	1774	955	329	447	10	9504	A		5937	6611	7	14	T	S
302115	1714	693	318	511	11	4387	A		3405	6611	13	233	T	A
302174	1740	594	403	475	00	4107	A		5106	6611	15	32	T	A
302196	1773	740	331	409	10	5476	A		4405	6611	21	329	T	3
302199	1727	604	426	471	00	9466	A		6037	6611	3	5	T	A
302304	1695	691	362	445	00	2905	A		6236	6611	2	4	T	A
430003	1765	746	338	421	10	14031	A		4313	6611	17	50	T	S

T 4 1 134679 229 000	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
T 1 1 113760 479 000	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
T 0 1 131914 253 000	61	000000	000000	0	0	0	0
	61	0-000000	0-000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
T 4 1 127553 258 000	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	62	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	[illegible]	000000	000000	0	0	0	0
T 4 1 144609 228 000	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	62	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
T 5 1 137418 300 000	61	000000	000000	0	0	0	0
	61	0-000000	0-000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
T 4 1 131694 [illegible] 000	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0
	61	000000	000000	0	0	0	0

403085	1702	621	759	492	00	11166	A		5089	6411	16	84
403156	1702	644	235	375	00	5916	A		5713	6411	23	160
403161	1727	694	451	531	00	865	A		5031	6411	A	3
403185	1626	593	836	446	00	4268	A		5104	6411	15	37
403198	1702	835	415	527	00	3407	A		5107	6411	3	23
403225	1681	553	417	477	00	703	A		5110	6411	5	32
403265	1595	588	234	379	00	4747	A		5108	6411	13	56

1	134292	291 001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
1	140668	256 000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
1	131398	362 000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
1	144814	229 000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
1	128317	393 111	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
1	112973	546 010	61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			57	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			57	000000	000000	0	0	0	0
1	110404	567 000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0

400274	1732	943	393	429	10	3787	A	5909	6611	7	20	T	S
400284	1791	744	341	528	00	9544	A	5707	6611	2	4	T	A
400289	1783	822	405	533	10	9082	A	4909	6611	19	86	T	A
400334	1742	695	441	549	00	5566	A	5307	6611	1	12	T	A
400335	1740	712	743	467	12	8020	A	4612	6611	13	219	T	A
400345	1691	904	274	324	00	5716	A	5313	6611	16	104	T	I
400365	1539	501	245	208	33	9105	A	5134	6611	15	40	T	A

42	T	S	1	145447	221	000	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
26	T	1	1	106359	609	000	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
12	T	S	1	113454	491	000	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
28	T	2	1	119784	324	001	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
136	T	1	1	119715	479	001	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
19	T	4	1	142679	247	000	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
5	T	4	1	137930	745	000	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0

400384	1707	503	171	469	32	5693	A		5707	6611	3
400388	1740	804	294	467	00	6692	A		2505	6611	41
400389	1903	819	314	380	01	2517	A		3005	6611	23
400394	1714	751	376	468	10	12365	A		6310	6611	4
400393	1707	744	351	464	12	5480	A		4311	6611	17
400448	1740	661	403	430	00	15080	A		5107	6611	1
500302	1556	630	243	472	10	4702	A		4311	6611	1

5	T	2	1	116101	512 000	61	0-000000	0-000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
6	T	0	1	115262	521 001	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						62	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						62	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
2	T	4	1	137723	234 001	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
2	T	5	1	128120	332 100	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
2	T	1	1	137601	233 000	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
2	T	5	1	122220	454 000	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
1	T	4	1	125826	414 000	61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0
						61	000000	000000	0	0	0	0

500019	1580	618	327	395	00	4957	A		6511	6611
500023	1651	995	175	307	13	845	A		6511	6611
500055	1753	304	440	587	00	15457	A		6511	6611
500056	1727	667	379	493	13	10378	A		6511	6611
500058	1676	566	473	442	00	1764	A		6511	6611
500067	1564	924	329	414	00	2424	A		6511	6611
500071	1714	596	509	438	13	877	A		6511	6611

123709	443	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
142424	252	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
140631	269	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
123526	449	002	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
110984	564	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
123821	176	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
123339	595	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0

500391	1702	690	339	437	00	7722	A		6511	6611	1	2 T 3
533395	1651	536	233	439	00	15557	A		6511	6611	1	2 T 3
533135	1765	563	399	544	00	14280	A		6511	6611	1	4 T 4
533123	1631	622	327	357	23	12520	A		6511	6611	1	2 T 5
530146	1651	689	241	335	00	15100	A		6511	6611	1	2 T 1
500176	1600	752	258	732	00	5776	A		6511	6611	1	6 T 4
500194	1732	714	310	337	00	2429	A		6511	6611	1	7 T 5

500195	1575	553	264	755	10	4232	A		6511	6611	1	2	T S
500221	1732	835	374	469	00	1633	A		4403	6611	14	9	T S
500254	1564	736	378	443	00	11851	A		6511	6611	1	2	T O
500298	1778	894	369	432	00	13658	A		6511	6611	1	6	T A
500327	1722	653	460	521	00	10296	A		6511	6611	1	2	T A
500333	1702	680	334	390	00	650	A		6511	6611	1	2	T A
500338	1526	595	322	300	00	761	A		6511	6611	1	6	T O

128745	387 000	41	000000	000000	0	0	0	0
		41	000000	000000	0	0	0	0
		42	000000	000000	0	0	0	0
		41	0-000000	0-000000	0	0	0	0
		41	000000	000000	0	0	0	0
		42	000000	000000	0	0	0	0
135221	321 100	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
132521	448 000	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
119626	499 073	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		62	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
145779	414 091	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
126512	411 091	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
111465	141 031	61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0
		61	000000	000000	0	0	0	0

500341	1714	551	348	414	10	15637	A		6511	6611	1	2	T	S
500342	1564	707	336	433	10	8239	A		6511	6611	1	6	T	A
500346	1753	583	338	343	10	7293	A		6513	6611	2	1	T	A
500347	1740	778	232	352	00	14164	A		6511	6611	1	2	T	A
500911	1727	692	372	416	00	2224	A		6211	6611	4	89	T	A
500935	1765	826	424	473	10	9829	A		6532	6611	11	65	T	S
500940	1765	619	435	542	00	2360	A		6521	6611	11	27	T	S

129324	383	000	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
121551	459	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			62	000000	000000	0	0	0	0
133760	368	000	61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
132590	368	000	61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
113513	541	002	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	0-000000	0-000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
134171	544	002	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
134542	329	001	61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0
			61	000000	000000	0	0	0	0

600054	1732	580	262	404	20	6825	A	4713	6611	14	412	T	A
600061	1651	671	261	334	00	1399	A	4411	6611	14	242	T	S
600066	1587	615	334	410	09	783	A	5135	6611	15	31	T	A
600094	1676	640	144	426	00	13682	A	5501	6611	11	87	T	0
600096	1727	726	276	385	13	11310	A	4636	6611	20	597	T	I
600100	1585	625	232	261	13	7418	A	4634	6611	20	362	T	2
600142	1714	574	432	473	00	11723	A	5520	6611	11	45	T	0

600160	1600	499	291	388	00	5170	A	5503	6611	13	122	T	9	1	136532	308	000	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
700006	1600	648	319	445	00	11101	A	5939	6611	7	15	T	4	1	132220	452	000	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
700031	1613	736	349	402	00	13333	A	5806	6611	8	37	T	5	1	127018	403	001	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	1
																		61	000000	000000	0	0	0	0	1
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
700032	1707	796	371	430	00	5767	A	6311	6611	6	12	T	4	1	136723	337	000	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	1
																		62	000000	000000	0	0	0	0	
700035	1753	683	558	590	00	6271	A	5313	6611	13	21	T	3	1	132634	367	000	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
700060	1740	[illegible]	322	357	00	10967	A	5307	6611	8	27	T	4	1	121642	457	001	61	000000	000000	0	0	0	0	1
																		61	000000	000000	0	0	0	0	1
																		63	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	1
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
700064	1722	713	471	517	00	14916	A	5313	6611	[illegible]	51	T	4	1	[illegible]	284	001	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	

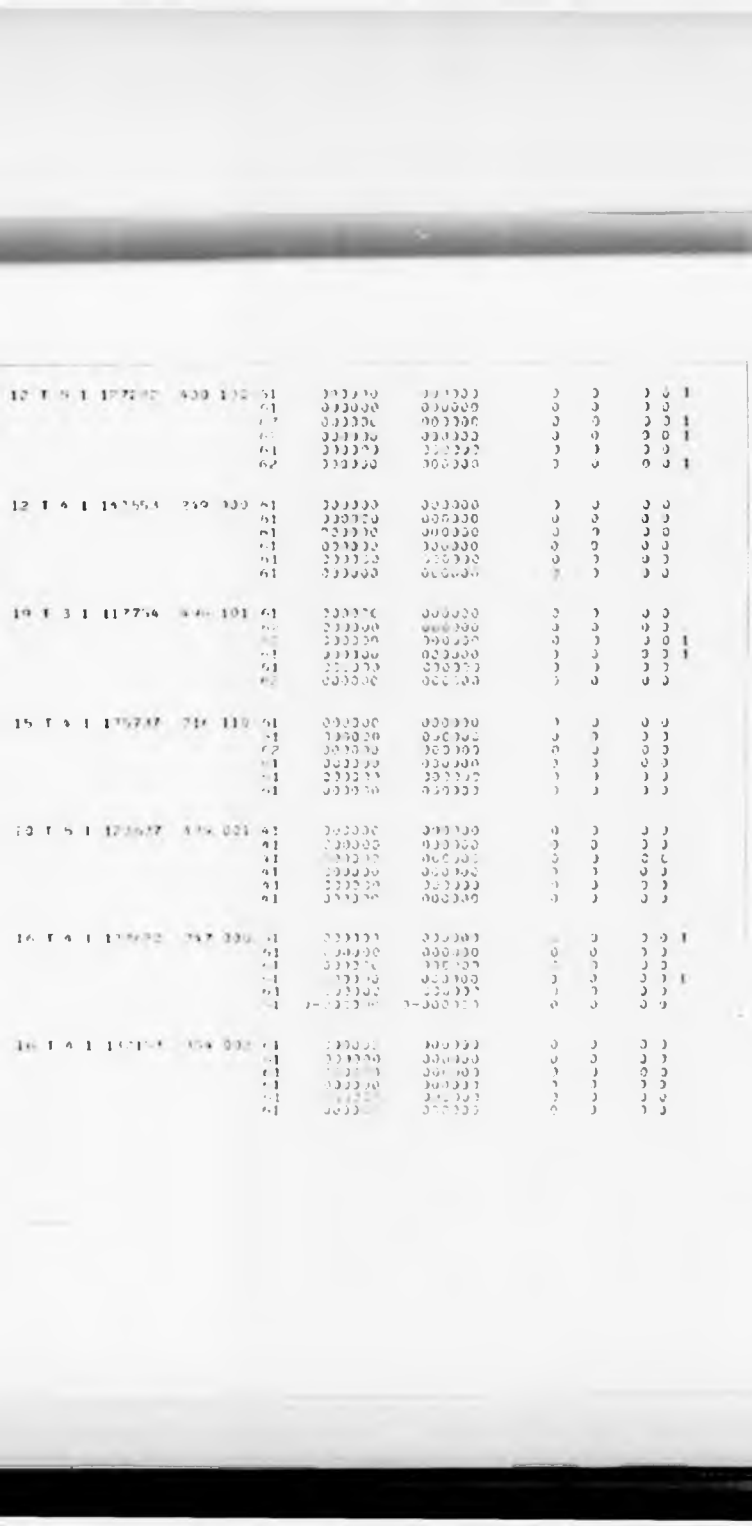
```
113512   474 331 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 62      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

142933   244 333 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0 1
                 61      000000     000000       0    0     0 0

123312   383 333 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0 1
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

113901   544 011 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61    0-000000   0-000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

115807   315 333 61    0-000000   0-000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 62      000000     000000       0    0     0 0
                 61    0-000000   0-000000       0    0     0 0
                 61    0-000000   0-000000       0    0     0 0
                 62      000000     000000       0    0     0 0

131720   356 330 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0

133504   [illegible] 331 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
                 61      000000     000000       0    0     0 0
```

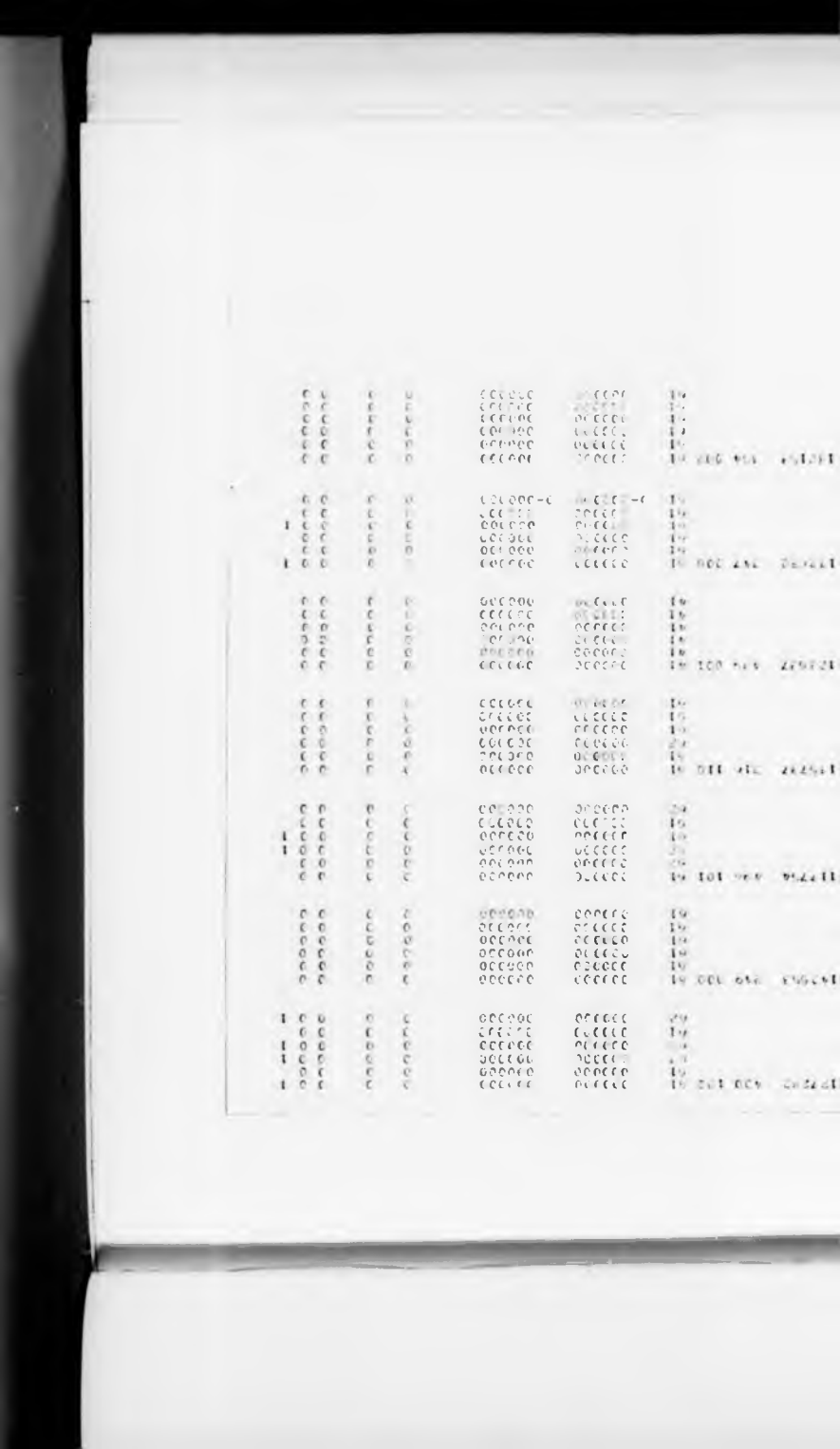
700073	1732	746	428	536	02	459	A		5436	6611	8	23	T 3 1
700030	1656	585	435	511	03	2559	A		6411	6611	2	1	T 4 1
700137	1758	571	442	523	13	5765	A		5413	6611	8	46	T 4 1
700216	1600	638	316	387	13	12335	A		5433	6611	9	50	T 4 1
700274	1538	728	193	344	03	1465	A		5417	6611	3	19	T 4 1
700308	1583	670	208	356	03	4027	A		5303	6611	6	13	T 5
700353	1727	673	464	530	03	8429	A		5434	6611	13	10	T 3

40

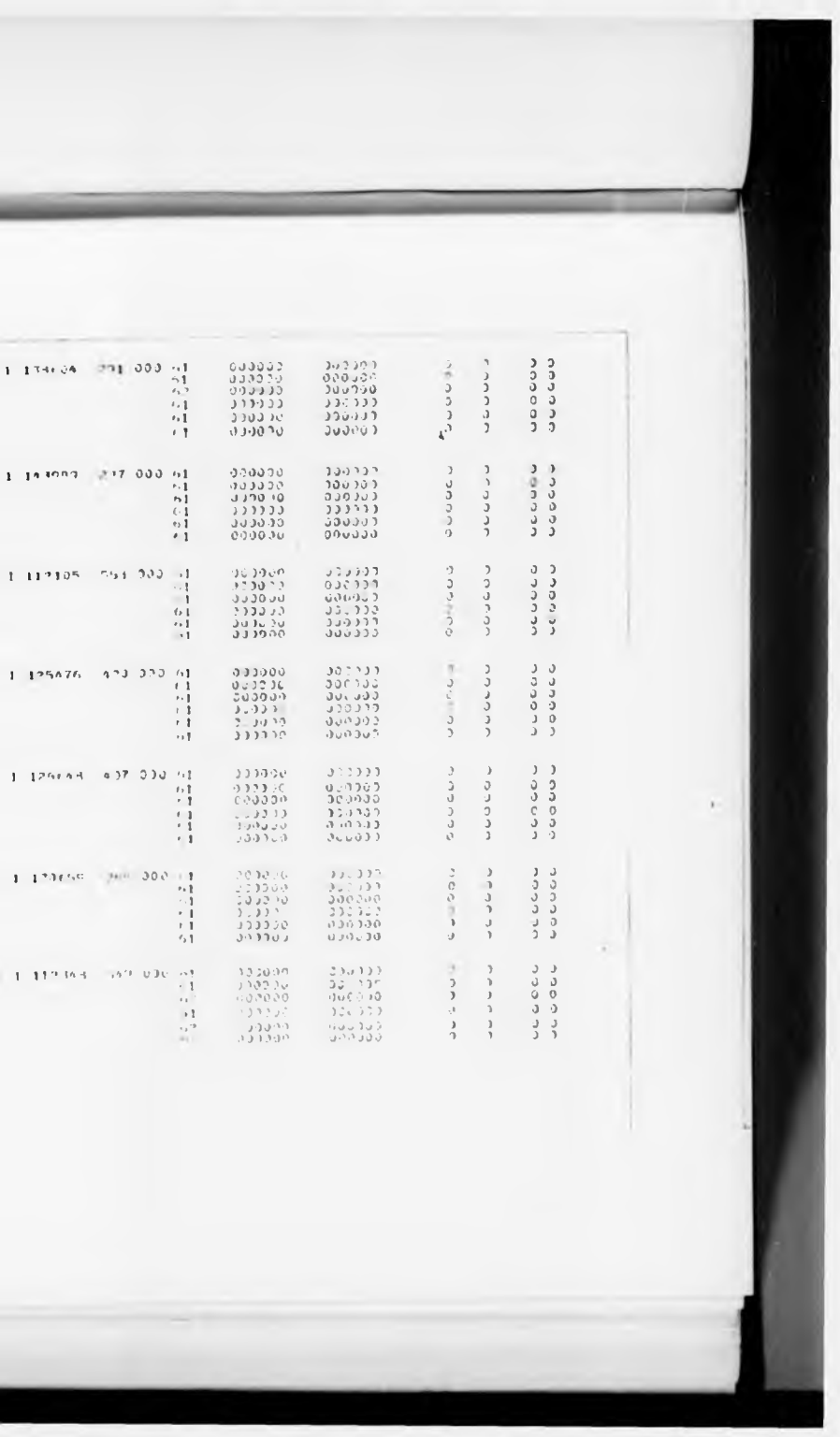
106062	514	210	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
111182	361	300	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
119600	498	000	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
123825	449	001	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
111506	537	009	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
118736	349	300	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
114191	549	307	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	

700359	1451	602	314	392	00	14391	A		5911	6611	13	20	T	A
700363	1707	730	315	362	00	5748	A		5911	6611	5	17	T	D
700372	1791	786	361	470	02	956	A		5905	6611	12	25	T	S
700393	1656	627	234	392	10	3337	A		5734	6611	3	54	T	D
700410	1303	816	335	402	00	8512	A		5935	6611	8	17	T	S
700468	1693	742	345	452	00	15047	A		5911	6611	2	4	T	S
700473	1714	565	152	391	03	11424	A		5934	6611	4	17	T	S





733492	1753	837	435	501	03	13021	A	6335	6611	5	12	T	5	1
733522	1664	674	371	465	03	14457	A	5011	6611	6	12	T	4	1
733530	1737	734	371	445	00	7006	A	5633	6611	13	19	T	3	1
733565	1481	722	317	474	00	3736	A	5417	6611	7	15	T	4	1
733594	1656	737	357	434	00	15667	A	5636	6611	13	20	T	5	1
733599	1429	797	471	565	03	13462	A	5323	6611	7	16	T	4	1
733615	1722	747	427	415	03	2966	A	5333	6611	3	16	T	4	1



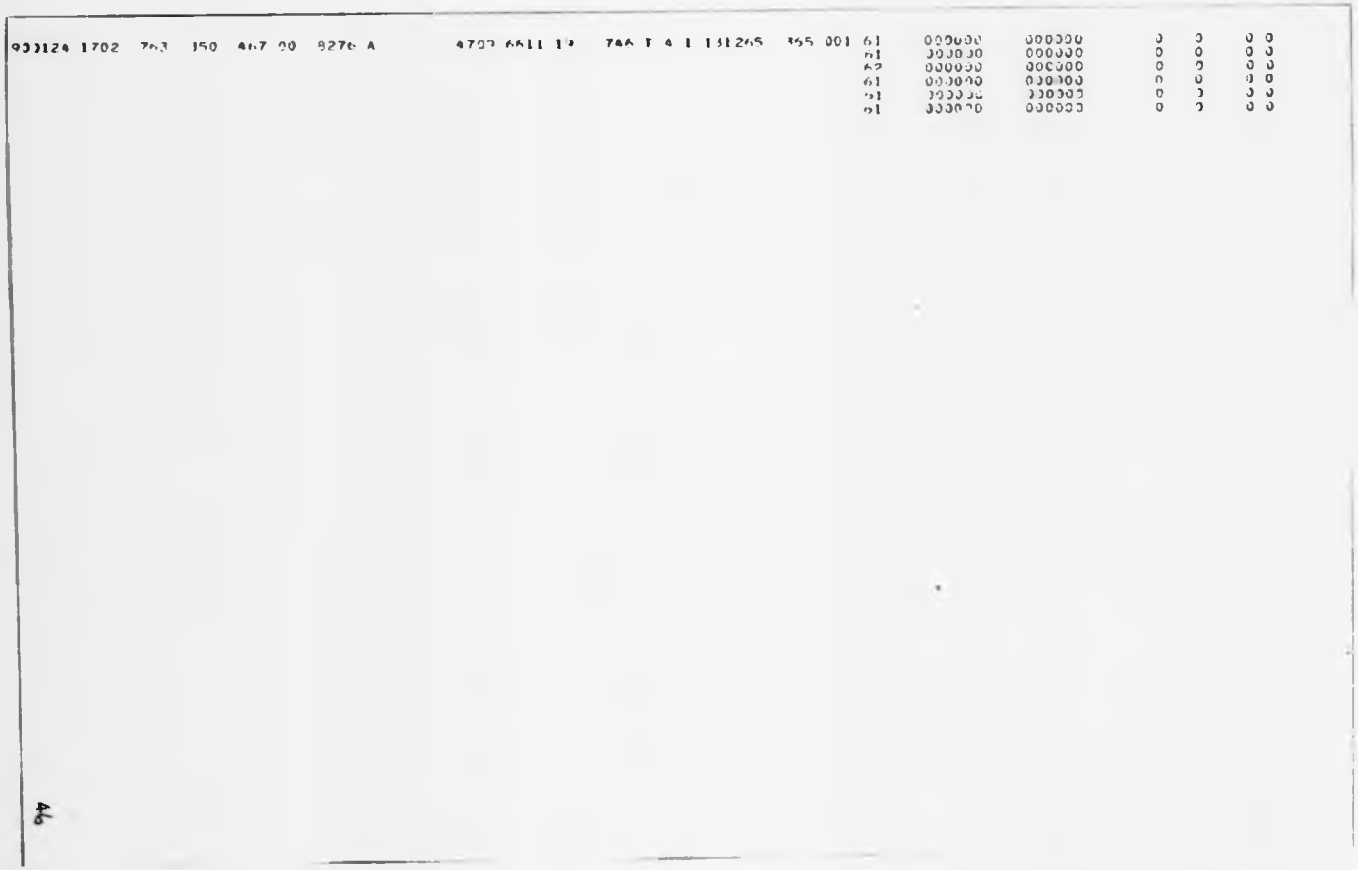
833331	1937	337	500	569	00	5587	A		5710	6611	3	19	T
833334	1646	674	373	433	00	6583	A		6631	6611	2	9	T
833349	1664	574	365	752	10	8755	A		5635	6611	10	20	T
833370	1737	692	371	435	00	7559	A		6001	6611	3	19	T
833391	1552	556	273	304	00	7606	A		5737	6611	3	23	T
833397	1703	555	351	424	00	6576	A		5303	6611	7	26	T
833415	1727	495	371	382	00	5884	A		5806	6611	3	16	T

177864	295	001	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	1
132050	344	101	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
144153	245	102	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
109601	502	002	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
121787	460	003	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			65	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
140544	272	030	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
116271	514	002	61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	1
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	

800126	1908	335	393	486	10	6006	A		6005	6611	6	31	T	A
800147	1753	667	135	472	15	4000	A		6003	6611	6	13	T	S
803171	1753	319	405	499	10	1466	A		6110	6611	5	15	T	A
933333	1635	355	215	304	20	15677	A		4035	6611	26	2807	T	A
933311	1630	767	306	430	10	5939	A		4230	6611	28	12	T	S
933325	1803	718	503	521	00	13327	A		6336	6611	3	26	T	A
933339	1702	457	287	406	12	3640	A		6030	6611	33	153	T	A

	119037	437	000	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
	143019	274	000	41	000000	000000	0	0	0	0	
				41	000000	000000	0	0	0	0	
				42	000000	000000	0	0	0	0	1
				41	000000	000000	0	0	0	0	
				41	000000	000000	0	0	0	0	
				42	000000	000000	0	0	0	0	
	127751	430	001	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
1	105570	622	002	61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				63	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
1	104192	526	001	63	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	1
				63	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
1	115262	525	001	62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	1
				63	000000	000000	0	0	0	0	1
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
1	122011	448	000	61	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				61	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	
				62	000000	000000	0	0	0	0	

900041	1753	588	336	840	11	161	A	4507	6611	21	592	T	S	
900042	1689	864	477	572	00	15648	A	6504	6611	1		T	0	
900054	1551	716	359	422	00	3067	A	4735	6611	19	65	T	0	
900068	1737	389	206	274	10	11888	A	4305	6611	26	61	T	S	
900075	1689	720	255	300	20	13352	A	3904	6611	27	2136	T		
900116	1691	324	292	383	12	11608	A	4604	6611	20	65	T	S	
900122	1676	504	337	415	00	15067	A	4604	6611	20	211	T		


930124 1702 763 150 467 00 9276 A 4703 6511 12 746 T 4 1 131265 355 001
61 000000 000000 0 0 0 0
61 000000 000000 0 0 0 0
61 000000 000000 0 0 0 0
61 000000 000000 0 0 0 0
61 000000 000000 0 0 0 0
61 000000 000000 0 0 0 0

COHORT "A"

"Normals": Dead

pp. 48 - 50

[illegible]	[illegible]	330	01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
110629	572	302	01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
116459	513	331	01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	1
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
122773	433	333	41	0000000	0000000	0	0	0	0	
			41	0000000	0000000	0	0	0	0	
			42	0000000	0000000	0	0	0	0	1
			41	0000000	0000000	0	0	0	0	
			41	0000000	0000000	0	0	0	0	
			42	0000000	0000000	0	0	0	0	
104564	612	331	01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	1
			02	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
127742	135	111	01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
121497	415	301	01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	
			01	0000000	0000000	0	0	0	0	
			02	0000000	0000000	0	0	0	0	

10823	1664	773	330	394	02	7948	D	73	157	4709	6611	12		69	T	4
900004	1613	639	242	355	12	14979	D	72	161	4401	6611	18		124	T	4
80425	1702	971	315	390	10	11198	D	75	162	3302	6611	33		430	A	4
200042	1707	767	362	468	00	15655	D	75	162	5207	6611	14		27	A	4
200380	1727	826	301	411	00	2405	D	70	162	3502	6611	31		102	A	4
300146	1689	963	364	429	10	6491	D	73	162	4709	6611	19		64	T	4
400029	1829	946	368	445	23	2537	D	73	162	4703	6611	19		368	T	4

302307	1600	640	221	298	10	1880	D	72	177	3703	6611	20	387	T	S		
101218	1748	650	348	494	00	4098	D	70	139	4707	6611	19	39	A	A		
100415	1732	720	432	494	00	13474	D	74	202	4604	6611	20	153	A	3		
330724	1638	671	259	326	20	15522	D	74	202	1713	6611	27	169	T	S		
301743	1914	957	135	269	21	21488	D	74	331	3406	6611	25	895	T	S		
10912	1707	826	202	284	10	17619	D	71	420	3731	6611	22	214	T	S		
90120	1671	599	304	297	00	13114	D	72	420	1907	6611	29	1135	T	S		

274	F	A	1	105921	625	003	01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
10	F	A	1	108152	591	002	01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
128	A	S	1	126745	410	001	02	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
128	A	0	1	104776	530	002	01	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
26	F	A	1	106447	611	000	01	0000000	0000000	0	0	0	0
							02	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
14	F	Z	1	115941	517	000	01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
24	F	S	1	110259	324	000	01	0-0000000	0-0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0
							01	0000000	0000000	0	0	0	0

33283	1689	611	243	343	00	8561	0	71	420	4336	6611	23
90254	1727	610	282	378	00	8159	0	74	420	7737	6611	1
101016	1792	819	371	444	00	12042	0	74	420	4304	6611	22
230461	1613	562	254	320	20	5732	0	73	420	2403	6611	42
330305	1651	753	276	365	00	11319	0	68	420	3603	6611	23
600046	1753	393	329	447	00	11317	0	74	420	5738	6611	1
302155	1731	747	417	502	00	10??	0	73	4??	????	6611	?

COHORT "A"

"Less-than-normals": Alive

pp. 52 - 134

54	1664	655	223	373	00	14855	A	2707	6611	16	185	T	4	2	107262	633	110	61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		62	000000	000000		0	0		0	0
																		62	000000	T01011010		0	0		0	0
																		61	000000	000000		0	0		0	0
																		62	000000	000000		0	0		0	0
10024	1646	645	258	372	02	10346	A	4410	6611	17	116	T	1	2	118000	436	000	61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	T01001001		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
10040	1626	676	226	318	00	9148	A	2907	6611	28	172	T	5	2	108828	587	000	61	000010	T10001001	=	0	0		0	0	1
																		61	000000	000000		0	0		0	0
																		61	000000	000000	B	0	0		0	0
																		61	000000	T01011001		0	0		0	0	1
																		61	000000	000000		0	0		0	0	1
																		61	000000	000000		0	0		0	0
10043	1681	627	315	420	00	9783	A	3611	6611	17	315	T	4	2	117737	409	000	61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	000000		0	0	L	1	0
																		61	000000	000000		0	0		0	0
																		61	000000	T10010000		0	0	L	1	0
																		61	000000	000000		0	0		0	0
10115	1727	207	350	447	00	13790	A	4207	6611	14	78	T	5	2	126064	405	002	61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		62	000000	000000	F	0	0		0	0
																		61	000000	T01011000		0 F	0		0	0
																		62	000000	000000		0	0		0	0
																		62	000000	000000		0	0		0	0
10124	1702	756	336	464	00	14104	A	3707	6611	14	40	T	0	2	120532	471	000	61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		61	000000	000000		0	0		0	0
																		62	000000	000000		0	0		0	0
																		61	000000	000000		0	0	G	1	0
10165	1613	553	207	257	10	5171	A	2304	6611	16	757	T	0	2	101526	653	002	61	000000	000000		0	0		0	0
																		62	000000	000000		0	0		0	0
																		62	P01010000	000000		0	0		0	0	1
																		61	000000	T01111011		0	0		0	0
																		61	000000	000000	n	0	0		0	0	1
																		61	000000	000000		0	0		0	0

52

2 107650	603 030	32	000000	000000		0	0	0	0		
		33	000000	000000	L	1	0	0	0	1	
		33	000000	000000		0	0	0	1	1	
		33	000000	T111111111	H	1	1	0	0		
		33	000000	000000		0	0	0	0		
		32	000000	000000		0	0	0	0		
2 130779	365 030	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	T01011001		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
2 117801	495 030	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	000000		0	0	0	1	1	
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	000000		0	0	0	0		
2 105723	431 001	31	000000	T01001001		0	0	0	0		
		31	000000	501001001		0	0	0	0		
		31	000000	000000		0	0	0	0	1	
		31	000000	000000		0	0	0	0		
		31	000000	000000		0	0	0	0		
		31	000000	000000		0	0	0	0		
2 104679	439 030	31	000000	501001000		0	0	0	0		
		31	000000	000000		0	0	0	0		
		32	000000	000000		0	0	0	0		
		31	000000	T01001001		0	0	0	0		
		31	000000	000000		0	0	0	0		
		32	000000	000000		0	0	0	0		
2 105156	422 001	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	T01001001		0	0	0	0		
		61	000000	T11011111		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
2 114452	510 030	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	T01001001		0	1	0	0		
		61	000000	T11111111		0	0	0	0		
		62	000000	501001001		0	0	0	0		
		61	000000	000000		0	0	0	0		

10185	1587	987	196	257	00	14450	A		2503	6611	14	758 T 2
10206	1626	659	322	378	10	13893	A		5310	6611	9	19 T 4
10207	1476	846	310	369	00	2670	A		4513	6611	13	209 T 3
10293	1686	702	233	359	10	7604	A		2036	6611	39	480 T 5
10299	1753	940	249	342	00	2210	A		2436	6611	33	373 T 3
10311	1664	735	340	406	00	2917	A		4207	6611	23	98 T 3
10341	1765	600	233	378	00	12129	A		4713	6611	33	249 T 5

S

0 0	0	0	000000	000000	19	
0 0	0 1	0 1	000000	000000	19	
1 0	0	0 1	100100011	000000	19	
0 0	0	0 1	000000	000000	29	
0 0	0 1	0	000000	000000	19	
0 0	0	0 1	000000	000000	19	000 205
0 0	0	0	001001101	00000000	11	
0 0	0	0	000000	000000	19	
0 0	0	0	110111011	000000	29	
0 0	0	0	010110011	00000000	21	
1 0 0	0	0	000000	000000	11	
0 0	0	0	110110215	000000	11	110 209
0 0	0	0	000000	000000	29	
0 0	0	0	000000	000000	19	
0 0	0	0	100110101	000000	19	
1 0	0	0	100100100	000000	29	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	100 159
0 0	0	0	000000	000000	19	
0 0	0	0	000000	100100100	19	
0 0	0	0	000000	100110100	19	
1 0 0	0	0	000000	000000	29	
0 0	0	0	100100100	000000	19	
0 0	0	0	110110011	100110100	19	100 025
0 0	0	1 34	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0 34	110110101	000000	19	
1 0 0	0	0H 3	000000	000000	29	
0 0	0	0 3	000000	000000	19	
0 0	0	1 34	000000	000000	19	000 9[illegible]
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	110111101	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	000 125
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	
0 0	0	0	000000	000000	19	000 0[illegible]

13421	1707	699	403	584	33	11699	A		4711	6611	13	33	T	4	2 124432
10463	1924	903	241	725	00	17482	A		4536	6611	21	27	T	2	2 110174
10509	1740	823	353	495	20	14422	A		3409	6611	11	120	T	5	2 124079
10624	1791	841	217	725	22	1685	A		4109	6611	14	131	T	4	2 115664
13657	1858	1068	407	488	10	6157	A		4439	6611	19	56	T	5	2 122365
10663	1651	835	289	396	00	13097	A		4537	6611	23	158	T	2	2 127743
13685	1773	751	347	448	20	12384	A		4203	6611	16	130	T	5	2 117239

6 T A 2 121747	448	030	61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
			61	000000	000000		0	0	L	1	0		
			61	000000	000000		0	0		0	0		
348 T 5 2 105862	626	032	31	000000	S010111C1		0	0		0	1		
			31	00000000	S01101901		0	0		0	1		
			31	00000000	00000000		0	0		0	2		
			31	000000	000000		0	0		0	0	1	
			31	000000	000000		0	0		0	0	1	
			31	00000000	000000		0	0		0	0	1	
249 T 4 2 113432	479	033	61	000000	T1130101I		0	0		0	0		
			62	000000	000000		0	0		0	0		
			61	000000	T1111111I		0	0		0	0		
			61	000000	T110111I1		0	0		0	0	1	
			61	000000	T110100I0		0	0		0	1		
			61	001000100	000000		0	0		0	0		
80 T 4 2 112118	553	031	62	000000	T010011C1		0	0		0	0		
			61	000000	000000		0	0		0	0		
			62	000000	000000		0	0		0	0	1	
			61	000000	T1111101I	L	1	0		0	0		
			62	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
258 T 1 2 107090	632	110	61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0	1	
			62	000000	000000		0	0		0	0	1	
			61	000000	T010C1001		0	0		0	1		
			62	000000	000000		0	0		0	0		
			62	000000	000000		0	0		0	1		
26 T 4 2 122673	447	130	61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
			62	000000	000000		0	0		0	1		
			61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	0		
47 T 3 2 114426	609	032	61	000000	000000		0	0		0	0		
			62	000000	000000		0	0		0	0		
			61	000000	000000		0	0		0	1		
			61	000000	U010011C1		0	0		0	1		
			61	000000	000000		0	0		0	1		
			61	000000	000000		0	0		0	0		

13697	1702	771	373	461	00	1176	A	4624	6611 13
10713	1656	665	152	305	20	13912	A	4502	6611 19
13723	1664	642	245	313	00	4565	A	4539	6611 23
10762	1676	948	212	253	00	12178	A	4706	6611 9
13775	1676	312	232	295	13	256	A	4513	6611 13
13809	1671	598	430	527	00	2666	A	5506	6611 11
13918	1651	321	234	291	00	333	A	2613	6611 11

4	2	111494	555	000	01	000000	000000		0	0		0	1	
					01	000000	000000		0	0		0	0	
					02	000000	000000		0	0		0	1	1
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
5	2	111997	554	001	01	000000	000000		0	0	P	0	1	
					01	000000	000000	F	1	0		0	1	
					01	000000	000000		0	0	H	1	0	1
					01	000000	000000		0	0	H	1	0	
					01	000000	000000		0	0	F	1	1	
					01	000000	000000		0	0	H	1	0	1
4	2	107607	597	002	01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
					02	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
4	2	112214	350	010	01	000000	000000		0	0		0	1	
					01	000000	000000	A	0	0		0	0	1
					02	000000	000000		0	0		0	1	
					01	000000	000000		0	0		0	0	1
					01	000000	000000		0	0		0	1	1
					02	000000	000000		0	0		0	0	1
4	2	103239	540	000	01	000000	000000		0	0		0	1	
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	1
					01	000000	000000		0	0		0	0	
					01	000000	000000		0	0		0	0	
5	2	114515	529	001	01	000000	000000		0	0		0	0	1
					01	000000	000000		0	0		0	0	
					01	000000	000000	F	1	0		0	1	1
					01	000000	000000		0	0		0	0	1
					01	000000	000000		0	0		0	0	
					02	000000	000000		0	0		0	0	
5	2	108120	533	001	01	000000	000000		0	0		0	1	
					01	000000	000000	L	0	0		0	1	
					01	000000	000000		0	0		0	1	
					01	000000	000000		0	0		0	1	
					01	000000	000000		0	0		0	0	

10828	1451	707	311	428	10	11580	A		3113	6611	21	552 T
13881	1681	738	266	319	23	14846	A		4401	6611	22	210 T
10882	1714	802	262	353	22	13577	A		1302	6611	23	1455 T
13883	1722	789	349	452	00	13923	A		5132	6611	15	45 T
13991	1737	739	287	391	00	4240	A		3733	6611	21	900 T
10301	1727	725	230	355	10	7595	A		5204	6611	14	152 T
10305	1639	634	240	324	20	5396	A		3410	6611	22	165 T

61	T	4	2	114865	528	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
							61	000000	000000	0	0	0 0 1
							61	000000	T01000001	0	0	0 0 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
8	T	0	2	143734	239	001	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	T01001001	0	0	0 0
							61	000000	T10001000	0	0	0 0
							61	000000	000000	0	0	0 0
21	T	0	2	136876	335	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	P01011001	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
412	T	3	2	120300	473	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	T01011011	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
637	T	0	2	122429	452	000	61	000000	000000	0	0	0 1 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 1 1
							61	000000	000000	0	0	0 0 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
21	T	5	2	134391	353	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							61	P01011001	T10011001	0	0	0 0
							62	000000	T01001000	0	0	0 0
							61	010100110	000000	0	0	0 0
21	T	4	2	124620	430	000	61	000000	T01001001	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0

11008	1675	733	267	341	00	4303	A	5004	6611	13
11010	1748	709	395	455	02	15052	A	6203	6611	4
11014	1581	748	356	379	00	10921	A	5536	6611	9
11013	1597	598	326	423	00	12047	A	4907	6611	21
11029	1603	490	303	332	00	5386	A	4039	6611	26
11030	1626	758	323	398	00	13405	A	5137	6611	6
11034	1791	374	376	450	00	15684	A	5429	6611	2

12003	1727	805	238	306	10	5107	A	4601	6611	18	224	T	0	2	121392	462	002	61	000000	000000		0	0	0	0	
																		61	000000	000000		0	0	0	0	
																		62	001010000	000000		0	0	0	0	1
																		62	T01111011	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
40205	1714	828	250	318	10	2040	A	2305	6611	29	316	T	4	2	105359	521	100	61	000000	T01001001		0	0	0	0	
																		61	000000	T01001001		0	0	0	0	
																		62	000000	000000		0	0	0	0	
																		62	000000	T01001001		0	0	0	0	
																		61	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
40215	1681	707	276	320	00	7570	A	1807	6611	36	343	T	1	2	106540	610	001	62	000000	T01100001		0	0	0	0	
																		61	000000	T11011011	E	0	0	0	0	
																		63	000000	000000	F	0	0	0	0	
																		62	000000	T10011001		0	0	0	0	1
																		61	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
40216	1681	782	283	355	10	14330	A	4607	6611	15	145	T	5	2	120489	46?	000	61	000000	000000		0	0	0	0	
																		61	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
																		61	000000	T10111011		0	0	0	0	
																		62	000000	T10001001		0	0	0	0	
																		61	000000	000000		0	0	0	0	
30004	1605	604	236	340	20	3729	A	4231	6611	22	175	T	4	2	113470	544	000	61	000000	T11011011		0	0	0	0	
																		62	000000	T01011011		0	0	0	0	
																		62	000000	T22011011		0	0	0	0	
																		61	000000	T01111011		0	0	0	0	
																		61	011010010	000000		0	0	0	0	
																		61	001100100	000000		0	0	0	0	
80008	1714	982	369	396	00	13439	A	2906	6611	31	71	A	4	2	105664	621	002	61	000000	000000		0	0	0	0	
																		62	000000	T01001001		0	0	0	0	1
																		62	000000	000000		0	0	0	0	
																		61	000000	000000		0	0	0	0	1
																		61	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	
80009	1714	975	205	249	00	1160	A	2905	6611	27	601	A	0	2	107040	607	000	63	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	1	1
																		63	000000	000000		0	0	0	1	1
																		62	000000	T01011011		0	0	0	1	1
																		61	000000	000000		0	0	0	0	
																		62	000000	000000		0	0	0	0	

5	2	120182	471	001	61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	101001000		0	0	0	0	0	1
					61	000000	101011000		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
5	2	105995	615	000	31	000000	000000		0	0	0	1		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	1	1	
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	1	0		
					31	000000	000000		0	0	0	0	1	
0	2	104937	636	101	31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0	1	
					31	000000000	101111011		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
1	2	110146	572	000	61	000000	000000	L	1	1	0	0	0	
					61	000000	000000	L	0	0	1	0	0	1
					61	000000	000000	1	1	L	0	0	1	
					61	000000	000000	0	1	0	0	0	0	
					61	000000	000000	LL	0	0	0	0	0	1
					61	000000	000000		0	0	0	0	0	
2	2	107247	612	002	31	000000	101011001		0	0	0	0	0	
					31	000000	000000		0	0	0	0	0	
					31	000000	101001100		0	0	0	0	0	
					31	000000000	101011001		0	0	0	0	0	
					31	000000	000000		0	0	0	0	0	
					31	000000	000000		0	0	0	0	0	
4	2	113463	475	000	61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	
					61	000000	101001001		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	
1	2	106773	637	011	61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	1	1
					61	000000	000000		0	0	0	0	0	
					61	000000	000000		0	0	0	0	0	1
					61	000000	000000		0	0	0	0	0	

80023	1681	763	261	335	20	1557	A	3704	6611	39	361 T
80024	1737	667	214	281	00	6803	A	2308	6611	15	225 T
80033	1732	751	308	389	10	8247	A	1911	6611	31	2390 T
80044	1702	873	256	335	00	8181	A	2504	6611	32	2304 T
80069	1634	633	193	325	10	8970	A	2704	6611	27	2024 T
80073	1727	689	292	440	00	1474	A	3733	6611	13	124 T
80377	1570	519	236	296	10	11341	A	2102	6611	43	111

	0	0		0		1	1	000000	000000
	0	0		1		0	1	100100111	000000
	0	0		0		0		000000	000000
	1	0		0		0	1	000000	000000
1	0	0		0		0		000000	000000
1	1	1	1	0	1	0	1	100100101	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		1		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
1	0	0		0		0		100110011	000000
1	0	0		0		0		000000	000000
1	0	0		0		0		100100101	000000
	0	0		0		0		100100011	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	1	0		0		0		110111121	000000
1	0	0		0		0		100100101	000000
	0	0		0		0		000000	000000
	0	0		0		0		110110101	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		1		000000	000000
	0	1		1		1		000000	000000
	0	0		0		1		000000	000000
	0	0		0		2		100100101	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		100100101	000000
1	0	0		0		0		000000	000000
1	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		100100101	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000
	0	0		0		0		000000	000000

80089	1714	749	333	411	00	10760	A	3704	6611	23	141	T	5	2	116312	512	000	61 61 62 61 62 61
90092	1656	905	238	283	00	596	A	1906	6611	33	225	T	4	2	101837	657	000	61 61 62 61 62 61
90093	1631	731	198	275	10	15648	A	2709	6611	21	50	T	4	2	107640	539	002	41 41 41 41 41 41
80096	1676	866	332	390	10	10632	A	4301	6611	12	292	T	1	2	119626	490	101	61 61 62 62 61 62
90103	1727	700	240	295	00	5657	A	2603	6611	11	114	T	5	2	104854	527	001	61 61 62 61 62 62
90107	1740	833	192	331	20	6419	A	3306	6611	17	1364	T	5	2	119565	477	002	61 61 61 61 61 62
90111	1600	712	283	463	00	7403	A	2827	6611	7	17	T	2	2	112156	552	000	61 61 61 61 62 61

80117	1531	863	227	292	13	8428 A	3404	6611 18
80128	1651	746	177	269	12	3339 A	2610	6611 35
80165	1664	776	245	313	13	9293 A	4510	6611 13
80166	1624	790	173	251	00	13042 A	2900	6611 14
80173	1681	954	131	250	13	9980 A	3610	6611 35
80178	1748	802	325	483	00	12480 A	4630	6611 14
80194	1631	609	332	789	33	4561 A	4731	6611 14

40185 1612 694 339 358 03 8564 A	2633 6611 38 331 T 4 2 103979	574 000	51	000000	101001001		0	0		0	0	
			61	000000	000000		0	0		0	0	
			62	000000	000000		0	0		0	0	
			61	000000	T10001001		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
40183 1549 523 258 316 00 128 A	2710 6611 30 1650 T 3 2 104854	617 002	61	000000	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	F01010000	000000		0	0		0	0	1
			61	P01111001	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	P01100000	T10001000		0	0		0	0	
40193 1638 861 189 282 00 14762 A	2706 6611 38 244 T 5 2 105317	622 001	31	000000	110001001	0	0	0		0	0	
			42	000000	000000		0	0		0	0	
			13	000000	T10011010		0	0	F	1	0	1
			32	000000	T10111011		0	0	F	1	0	
			12	000000	000000		0	0		0	0	
			32	00000000	00000000	F	1	0		0	0	
40194 1638 678 246 316 00 1393 A	2305 6611 15 531 T 4 2 108037	595 001	61	000000	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	000000	000000	1	0	0		0	0	
			61	000000	T01001001		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
40197 1753 867 253 347 10 8424 A	2337 6611 40 490 T 5 2 104295	610 000	61	000000	121011011	L	0	0		0	0	
			61	000000	000000	L	0	0		0	0	
			62	000000	U11011000	L	0	0		0	0	
			61	000000	T1111011	L	0	0		0	0	
			62	000000	000000		0	0		0	0	
			62	000000	000000		0	0		0	0	
40224 1689 952 245 351 00 6573 A	3031 6611 15 91 T 4 2 113566	478 000	61	000000	000000		0	0		0	0	
			61	000000	501001001		0	0		0	0	
			62	000000	000000	H	0	0		0	0	1
			61	000000	T10011011		0	0		0	0	
			61	000000	000000		0	0		0	0	
			61	000000	000000		0	0		0	0	
40229 1587 647 267 313 03 9671 A	2699 6611 23 221 T 5 2 113791	569 023	61	000000	000000	H	1	0		0	0	
			61	000000	U01011000		0	H 0		0	0	
			61	000000	T11010012	H F	1	1 0		0	0	1
			61	000000	T01011012		1	L 0		0	0	
			61	P10010010	000000	H H	0	H 0		0	1	
			61	000000	000000		0	0		0	0	

563	002	61	000000	000000	FP	1	0	0	0
		62	000000	000000	P	0	0	0	0
		62	000000	000000	EE	1	0	0	0
		61	000000	101011001	FP	1	0	0	0
		61	000000	000000	EE	1	0	0	0
		62	000000	000000	EE	2	0	0	0
543	001	61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
		62	000000	000000		0	0	0	0
		61	000000	101001001		0	0	0	0
		61	000000	000000		0	0	0	0
		62	000000	000000		0	0	0	0
647	100	61	000000	101001011		0	0	0	0
		61	000000	110001001		0	0	0	0
		62	000000	101011011		0	1	0	1
		61	P10011011	000000		0	0	0	0
		62	000000	110011010		0	1	0	0
		61	000000	000000		0	0	0	0
570	101	61	000000	000000		0	0	0	0
		61	000000	111001001		0	0	0	0
		61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
		61	P01100000	000000		0	0	0	0
[illegible]	000	61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
		61	000000	000000	8	0	0	0	0
		61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
		61	000000	000000		0	0	0	0
[illegible]	[illegible]	31	000000	S10021001		0	0	0	0
		31	000000	000000		0	0	0	0
		32	000000	000000		0	0	0	0
		31	000000	111111011		0	0	0	0
		31	000000	000000		0	0	0	0
		32	000000	000000		0	0	0	0
[illegible]	011	62	000000	[illegible]011011		0	0	L1	0
		61	000000	000000		0	0	L2	0
		62	000000	L11011011		0	0	FL2	0
		61	000000	110011011		0	0	L1	0
		61	000000	000000		0	0	L1	0
		[illegible]	000000	000000		0	0	X2	0

80233	1580	574	236	294	10	1311	A	3734	6611	14	214	T	3	2	110473
80238	1740	992	330	406	10	3477	A	3705	6611	1	5	T	5	2	113073
80239	1544	671	227	272	02	11346	A	4304	6611	1	6	T	4	2	102765
80245	1651	536	140	255	20	2659	A	2910	6611	1	4	T	4	2	100354
80253	1587	533	328	420	00	3919	A	2933	6611	3	40	T	2	2	103391
80259	1651	679	250	303	00	14605	A	1430	6611	11	104	T	4	2	105017
80287	1697	921	326	433	20	15653	A	2604	6611	20	209	A	5	2	104314

438	A	4	2	105892	619	001	42	000000	000000	0	0		0	0	
							41	000000	000000	0	0		0	0	
							42	000000	000000	0	0		0	1	
							41	000000	000000	0	0		0	0	
							41	000000	000000	0	0		0	0	
							42	000000	000000	0	0		0	0	
308	T	5	2	101771	656	003	61	000000	101001001	0	0	5	0	0	
							61	000000	000000	0	0		1	0	
							61	001001000	000000	0	0		1	0	
							61	000000	111001001	0	0		1	1	1
							61	000000	101001000	0	0		1	0	
							62	000000	000000	0	0	8	1	0	
73	T	3	2	114504	526	001	62	000000	000000	0	0		0	0	1
							62	000000	000000	0	0		0	0	1
							62	000000	000000	0	0		0	1	1
							62	000000	101001001	0	0		0	1	1
							62	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	1	
1413	T	4	2	106537	608	000	62	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	0	
							61	000000	101011001	0	0		0	0	
							61	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	0	
305	A	0	2	118392	533	000	61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
41	A	4	2	120247	475	001	61	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	0	
							62	000000	000000	0	0		0	0	
							61	000000	101001001	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
35	A	0	2	105661	621	002	61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	1	
							61	000000	000000	0	0		0	0	
							61	000000	000000	0	0		0	0	

80335	1486	592	196	253	10	15663	A	7013	6611	22
80438	1690	684	243	280	00	4749	A	2713	6611	31
80524	1575	721	318	353	00	8177	A	3601	6611	13
80525	1613	646	210	258	10	12689	A	1411	6611	43
100010	1803	709	342	454	10	7447	A	3523	6611	31
100029	1773	746	285	359	11	10538	A	5131	6611	15
100043	1924	814	404	478	01	8691	A	4335	6611	17

130 A 2 2 104095	643 301	32	000000	5013031001		0	0	0	2			
		32	000000	0000000 A		0	0	0	0			
		32	0000000	0000000		0	0	0	1	1		
		32	0000000	0000000	PLP2	0	0	0	1	1		
		32	0000000	0000000		0	0	0	2			
		31	000000	000000		0	0	0	0			
339 A 4 2 104740	630 303	62	000000	5013031001		0	0	0	0			
		62	000000	5011111111		0	0	0	0			
		63	000000	000000		0	0	0	0	1		
		62	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
127 A 4 2 117317	504 100	61	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
		63	000000	000000		0	0	0	0	1		
		62	000000	1310013131		0	0	0	0			
		61	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
360 A 5 2 109171	546 003	61	000000	1010013001		1	0	0	0			
		62	000000	000000		0	0	0	0			
		63	000000	000000		0	0	0	0	1		
		61	000000	000000		0	0	0	0	1		
		61	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
509 A 4 2 117026	404 002	61	P010130010	000000		0	0	0	0			
		61	000000	5010011001		0	0	0	0	1		
		62	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	P010000100	000000		0	0	0	0			
497 A 1 2 104773	533 000	63	000000	5013111011		0	0	0	0	1		
		62	000000	000000		0	0	0	0	1		
		63	000000	000000		0	0	0	0	1		
		62	000000	000000		1	0	0	1	1		
		62	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
18 A 5 2 105562	320 300	61	000000	000000		0	0	0	0			
		62	000000	000000		0	0	0	0			
		63	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	1010100000		0	0	0	0			
		61	000000	000000		0	0	0	0			

100041	1679	762	210	298	13	762	A	1633	6611	12
100076	1595	704	140	216	00	11313	A	1934	6611	32
100127	1697	736	303	366	10	12666	A	4410	6611	21
100128	1702	795	260	327	10	11965	A	2700	6611	35
100149	1727	692	262	171	00	8372	A	3613	6611	24
100174	1631	735	205	277	00	1090	A	2635	6611	30
100181	1639	601	334	450	00	4136	A	5536	6611	0

7	146 A 0 2 117851	439 000	62	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			63	000000	000000	0	0	0	0	1		
			61	000000	T01001001	0	0	0	0			
			62	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
4	7 A 4 2 135287	326 100	61	000000	T10011011	0	0	0	0			
			61	000000	000000	0	0	0	0			
			62	000000	U2101101I	0	0	0	0	1		
			62	000000	T01011011	0	0	0	0			
			61	011011000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
11	720 A 4 2 111906	556 001	61	000000	T01001001	0	0	0	0			
			62	000000	S01011011	0	0	0	0	1		
			62	000000	000000	0	0	0	0	1		
			61	000000	T01001011	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
35	1229 A 4 2 115312	545 137	61	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0	1		
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
1	3 A 4 2 134190	742 000	61	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0	1		
			61	000000	000000	0	0	0	0			
1	2 A 4 2 142670	256 000	61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			
43	548 A 4 2 119461	640 000	61	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			62	000000	000000	0	0	0	0			
			61	000000	T01001001	0	0	0	0			
			61	000000	000000	0	0	0	0			
			61	000000	000000	0	0	0	0			

133192	1753	890	335	421	00	8424	A	4924 6611
133193	1732	748	391	440	00	5321	A	5506 6611
133198	1676	755	193	239	10	4932	A	3509 6611
133214	1664	735	278	337	00	1136	A	3003 6611
133223	1689	628	401	440	00	14342	A	6505 6611
133240	1732	773	416	505	10	15681	A	6536 6611
133242	1676	735	329	364	07	2332	A	2501 6611

10	A	S	2	119312	444	002	41	000000	000000		0	0	0	0
							62	000000	000000	L	1	0	0	0	1
							63	000000	000000		0	0	0	0	1
							62	000000	T01001021		0	0	0	0	
							52	000000	000000		0	0	0	0	
							01	000000	000000		0	0	0	0	
	A	0	2	144454	234	000	41	000000	S01001001		0	0	0	0	
							41	000000	000000		0	0	0	0	
							41	000000	000000		0	0	0	0	
							41	000000	000000		0	0	0	0	
							41	000000	000000		0	0	0	0	
							42	000000	000000		0	0	0	0	
183	A	4	2	126292	414	001	61	000000	1010111111		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	S01001001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							01	000000	000000		0	0	0	0	
122	A	4	2	103164	646	001	61	000000	T01001001	FL	1	1	0	0	
							62	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	1
							61	P1011111	T1011111		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
	A	S	2	1	317	001	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	1	
							61	000000	T01011111		0	0	0	0	
							01	000000	T01010000		0	0	0	0	
							01	000000	000000		0	0	0	0	
121	A	S	2	103	593	001	61	000000	000000	P	0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
71	A	4	2	145393	123	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	1	
							62	000000	000000		0	0	0	1	
							61	000000	000000		0	0	0	1	
							01	000000	000000		0	0	0	0	
							01	000000	000000		0	0	0	0	

100245	1949	934	326	384	10	3138	A		4504	6611 15
100261	1681	707	367	469	00	15650	A		6609	6611
100266	1676	543	247	360	11	9088	A		4509	6611 20
100284	1946	795	280	345	20	12579	A		1701	6611 49
100285	1697	642	254	300	00	10914	A		6430	6611 2
100286	1664	934	413	365	00	13605	A		2702	6611 17
100298	1714	941	416	464	10	3488	A		5013	6611 19

100303	1758	755	317	454	00	6684	A	5007	6611	15	30	A	5	2	107709	601	000	62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	1
																		61	000000	000000			0		0	0	0	
																		61	000000	000000			0		0	0	0	
																		61	000000	511001001			0		0	0	0	
100323	1581	695	398	488	00	3713	A	5010	6611	16	122	A	4	2	125473	423	000	61	000000	101001001			0		0	0	0	
																		62	000000	101011011			0		0	0	0	1
																		62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	
																		61	000000	000000			0		0	0	0	
																		61	000000	000000			0		0	0	0	
100325	1792	628	178	279	00	432	A	2902	6611	36	1100	A	4	2	106661	617	000	31	000000	000000		B	0	L	0	0	0	
																		32	000000	501011011		L	0		0	0	0	1
																		32	000000	101011010		H	0		0	0	0	
																		32	00000000	00000000		L	0		0	0	0	
																		31	000000	000000		L	0		0	0	0	
																		32	00000000	00000000		L	0		0	0	0	
100343	1676	661	253	323	00	1531	A	4302	6611	23	101	A	4	2	106473	613	001	61	000000	510011011			0		0	0	0	
																		62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	1
																		61	000000	101011011			0		0	0	0	
																		61	000000	000000			0		0	0	0	
																		61	000000	000000			0		0	0	0	
100344	1732	391	417	491	00	2642	A	4310	6611	21	125	A	5	2	127776	401	001	62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	1
																		62	000000	101001001			0		0	0	0	
																		62	000000	000000			0		0	0	0	
																		62	000000	000000			0		0	0	0	
100350	1707	743	417	489	03	15679	A	6601	6611		1	A	4	2	141007	267	011	41	000000	111001011			0		0	0	0	
																		41	000000	501011011			0		0	0	0	1
																		42	000000	000000			0		0	0	0	
																		41	000000	111011011			0		0	0	0	
																		41	000000	000000			0		0	0	0	
																		42	000000	000000			0		0	0	0	
100401	1681	633	266	404	13	3342	A	2630	6611	38	656	A	5	2	109970	587	001	61	000000	000000		1	0	1	0	0	0	
																		61	000000	000000	D	L	0		0	0	0	1
																		61	000000	000000		L	2		0	0	2	
																		51	000000	000000	A	11	1		0	0	1	1
																		61	000000	000000		L	0		0	0	0	1
																		61	000000	000000		11	2		0	0	0	

945	A	0	2	106234	621	000	32	000000	501001001		0	0	0	0	
							31	000000	000000		0	0	0	0	
							33	000000	000000		0	1	0	0	
							32	000000	000000		0	0	0	0	
							32	000000	000000		0	0	0	0	
							32	000000	000000		0	0	0	0	
817	A	4	2	112424	554	010	61	000000	000000		0	0	0	1	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	1	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	1
472	A	4	2	119273	485	000	61	000000	110011011		0	0	0	0	
							61	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	1
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
175	A	5	2	119956	473	002	61	000000	101011000		0	0	0	0	
							62	000000	000000		0	0	0	0	1
							63	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	101001000		0	0	0	0	
							62	000000	000000		0	0	0	0	
107	A	4	2	134126	637	002	61	000000	000000		0	0	0	0	
							62	000000	511111111		0	0	0	0	
							63	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
204	A	5	2	106684	614	001	61	000000	112011011		0	0	0	0	
							61	011001001	000000		0	0	0	0	
							62	000000	121011011		0	0	0	0	1
							61	000000	110011011		0	0	0	0	
							61	011011011	111011011		0	0	0	0	
							62	000000	111001001		0	0	0	0	
1364	A	4	[illegible]	114002	437	001	61	000000	111001011	[illegible]	1	1	0	0	
							61	000000	112001001	[illegible]	1	0	0	0	
							62	000000	111011000	[illegible]	2	1	0	0	
							61	000000	122011011	[illegible]	2	0	0	1	1
							61	000000	000000	[illegible]	2	0	0	0	
							61	000000	000000	[illegible]	2	0	0	0	

100404	1621	745	237	266	00	13722	A	2832	6611	32
100431	1707	753	210	339	00	12759	A	2733	6611	38
100432	1702	785	236	373	10	8745	A	4203	6611	24
100443	1689	719	280	382	00	4510	A	4237	6611	34
100453	1605	658	175	321	10	2817	A	2435	6611	42
100465	1714	833	281	374	00	13007	A	2513	6611	43
100480	1676	676	268	361	10	2481	A	1335	6611	51

57	A	5	2	119226	496	002	61	000000	110001001	0	0	0	0	0	
							62	000000	000000		0	0	0	0	1
							63	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
71	A	1	2	114790	530	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	1
							61	000000	101001001		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	x1	0	
166	A	4	2	107728	501	000	61	000000	000000	n	2	0	0	0	
							61	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	1
186	A	1	2	105587	628	000	31	000000	000000	L	0	0	0	0	
							31	000000	000000	L	0	0	0	0	
							33	000000	000000		0	0	0	0	1
							32	000000	101001001		0	0	0	0	
							31	000000	000000		0	0	0	0	
							32	000000	000000		0	0	0	0	
587	A	5	2	112129	556	003	63	000000	511011011		0	1	0	0	
							62	000000	101001001		0	1	0	0	
							63	000000	122111011		0	1	0	0	
							61	000000	012011001		0	2	0	0	
							62	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	
3	A	0	2	144751	228	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	1
							61	000000	000000		0	0	0	0	
							62	000000	000000		0 1	0	0	0	
							61	000000	000000		0	0	0	0	
48	A	4	2	119541	572	002	61	000000	111011011		0	0	0	0	
							63	000000	101211011		0	0	0	0	
							63	000000	000000		0	0	0	0	
							61	000000	101011003		0	0	0	0	
							61	000000	111011010		0	0	0	0	
							61	000000	000000		0	0	0	0	

100465	1681	293	230	419	02	194	A	4509	6611	19
100503	1702	779	363	438	00	12532	A	4410	6611	17
100513	1714	683	264	426	10	8587	A	7608	6611	25
100553	1441	314	749	431	00	727	A	3705	6611	39
100568	1621	740	177	240	22	9813	A	3503	6611	31
100626	1773	718	617	455	00	9915	A	6430	6611	2
100651	1554	612	135	283	10	4371	A	4731	6611	13

100665	1702	944	320	370	10	10802	A	2311	6611	36
100671	1595	580	251	327	10	5105	A	4312	6611	22
100712	1631	587	364	452	00	4312	A	4604	6611	20
100727	1603	790	140	198	20	12769	A	1935	6611	44
100740	1613	638	295	374	00	13560	A	4605	6611	19
100790	1576	957	348	420	00	12048	A	3709	6611	23
100812	1581	959	348	444	00	9622	A	2837	6611	14

25	A	4	2	131265	363	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							61	000000	T01011000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
28	A	4	2	137340	302	001	61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	T01010000	0	0	0 0
							61	000000	000000	0	0	0 0
259	A	2	2	121295	465	012	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
							63	000000	000000	0	0	0 0 1
							62	000000	T01001001	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
115	A	4	2	121847	460	032	61	000000	S01011011	0	0	0 0
							62	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							61	000000	S01001001	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
79	A	4	2	107153	636	000	61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0 1
							62	000000	000000	0	0	0 0 1
							61	000000	T01011000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
60	A	4	2	136171	414	031	61	000000	T01001001	0	0	0 0
							62	000000	000000	0	0	0 0
							63	000000	000000	0	0	0 0 1
							61	P01011011	000000	0	0	0 0
							62	000000	T01001000	0	1	0 0
							61	01011000	000000	0	0	0 0
63	A	4	2	114476	534	031	61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
							62	000000	000000	0	1	0 0
							61	000000	T01001001	0	1	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0

100915	1783	679	423	456	00	8675	A	5113	6611	10
100849	1697	762	346	456	13	10219	A	5536	6611	6
100972	1595	847	264	309	03	3228	A	4603	6611	20
100875	1697	538	389	424	03	4564	A	4711	6611	12
100977	1600	640	279	381	03	15072	A	4531	6611	21
100841	1676	686	432	515	13	3553	A	4733	6611	14
100935	1626	633	195	432	22	4609	A	3606	6611	33

```
44 A A 2 107448  639 001 41  000000 S01001001      0  0   0 0 0
                         31  000000   000000   1  1   0 0 0
                         21  000000   000000     11   0 0 0
                         32  000000   000000     0  0   0 0 0
                         11  000000   000000     0  0   0 0 0
                         32  000000   000000     0  0   0 0 0

609 A A 2 114418  534 002 61 P100011011 T010011011   1  0   0 0 0
                         62  000000 T111001001   1  1   0 0 0
                         61  000000   000000     0  0   0 0 1
                         62  000000 T213111011   1  11  0 0 0
                         61  000000   000000     0  0   0 0 0
                         61 P011000000 T111001001     0  0   0 0

387 A 1 2 105439  625 001 61  000000 T110111011   1  1   0 0 0
                         62  000000 S010011001     0  0   0 0 1
                         61  000000 L110110000     0  0   0 1 1
                         62  000000 T011110010     0  0   0 0
                         62  000000   000000     0  0   0 0
                         62  000000   000000     0  0   0 0

136 A 3 2 104585  639 000 32 P010100110   000000     0  0   0 1
                         31  000000   000000     0  0   0 0
                         32  000000   000000     0  0   0 1 1
                         31  000000   000000     0  0   0 2 1
                         31  000000   000000     0  0   0 0
                         32 P011100000 000000     0  0   0 1 1

635 A 2 2 111562  562 003 62  000000 T110111011   1  1   0 0 0
                         61  000000 T010011001     0  0   0 0
                         61  000000 T123111011     0  0   0 0
                         61  000000 T223111011     0  0   0 1
                         62  000000 T110111000     0  1   0 0
                         62  000000   000000     0  0   0 0

90 A 3 2 104227  624 001 61  000000 T011001001     0  0   0 0
                         01  000000 T010111010     0  0   0 0
                         02  000000   000000     0  0   0 0 1
                         01  000000 T010111001     0  0   0 0
                         01  000000   000000     0  0   0 0
                         01  000000   000000     0  0   0 0

60 A 1 2 105214  622 002 31  000000 T010111001     0  1   0 2
                         31  000000   000000     0  0   0 0
                         32  000000 T010011000     0  0   0 0 1
                         31  000000   000000     0  0   0 1 1
                         31  000000   000000     0  0   0 1
                         31  000000   000000     0  0   0 0
```

100314	1671	762	220	311	13	15400	A		1733	6611	20
130924	1748	773	271	375	12	9300	A		1038	6611	33
130956	1631	739	240	333	00	4601	A		4106	6611	35
130963	1671	581	203	288	00	13515	A		2634	6611	40
131315	1681	681	248	268	23	15245	A		2508	6611	32
131025	1753	1033	348	424	00	8521	A		3402	6611	35
131039	1626	734	238	104	12	10900	A		2337	6611	17

257	A	5	2	123298	445	001	61	000000	101001001		0	0	0	0	
							62	P01011011	101001001		0	0	0	0	1
							62	000000	000000		0	0	0	1	
							62	000000	110011010		0	0	0	1	1
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
69	A	4	2	115521	492	010	61	000000	000000	LL	1	0	0	0	
							61	000000	000000	L	0	0	0	0	1
							62	000000	000000	LL	0	0	0	0	
							61	000000	101011001	LL	1	0	0	0	
							61	000000	000000	LL	1	0	0	0	
							61	000000	000000	L	0	0	0	0	
67	A	1	2	104437	640	000	31	000000	501001001	I	0	0	0	0	
							31	000000	000000		0	0	0	0	
							32	000000	000000		0	0	0	0	
							31	00000000	00000000	L	0	0	0	0	
							31	000000	000000	L	0	0	0	0	
							31	00000000	00000000	L	0	0	0	0	
111	A	4	2	128142	397	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	1
							62	001011010	000000		0	0	0	1	1
							62	P01011000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
55	A	5	2	127567	398	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	101001000		0	0	0	0	1
							61	000000	L10001001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
136	A	1	2	111137	946	001	62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	1
							61	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	1	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	1	
52	A	1	2	117462	354	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000	L	0	0	0	1	
							61	000000	000000		0	0	0	1	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	

101053	1707	714	326	426	00	14206	A	4603	6611	22
101063	1697	690	259	337	22	8389	A	8503	6611	31
101072	1431	477	272	351	02	9220	A	2008	6611	35
101074	1732	674	350	411	20	13557	A	4034	6611	17
101084	1664	861	415	502	10	870	A	5035	6611	16
101152	1676	911	293	320	02	14730	A	4703	6611	19
101176	1758	941	383	475	03	11433	A	5011	6611	13

272	A	4	2	123667	041	302	01	0000000	5010001001	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							01	0000000	T010001001	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
648	A	5	2	115406	525	001	01	0000000	5010011011	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							03	0000000	0000000	0	0	0	0	
							01	0000000	T010011001	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
							01	0000000	5010001000	0	0	0	0	
29	A	3	2	128062	307	001	01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							01	0000000	0000000	0	0	0	0	1
							01	0000000	T010001001	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
159	A	4	2	113965	568	000	01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	1
							02	0000000	0000000	0	0	0	0	
							02	0000000	T010011000	0	0	0	0	1
							01	0000000	0000000	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
982	A	5	2	112615	552	002	01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	1
							02	0000000	T010001001	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
219	A	1	2	135461	419	000	01	0000000	1100001011	0	0	0	0	
							01	0000000	0000000	0	0	0	0	
							01	0000000	0000000	0	0	0	0	1
							02	0000000	0000000	0	0	0	0	1
							02	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
94	A	4	2	127081	493	002	01	0000000	1100011011	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							02	0000000	0000000	0	0	0	0	1
							01	0000000	T1 0011011	0	0	0	0	
							02	0000000	0000000	0	0	0	0	
							01	0000000	0000000	0	0	0	0	

101202	1758	735	324	419	13	10885	A		4139	6611	25
101213	1664	702	347	436	23	2755	A		3339	6611	13
101233	1754	834	398	475	13	11651	A		5104	6611	0
101239	1664	642	253	292	13	12157	A		3713	6611	27
101241	1676	437	257	360	23	14545	A		2811	6611	34
101244	1664	849	283	383	33	5346	A		2335	6611	34
101232	1753	361	393	486	13	936	A		4574	6611	21

131294	1707	771	332	378	00	5331	A		5307	6611 16
131307	1778	752	331	368	10	13701	A		3512	6611 30
131313	1685	1179	229	267	03	1958	A		2013	6611 44
131341	1707	770	346	451	10	1543	A		5533	6611 5
131365	1441	1127	371	444	13	6263	A		4135	6611 23
131375	1723	916	333	332	02	14609	A		4211	6611 23
131412	1526	685	180	385	00	173	A		2334	6611 09

101430	1732	949	239	340	22	3486	A	4713	6611	19
131451	1595	630	175	241	10	0457	A	3512	6611	33
131453	1753	819	300	351	33	9665	A	5011	6611	19
131461	1613	812	217	263	10	13832	A	4709	6611	19
131465	1732	849	261	354	33	2939	A	2235	6611	91
131471	1732	748	178	420	33	2883	A	6533	6611	1
131477	1732	648	259	332	30	13502	A	4733	6611	19

```
246 A 4 2 107717  600 101 61   000000   000000   R  0  0   0 2
                  61   000000   000000 D R  0  0   0 0 1
                  62   000000   000000   R  0  0   0 1
                  62   000000 T01001001   R  0  0   0 1 1
                  61   000000   000000      0  0   0 0
                  62   000000   000000   R  0  0   0 1

144 A 5 2 121209  466 000 63   000000 S11011011      0  0   0 0
                  62   000000   000000      0  0   0 0 1
                  63   000000   000000      0  0   0 0 1
                  62   000000   000000      0  0   0 0
                  63   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0

 41 A 0 2 121956  459 001 61   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0
                  63   000000   000000      0  0   0 0 1
                  62   000000 T01011001      0  0   0 0 1
                  63   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0

  4 A 4 2 134201  336 001 62   000000 T11001001      0  0   0 0
                  62   000000   000000      0  0   0 0 1
                  63   000000   000000      0  0   0 0 1
                  62   000000 T10011011      0  0   0 0 1
                  62   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0

420 A 4 2 116648  511 001 61   000000   000000      0  0   0 0
                  61   000000 S11000010      0  1   0 0 1
                  63   000000   000000      0  0   0 0
                  62   000000 T10011001      0  0   0 0
                  62   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0

 44 A 4 2 121204  466 000 61   000000   000000      0  0   0 0
                  61   000000   000000      0  0   0 0
                  62   000000   000000      0  0   0 0
                  61   000000 T01011001      0  0   0 0
                  61   000000   000000      0  0   0 0
                  61   000000   000000      0  0   0 0

 24 A 0 2 113667  541 002 61 P12010011 T01001001 D  2 1   0   0 0
                  61   022111111   000000      0 E  0   0 0 1
                  62 P12111000   000000   E  1 E  0   0 1
                  61   022111111   000000   E  0 E  0   0 1
                  61 P10010010   000000      0 E  0   0 0
                  61 P22110110   000000      0 E  0   0 0
```

IQ1493	1702	758	264	334	00	14111	A		2304	6611 40
131484	1681	904	333	396	10	1546	A		4104	6611 25
131502	1924	1167	429	506	00	8129	A		4704	6611 17
131509	1727	952	353	408	00	12566	A		5537	6611 2
131534	1671	837	249	318	20	9619	A		4136	6611 34
101576	1714	334	346	430	10	9698	A		4603	6611 20
131535	1689	728	256	432	00	13728	A		5210	6611 14

78

709	A	1	2	134104	641	002	31	000000	101001001		0	0		0	0	
							31	000000	000000		0	0		0	0	
							33	000000	110011010		0	0		0	0	
							31	000000	000000		0	0		0	0	
							31	000000	000000		0	0		0	0	
							32	000000	000000		0	0		0	0	
248	A	1	2	120757	470	000	61	000000	111011011		0	0		0	0	
							62	000000	511011011		0	0		0	0	1
							62	011010010	101001001		0	0		0	0	
							61	000000	101011011		0	0		0	0	
							62	000000	000000		0	0		0	0	
							61	000000	110100000		0	0		0	0	
3	A	4	2	129414	384	000	61	000000	111011011		0	0		0	0	
							62	000000	101001001		0	0		0	1	1
							62	000000	000000		0	0		0	1	1
							62	000000	101011000		0	0		0	1	
							62	000000	000000		0	1		0	0	
							62	000000	000000		0	0		0	0	
34	A	0	2	113887	538	001	62	000000	000000		0	0		0	0	
							62	000000	000000		0	0		0	0	
							63	000000	000000		0	0		0	1	1
							62	000000	000000		0	0		0	0	
							62	000000	000000		0	0		0	0	
							62	000000	000000		0	0		0	0	
66	A	4	2	105242	632	002	31	F01010010	511001001	F	0	0		0	0	
							32	000000	000000		0	0		0	0	
							32	000000	000000		0	0		0	1	
							32	000000	101011001		0	0		0	0	
							32	000000	000000		0	0		0	0	
							32	000000	000000		0	0		0	0	
32	A	4	2	132000	354	001	61	000000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
							62	000000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
							62	000000	101010000		0	0		0	0	
							61	000000	000000		0	0		0	0	
66	A	4	2	121865	410	002	61	000000	111011011		0	0		0	1	
							61	000000	511001001		0	0		0	0	
							62	F1/111111	000000		0	0		0	0	1
							62	F1/011010	000000		0	0		0	0	1
							62	000000	000000		0	0	F	1	0	
							61	F? 110110	111001001		0	0		0	0	

101677	1613	793	288	429	00	80[illegible]	A	2401	6611 40
101733	1597	777	369	489	00	734	A	3933	6611 26
101737	1924	944	445	532	11	12142	A	5032	6611 6
233001	1605	935	296	322	20	9188	A	5011	6611 15
233004	1676	785	275	454	10	9937	A	4229	6611 24
233014	1551	749	329	392	00	5965	A	5012	6611 15
233017	1748	549	249	194	00	4163	A	4311	6611 26

709 A 4 2 134104	641	002	31	000000	101001001	0	0	0	0	
			31	000000	000000	0	0	0	0	
			33	000000	110011010	0	0	0	0	
			31	000000	000000	0	0	0	0	
			31	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
248 A 1 2 120757	470	000	61	000000	111011011	0	0	0	0	
			62	000000	511011011	0	0	0	0	1
			62	011010070	101001001	0	0	0	0	
			61	000000	101011011	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	110100000	0	0	0	0	
3 A 4 2 129414	384	000	61	000000	111011011	0	0	0	0	
			62	000000	101001001	0	0	0	1	1
			62	000000	000000	0	0	0	1	1
			62	000000	101011000	0	0	0	1	
			62	000000	000000	0	1	0	0	
			62	000000	000000	0	0	0	0	
34 A 0 2 113887	518	001	62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	1	1
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
66 A 4 2 105242	632	002	31	801010010	511001001	0	0	0	0	
			32	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	1	
			32	000000	101011001	0	0	0	0	
			32	000000	000000	0	0	0	0	
			32	000000	000000	0	0	0	0	
32 A 4 2 132000	394	001	61	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	000000	0	0	0	0	
			61	000000	000000	0	0	0	0	
			62	000000	101012000	0	0	0	0	
			61	000000	000000	0	0	0	0	
66 A 4 2 121865	410	002	61	000000	111011011	0	0	0	1	
			61	000000	511001001	0	0	0	0	
			62	834111111	000000	0	0	0	0	1
			62	812011010	000000	0	0	0	0	1
			62	000000	000000	0	0	1	0	
			61	827110110	111001001	0	0	0	0	

191677	1613	793	288	429	03	80[illegible]	A	2401	6611 43
191733	1597	777	349	489	00	774	A	3933	6611 26
191737	1924	944	445	532	11	12142	A	5932	6611 6
230001	1605	935	296	322	20	9188	A	5011	6611 15
230004	1576	785	275	364	10	9937	A	5239	6611 24
230014	1551	749	329	382	30	5565	A	5012	6611 15
230017	1748	549	269	39[illegible]	00	6164	A	4311	6611 26

21	A	4	2	127411	403	302	61	000000	T01001001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	T01111110		0	0	0	0	1
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
	A	0	2	138572	292	010	61	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	1	1
							61	000000	000000		0	0	0	1	1
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	1	
49	A	3	2	114379	538	031	61	000000	T11011011		0	0	0	0	
							62	000000	T01001000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	T10011010	L	1	0	0	0	1
							62	000000	T11011011		0	0	0	0	
							61	000000	000000		0	0	0	0	
75	A	4	2	139939	579	003	61	000000	T11011011		0	0	0	0	
							61	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	1	1
							61	000000	T01011001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
120	A	1	2	115087	527	000	61	000000	T11111111		0	0	0	1	1
							61	000000	T11111111	D	0	0	0	1	
							61	000000	T01010000		0	0	0	1	1
							61	000000	T11110110		0	0	0	1	1
							61	000000	T01010000		0	0	0	0	
							61	000000	T11100100		0	0	0	1	
76	A	3	2	114612	539	111	61	000000	T01011010		0	0	0	0	
							62	000000	000000		0	0	0	0	1
							62	000000	T10011011		0	0	0	0	1
							62	000000	T01011001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
232	A	4	2	113348	574	031	61	000000	T10001001		0	0	0	0	
							62	000000	T01001001		0	0	0	0	
							62	000000	T01011000		0	0	0	0	
							61	000000	T10011001		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	

200318	1549	658	311	374	00	7644	A	4739 6611	13
200322	1646	742	312	344	00	7186	A	4635 6611	
200323	1613	719	329	293	00	8437	A	4734 6611	19
200349	1621	716	295	381	01	13641	A	2634 6611	27
200363	1765	840	343	437	02	2308	A	4233 6611	24
200376	1753	822	294	368	00	10254	A	4534 6611	21
200389	1783	796	430	466	00	333	A	3612 6611	23

```
65 A 1 2 117684  601 301 61  000000 T110111011      0  0    0 0
                 62  000000 S110111010      0  0    0 0 1
                 62  000000 T110111100      0  0    0 1
                 61  000000    000000      0  0    0 0
                 62  000000 T110111000      0  0    0 0
                 62  000000    000000      0  0    0 0

159 A 5 2 112084  557 031 61  000000 T110111011      0  0    0 0
                 62  000000 S110101010      0  0    0 0
                 62  000000    000000      0  0    0 0
                 62  000000 T201111111      0  0    0 1 1
                 61  000000    000000      0  0    0 0
                 62  000000 T111111110      0  0    0 0

 55 A 4 2 108834  539 031 61  000000 T010111011      0  0    0 0
                 62  000000    000000      0  0    0 0
                 62  000000    000000      0  0    0 0 1
                 62  000000 T101111011      0  0    0 0
                 62  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0

242 A 5 2 103045  647 002 61  000000 T110011011      0  0    0 0
                 61  000000 T110101011      0  0    0 1
                 62  000000    000000      0  0    0 0 1
                 62  000000 T010101011      0  0    0 0
                 61  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0

433 A 4 2 110664  571 002 61  000000 T010001001      0  0    0 0
                 62  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0 1
                 62 P01 000000    000000      0  0    0 0
                 62  000000    000000      0  0    0 0
                 62  000000    000000      0  0    0 0

 18 A 3 2 137432  303 000 61  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0
                 62  000000 C010000001      0  0    0 1 1
                 62  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0

 45 A 4 2 105641  621 003 61  000000 S110111011      0  0    0 0
                 61  000000    000000      0  0    0 0
                 61  000000    000000      0  0    0 0
                 61  000000 T010111011      0  0    0 0
                 61  000000    000000      0  0    0 0
                 62  000000    000000      0  0    0 0
```

200090	1595	616	275	183	00	2877	A		4331	6611 23
200097	1589	562	229	267	00	15533	A		3337	6611 12
200102	1638	670	218	370	00	4052	A		4710	6611 19
200123	1681	865	257	356	00	3602	A		1836	6611 17
200131	1740	875	296	410	00	5770	A		2611	6611 21
200139	1707	722	414	492	00	4251	A		5604	6611 13
200148	1646	679	295	403	21	15644	A		4503	6611 21

```
48 A 0 2 100245  621 001 31   000000 S12011011        0  0    0 0
                 31 C0C000000 SC1C11011        0  0    0 0
                 32   000000   000000        0  0    0 2
                 31   000000   000000        0  0    0 1
                 32   000000   000000        0  0    0 0
                 31   000000   000000        0  0    0 0

91 A A 2 132041  349 013 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
                 62   000000   000000        0  0    0 0
                 61   000000 T01011011        0  0    0 0
                 62   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0

75 A 0 2 128656  321 001 62   000000 T01001001        0  0    0 1
                 62   000000   000000        0  0    0 0 1
                 63   000000   000000        0  0    0 1
                 62   000000   000000        0  0    0 1
                 62   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0

32 A A 2 124037  337 300 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
                 61   000000 T01001011        0  0    0 0
                 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0

75 A A 2 113495  434 001 61   000000   000000        0  0    0 0
                 62   000000 S01001001        0  0    0 0
                 63   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0

25 A 0 2 105045  633 001 31   000000 T01001001        0  0    0 0
                 32   000000 S10011011        0  0    0 0
                 33   000000   000000        0  0    0 1
                 32   000000 T01001001        0  0    0 0
                 32   000000   000000        0  0    0 0
                 31   000000   000000        0  0    0 0

38 A 0 2 107240  625 300 61   000000 S01011011        0  0    0 1
                 62   000000   000000        1  0    0 0 1
                 62   000000   000000        0  0    0 1 1
                 61   000000 T01001011        1  0    0 1 1
                 61   000000   000000        0  0    0 0
                 61   000000   000000        0  0    0 0
```

233153	1908	740	149	256	10	15075	A	4508	6611	20
233154	1702	725	385	461	00	8343	A	5007	6611	16
233174	1773	865	334	398	10	13141	A	4535	6611	21
233177	1603	663	333	481	02	5625	A	4506	6611	14
233178	1732	677	300	431	11	12511	A	3539	6611	11
233183	1714	757	273	324	00	2379	A	2812	6611	37
233185	1737	638	248	361	03	5836	A	4717	6611	13

200199	1562	556	136	229	23	9319	A		2002	6611	36
200196	1451	728	167	246	00	5433	A		2409	6611	42
200198	1758	706	347	447	03	5459	A		5103	6611	14
200204	1671	698	186	227	12	12765	A		4704	6611	27
200207	1758	704	293	349	00	12973	A		4136	6611	20
200219	1631	690	197	247	02	3014	A		2333	6611	37
200224	1748	736	288	336	13	8355	A		3513	6611	24

```
 56 A 0 2 119706   441 101 62   000000   000000     0 0   0 1
                       62   000000 L01000000       0 0   0 0
                       62   000000   000000 A      0 0   0 1
                       62   000000 U01101001       0 0   0 0
                       62   000000   000000       0 0   0 0
                       62   000000   000000       0 0   0 0

148 A 4 2 107551   600 000 31   000000 S11011011 D   0 0   0 0
                       31   000000 T11011011       0 0   0 0
                       32   000000   000000       0 0   0 0
                       31   000000 T01011001       0 0   0 0
                       31   000000   000000       0 0   0 0
                       32   000000   000000       0 0   0 0

106 A 5 2 113737   541 001 61   000000   000000     0 0   0 0
                       62   000000   000000       0 0   0 0
                       62   000000   000000       0 0   0 0
                       61   000000   000000       0 0   0 0
                       62   000000   000000       0 0   0 0
                       62 P01100000   000000       0 0   0 0

119 A 1 2 106400   620 000 31   000000   000000     0 0   0 0
                       31   000000   000000   L   2 0   0 0 1
                       32 C00000000   000000000     0 0   0 0 1
                       31   000000   000000       0 0   0 0 1
                       31 000000000 000000000   L   1 0   0 0
                       32   000000   000000       0 0   0 0

 19 A 4 2 139006   207 000 61 P01010010   000000     0 0   0 0
                       61   000000   000000       0 0   0 0
                       62   000000   000000       0 0   0 0
                       61   000000   000000       0 0   0 0
                       61   000000   000000       0 0   0 0
                       61   000000   000000       0 0   0 0

 46 A 5 2 120224   476 003 61   000000 T01011110     0 0   0 0
                       61   000000   000000   L   1 0   0 0
                       62   000000   000000       0 0   0 0
                       61   000000 S01111110       0 0   0 0
                       61 001100010   000000   L   0 0   0 0
                       61   000000   000000       0 0   0 0

 57 A 4 2 124282   435 000 61   000000   000000     0 0   0 0
                       61   000000   000000       0 0   0 0
                       62   000000   000000       0 0   0 0
                       61   000000 T01011001       0 0   0 0
                       61   000000   000000       0 0   0 0
                       61   000000   000000       0 0   0 0
```

200223	1707	858	312	325	00	10116	A	4302	6611	23
200252	1753	701	295	434	00	10872	A	4705	6611	39
200266	1714	802	277	433	00	8061	A	4135	6611	25
200276	1740	671	331	346	00	14081	A	2506	6611	41
200285	1701	734	372	511	00	5530	A	5509	6611	11
200291	1671	562	181	372	10	6675	A	4613	6611	20
200296	1778	674	444	591	00	5490	A	4601	6611	20

137	A	0	2	123914	469	030	62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	1
							62	000000	T01001001		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
22	A	0	2	134145	640	011	71	000000	T01001000	A	0	0	0	0	
							71	000000	000000		0	0	0	0	1
							51	000000	000000		0	0	0	0	1
							51	000000	000000		0	0	0	1	1
							52	000000	000000		0	0	0	0	
							52	00000000	000000		0	0	0	1	
121	A	0	2	110823	569	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	1	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
62	A	0	2	131182	365	001	61	000000	T11011011		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	T01010000		0	0	0	0	
							61	000000	000000		0	0	0	0	
59	A	0	2	139526	543	031	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	1
							62	000000	000000		0	0	0	0	
							61	000000	001011101		0	0	0	1	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
825	A	2	2	104037	644	031	71	000000	T01001001		0	0	0	0	
							71	000000	000000		0	0	0	0	
							32	000000	000000		0	0	0	0	1
							71	000000	T10111011		0	0	0	0	
							71	000000	000000		0	0	0	0	
							12	000000	000000		0	0	0	0	
62	A	0	2	126024	433	031	61	000000	T01001001		0	0	0	0	
							62	000000	000000		0	0	0	0	
							63	000000	000000		0	0	0	0	
							62	000000	T01011001		0	0	0	0	
							62	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	

200306	1656	779	318	372	30	10260	A		3705	6611 24
200311	1546	540	141	432	00	10800	A		4105	6611 25
200314	1644	611	261	346	00	3876	A		4702	6611 19
200318	1638	524	332	418	02	9186	A		5101	6611 15
200319	1723	699	334	493	10	5140	A		4504	6611 21
200327	1580	657	214	390	00	2293	A		2613	6611 33
200333	1664	722	360	446	10	7000	A		4613	6611 18

```
 9 A 3 2 127967  398 000 61  000000  000000    0  0   0 0
                 62  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 1 1
                 61  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0

105 A 4 2 117437  504 100 61  000000  1010111011    0  0   0 0
                 62  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0 1
                 62  000000  1010111001    0  0   0 0
                 61  000000  000000    0  0   0 0
                 62  000000  000000    0  0   0 0

 50 A 4 2 107087  513 001 41  000000  S110111011  D    0  0   0 0
                 41  000000  000000    0  0   0 0
                 42  000000  000000  L 1  1   0 0 1
                 41  000000  000000    0  0   0 0 1
                 41  000000  000000    0  0   0 0
                 41  000000  000000  L 1  0   0 0 1

 20 A 5 2 136765  516 001 31  000000  T110011001    0  0   0 0
                 32  000000  S010011001    0  0   0 0
                 33  0000000  T1001C001    0  0   0 0 1
                 33  000000  1010000011    0  0   0 0
                 35  000000  000000    0  0   0 0
                 32  0011100100  000000    0  0   0 0

 54 A 4 2 125323  525 102 61  000000  T010000011    0  0   0 0
                 61  000000  T1111111    0  F  0   0 0 1
                 62  000000  T110011011    0  F  0   0 0 1
                 61  000000  T1111111    0  F  0   0 0
                 62  000000  000000    0  0   0 0
                 61  T111001100  000000    0  -  0   0 0

203 T 3 2 100002  528 001 61  000000  000000  F 1  0  0H 2 0
                 61  000000  000000    0  0  0H 3 0
                 61  000000  000000    0  0  0H 3 0
                 61  000000  1010111000    0  0  0H 3 0
                 61  000000  000000    0  0  0H 2 0 1
                 61  000000  000000    0  0  0H 3 0

1343 T 5 2 110436  530 002 61  000000  000000    0  0   0 1
                 61  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0
                 61  000000  000000    0  0   0 0 1
                 61  000000  000000    0  0   0 0
```

200352	1699	640	371	457	00	7166	A		4905	6611 18
200365	1464	804	288	171	20	4577	A		3701	6611 25
200367	1613	562	252	292	12	15651	A		4539	6611 21
200368	1740	943	371	453	00	14444	A		2605	6611 29
200374	1581	799	319	426	10	11586	A		5337	6611 16
300309	1575	589	263	319	00	11405	A		1434	6611 28
333318	1613	547	271	363	13	2176	A		3513	6611 13

```
385 T 4 2 113995  546 001 61    000000    000000      L I    0    0 0 1
                          61    000000    000000        0    0    0 0 0
                          61    000000    000000        0    0    0 0 0
                          61    000000    000000        0    0    0 0 0
                          61    000000    000000        0    0    0 0 0
                          61    000000    000000        0    0    0 0 0

271 T 4 2 112231  551 000 61    000000    000000        0    0    0 0 1
                          61    000000    000000        0    0    0 0 1
                          61    000000    000000        0    0    0 1 1
                          62    000000 0101010101  D   L  1    0    0 1 1
                          61 001010000  1010001001        0    0    0 1 1
                          61    000000    000000        0    0    0 0 1

592 T 3 2 105697  616 000 61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 1
                          61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0

1024 T 4 2 107694  646 111 61    000000 S1000001001    B   0 F  0    0 0
                          61    000000 S0100001001      L  I B  0 F  1 0
                          61    000000    000000      H   0 H  0    0 0 1
                          61    000000    000000      F   0 F  0    0 0
                          61    000000    000000      HH  I F  0    0 0
                          61    000000    000000          0    0    0 0

1030 T 3 2 105726  627 001 31 P11010010 S1100001001    F   I    0    0 0
                          31    000000 S1101011011    F   0    0    0 0
                          31 0000000000 1010001001    F   0    0    0 0
                          31    000000 1011011011    F   0    0    0 0
                          31 0000000000 1010100101    F   0    0    0 0
                          31    000000    000000    F   0    0    0 0

143 T 4 2 125320  423 001 61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          61    000000 1110011000        0    0    0 0
                          61 P1000111111 1011111001      0    0    0 0
                          61    000000 1110001011        0    0    0 0
                          61    000000    000000        0    0    0 0

261 T 3 2 128403  349 001 61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          62    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          61    000000    000000        0    0    0 0
                          61    000000    000000        1    0    0 0
```

300328	1626	512	255	357	20	3728	A		4712	6611	18
300336	1689	727	192	260	10	3648	A		3109	6611	31
300142	1529	494	264	313	02	5571	A		4202	6611	23
300217	1580	466	262	325	10	8608	A		2315	6611	43
300225	1605	515	162	228	00	14263	A		2711	6611	33
300229	1691	760	350	307	10	14647	A		5408	6611	13
300229	1714	686	288	337	30	12409	A		4407	6611	21

300232	1765	726	460	577	00	8458	A	6205	6611	2
300238	1681	670	289	398	01	245	A	4205	6611	24
300240	1554	742	258	300	00	11599	A	4805	6611	18
300255	1400	907	171	248	20	681	A	2309	6611	30
300297	1758	658	370	484	00	1387	A	4737	6611	19
300355	1959	807	430	507	00	5670	A	4706	6611	19
300357	1732	961	383	372	02	423	A	3610	6611	23

4	2	135881	318	000	61	000000	101001001		0	0	0 0	
					61	000000	000000		0	0	0 0	
					61	000000	000000		0	0	0 0	
					61	000000	101001001		0	0	0 0	
					61	000000	110010000		0	0	0 0	
					61	000000	101100000		0	0	0 0	
4	2	129903	377	010	61	000000	000000		0	0	0 1	1
					61	000000	000000		0	0	0 0	1
					62	001001000	000000		0	0	0 1	1
					61	001111000	000000 A		0	0	0 1	1
					61	000000	000000		0	0	0 0	
					61	000000	000000		0	0	0 1	1
4	2	124257	430	000	61	000000	000000		0	0	0 0	
					61	000000	000000	L	1	0	0 0	
					61	000000	000000	L	0	0	0 0	
					61	000000	101001001		0	0	0 0	1
					61	000000	000000		0	0	0 0	
					61	000000	000000	L	1	0	0 0	1
4	2	137921	294	100	61	000000	000000		0	0	0 0	
					62	000000	501001001		0	0	0 0	
					62	000000	000000		0	0	0 0	
					61	000000	000000		0	0	0 0	
					62	000000	000000		0	0	0 0	
					62	000000	000000		0	0	0 0	
4	2	107174	617	002	31	000000	511001001	c	2	1	0 1	
					32	000000	511011011		0	0	0 1	
					32	000000	121111011		0 n	1	0 2	
					32	000000	122111011	n	1	2	0 1	
					31	000000	000000		0	0	0 0	
					31	000000	000000		0	0	0 0	
5	2	115742	514	001	61	000000	000000	L	1	0	0 0	
					61	000000	000000	L	1	0	0 0	
					62	000000	000000	L	1	0	0 0	
					61	000000	000000	n	1	0	0 0	
					62	000000	000000		0	0	0 0	
					62	000000	000000		0	0	0 0	
5	2	104740	641	002	32	000000	000000		0	0	0 0	
					31	000000	000000		0	0	0 0	
					32	000000	000000		0	0	0 1	1
					31	000000	000000		0	0	0 0	1
					31	000000	000000		0	0	0 0	
					31	000000	000000		0	0	0 0	

303396	1722	758	325	348	00	10741	A	5406	6611	13	62	T
300411	1740	589	374	457	10	367	A	4602	6611	23	123	T
303415	1676	887	316	417	00	13933	A	4336	6611	26	571	T
303460	1732	738	429	456	00	9672	A	5301	6611	8	17	T
300482	1629	619	126	229	20	11196	A	1613	6611	20	226	T
300483	1603	710	252	331	00	7732	A	1704	6611	20	260	T
300487	1651	744	248	282	12	12682	A	2635	6611	33	117	T

```
221 T 4 2 103640  648 001 31   000000   000000   0 0 RL 0 0
                  31   000000   000000   0 0 RL 1 0
                  31   000000   000000   0 0 RL 1 0
                  31   000000   000000   0 0 RL 1 0
                  31   000000   000000   0 0 RL 1 1 1
                  31   000000   000000   0 0 RL 1 0

273 T 4 2 128726  386 001 61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  62   000000   000000   0 0    0 1 1
                  61 P01 111000   000000   0 0    0 1 1
                  61   000000   000000   0 0    0 0
                  62   000000   000000   0 0    0 0 1

49 T 5 2 102682   648 001 61   000000   000000   0 0    0 0
                  61   000000 T01 001001   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0

418 T 4 2 104674  638 001 61   000000   000000   0 0 BR 1 0
                  61   000000   000000   0 0 BRL2 0
                  61   000000   000000   0 0 BMD2 0 1
                  61   000000   000000   0 0 BRL2 0
                  61   000000   000000   0 0 BRM1 0
                  61   000000   000000   0 0 DMD3 0

497 T 0 2 126674  400 000 61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  62   000000   000000   1 0 0    0 0
                  61   000000 T01 001001   1 1 0    0 0
                  61   000000   000000   1 0 0    0 0
                  61   000000   000000   1 1 0    0 0

1837 T 4 2 103204 651 002 62   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 1 1
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0 1
                  61   000000   000000   0 0    0 0 1

290 T 4 2 100417  574 000 61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000 T10 011000   0 0    0 0
                  61   000000 T01 011001   0 0    0 0
                  61   000000   000000   0 0    0 0
                  61   000000   000000   0 0    0 0
```

300498	1581	728	329	282	00	12757	A		1705	6611	40
300535	1575	545	328	380	00	9520	A		4505	6611	20
300540	1778	653	293	424	23	9571	A		4703	6611	19
300564	1611	473	220	281	00	15688	A		2301	6611	37
300566	1740	810	403	517	00	13851	A		4209	6611	21
300593	1646	557	148	311	10	15575	A		2309	6611	43
300549	1671	772	230	283	30	6001	A		4709	6611	13

5	2	104587	638	003	41	000000	000000	L	0	0	0	0		
					41	000000	000000		0	0	0	0		
					41	000000	000000		0	0	0	0		
					41	000000	5010113111		0	0	0	1	1	
					41	000000	000000		0	0	0	0		
					41	000000	000000		0	0	0	0		
3	2	113268	482	001	61	000000	T01001001		0	0	0	0		
					61	000000	000000		0	0	0	0		
					62	000000	L01010010		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
2	2	104687	638	000	32	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	000000	000000		0	0	0	0		
					31	001100100	000000		0	0	0	0		
4	2	125489	619	000	61	000000	000000		0	0	0	0		
					62	000000	T01001001		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
					61	000000	000000		0	0	0	0		
7	2	105637	619	003	31	000000	T11011001		0	0	1	1	1	0
					31	000000	T11011011		0	0	1	1	1	0
					32	000000	T11011001		1	1	0	1	1	0
					31	000000	T12011011		0	0	1	1	1	0
					31	00000000	110011001		0	0	1	1	1	0
					32	00000000	T11000001		0	0	1	1	1	0
2	2	118368	430	003	61	000000	000000		0	0		0	0	
					61	000000	000000		0	0		0	0	
					61	011000000	000000		0	0		0	0	
					61	001000000	000000		0	0		0	0	
					61	000000	T11001001		0	0		0	0	
					61	000000	000000		0	0		0	0	
4	2	104974	638	003	31	000000	000000		0	0		0	0	
					31	000000	000000		0	0		0	0	
					31	000000	000000		0	0		0	0	
					31	000000	T01011000		0	0		0	0	
					31	000000	000000		0	0		0	0	
					31	000000	000000		0	0		0	0	

300654	1773	719	195	274	10	15066	A	2439	6611	42	63	T
333583	1707	642	244	297	13	696	A	3739	6611	25	837	T
333609	1676	435	252	332	10	12253	A	4235	6611	24	158	T
333704	1681	726	352	468	20	13176	A	5906	6611	14	41	T
333732	1613	612	165	209	23	10674	A	4736	6611	18	100	T
333748	1664	771	275	333	13	2613	A	3336	6611	27	351	T
333751	1656	572	236	342	20	6171	A	2601	6611	18	287	T

```
300757 1605  627  214  286 00 10536 A    4209 6611 24   633 T 1 2 106682  619 002 31    CC0000 T01001001   FS I F 0    0 0
                                                                                  31    000000 U01001000      0 0    0 0
                                                                                  32    000000    000000   F 0 0    0 0 1
                                                                                  31    000000    000000      0 0    0 1 1
                                                                                  31 0000000000 0000000000   F 0 F 0    0 0
                                                                                  31 C0000000   0000000      0 0    0 1

300766 1651  589  170  269 00 14295 A    2102 6611 31  3019 T 5 2 107604  609 000 31    000000 T01001001      0 0    0 1
                                                                                  31    000000    000000   F1 0 0    0 0
                                                                                  31    000000    000000      0 0    0 0
                                                                                  32    000000 T10111111      0 0    0 0
                                                                                  31    000000    000000      0 0    0 0
                                                                                  32    000000    000000      0 0    0 0

300791 1562  475  182  227 10 15675 A    2303 6611 36  2200 T 3 2 103398  651 333 41 F11010010 S11001011      0 0    0 0
                                                                                  41    000000 T11111111      0 0    0 0
                                                                                  41 021110110    000000      0 0    0 0
                                                                                  41    000000 121111111      0 0    0 0
                                                                                  41    000000 S11011010      0 0    0 0
                                                                                  41 022110110    000000      0 0    0 0

300797 1727  589  109  233 00  2154 A    2131 6611 41   408 T 4 2 104734  629 000 61    000000    000000   BR 1 0 HL 1 0
                                                                                  61    000000    000000    L 1 0 HLX2 0
                                                                                  62    000000    000000   BR 1 0 BBX1 0
                                                                                  61    000000 T01011011    L 0 0 BBX2 0
                                                                                  61 010010010    000000      0 0 HL 1 0
                                                                                  61    000000    000000      0 0 BLL1 0

333406 1722  562  336  436 03  6426 A    4613 6611 18   177 T 3 2 124682  427 001 61    000000    000000      0 0    0 0
                                                                                  61    000000    000000      0 0    0 0
                                                                                  61    000000    000000      0 0    0 0
                                                                                  61    000000 T01001001      0 0    0 0
                                                                                  61    000000    000000      0 0    0 0
                                                                                  61    000000    000000      0 0    0 0

300814 1714  655  271  395 02  5892 A    5402 6611 12    54 T 0 2 107642  638 330 31    000000 T01001001      0 0    0 0
                                                                                  31    000000 T01001001      0 0    0 0
                                                                                  31    000000    000000      0 0    0 0 1
                                                                                  31    000000    000000      0 0    0 0
                                                                                  31    000000    000000      0 0    0 0
                                                                                  31    000000    000000      0 0    0 0

300815 1562  587  225  254 13 11900 A    1911 6611 45   29 T 4 2 103900  647 333 61    000000    000000   F  0 0 F 2 0
                                                                                  61    000000    000000      0 0 F 2 0 1
                                                                                  61    000000    000000      0 0 F1 2 0 1
                                                                                  61    000000    000000      0 0 F 2 1 1
                                                                                  61    000000    000000      0 0 F 2 0
                                                                                  61    000000    000000      0 0 F 2 0
```

3811	6611	12	138	T	4	2	116747	563	001	61	000000	110110110		0	0	0 0	
										61	011110110	000000		0	0	0 0	
										61	021010010	000000		0	0	0 0	
										61	011110110	000000		0	0	0 0	
										61	022110110	000000		0	0	0 0	
										61	022110110	000000		0	0	0 0	
5707	6611	7	19	T	4	2	143424	269	000	62	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										62	000000	000000		0	0	0 2	1
										62	000000	000000		0	0	0 0	
										62	000000	000000		0	0	0 0	1
										62	000000	000000		0	0	0 0	1
4506	6611	21	11	T	2	2	116084	506	001	61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										62	000000	101011011		0	0	0 0	
										62	000000	000000		0	0	0 0	
										62	000000	000000		0	0	0 0	
5501	6611	1	3	T	4	2	142212	252	100	61	000000	110011111		0	0	0 0	
										62	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
4109	6611	25	46	T	5	2	107504	609	000	32	000000	501001001		0	0	0 0	
										31	000000	000000		0	0	0 0	
										31	000000	000000	L	1	0	0 0	1
										32	000000	000000		0	0	0 0	
										32	000000	000000		0	0	0 0	
										42	000000	000000		0	0	0 0	
2713	6611	16	1390	T	4	2	104223	642	003	51	000000	522011010	[illegible]	1	0	0 2	1
										51	000000	521011010		0	0	0 1	
										51	000000	521011010		0	0	0 1	
										51	000000	522011010		0	0	0 1	
										51	000000	522011010		0	1	0 0	
										51	000000	523011110		0	0	0 0	
5303	6611	13	147	T	4	2	112744	475	001	61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	001001000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	
										61	000000	000000		0	0	0 0	

300857	1400	542	262	326	20	1204	A
300867	1758	949	463	502	10	6468	A
300877	1829	957	338	461	00	18539	A
300883	1476	703	448	461	00	7544	A
300889	1702	986	243	316	00	545	A
300893	1494	433	145	184	20	638	A
300925	1707	757	301	407	10	189	A

5 2 110831	267 000	61	000000	101011011	0 0 0 0
		61	000000	000000	0 0 0 0
		61	000000	000000	0 0 0 0
		61	000000	101011011	0 0 0 0
		61	000000	101010000	0 0 0 0
		61	010100100	000000	0 0 0 0
4 2 125051	414 002	61	000000	000000	0 0 0 0
		61	000000	101001001	0 0 0 0
		61	000000	000000	0 0 0 0
		61	000000	000000	0 0 0 0
		61	000000	000000	0 0 0 0
		61	000000	000000	0 0 0 0
4 2 106109	624 001	31	000000	000000	0 0 0 1
		31	000000	000000	0 0 0 1
		31	00000000	00000000	0 0 0 1
		31	000000	000000	0 0 0 1 1
		31	00000000	00000000	0 0 0 1 1
		31	0-000000	0-000000	0 0 0 0 1
5 2 107400	610 001	51	010010010	101001001	0 0 0 0
		51	010011011	110011011	0 0 0 0
		51	011011010	000000	0 0 0 0
		51	000000	101011001	0 0 0 0
		51	011011000	101010010	0 0 0 0
		51	000000	111001001	0 0 0 0
1 2 111948	534 001	61	000000	000000	H 1 L 0 0 0
		61	000000	000000	H1 H 0 0 0
		62	000000	000000	EH1 H 0 0 0 1
		51	000000	101011011	HH1 L 1 0 0 1
		62	000000	000000	0 0 0
		61	000000	000000	L1 0 0 0 1
4 2 115631	517 001	61	000000	000000	0 0 0 1
		61	000000	110001001	0 0 0 1
		61	000000	101001000	0 0 0 0 1
		61	000000	000000	0 0 0 0 1
		61	000000	110011010	0 0 0 0 1
		61	000000	000000	0 0 0 0 1
6 2 106042	624 001	31	000000	000000	1 0 0 0 0
		31	000000	000000	0 0 0 0
		31	000000	000000	L 0 0 0 0
		31	000000	101001001	0 0 0 0
		31	000000	000000	1 0 0 0 1
		31	100000	000000	L 0 0 0 0

330936	1740	662	427	489	10	14611	A	4731	6611	19	223	T
330967	1689	566	327	331	13	14023	A	4306	6611	21	1101	T
330985	1587	476	144	230	20	2787	A	2131	6611	43	99	T
331021	1638	717	215	313	20	1313	A	2603	6611	24	586	T
331038	1575	721	250	265	20	12053	A	4333	6611	25	214	T
331043	1538	535	215	263	00	10697	A	4411	6611	21	334	T
331066	1526	569	238	245	00	4833	A	2936	6611	31	344	T

736	T	4	2	107426	638	001	31	000000	5100001001	L	0	L	0	0	0	
							31	000000	000000	L	0		0	0	0	
							31	0000000	0000000	L	0		0	0	0	
							31	000000	000000	L	0		0	0	0	
							31	000000	T010110000	L	0		0	0	0	1
							31	0000000	0000000	L	0		0	0	0	1
274	T	4	2	105467	633	003	31	000000	T010011001		0		0	0	0	
							31	000000	000000	L	0		0	0	0	
							32	0000000	000000		0		0	0	0	
							31	000000	000000		0		0	0	0	
							31	000000	000000		0		0	0	0	
							32	000000	000000		0		0	0	0	
344	T	5	2	131618	360	000	61	000000	000000		0		0	0	0	
							62	000000	L01001001		0		0	0	0	
							62	000000	T010110000		0		0	0	0	1
							61	000000	T010010001		0		0	0	0	
							62	000000	000000		0		0	0	0	
							62	000000	000000		0		0	0	0	
707	T	1	2	105370	631	010	31	000000	000000	L	1		1	0	0	
							31	000000	000000		0		0	0	0	
							32	000000	000000	H	1		0	0	0	
							31	0000000	0000000	B	1		0	0	0	
							31	000000	000000	L	1		0	0	0	1
							32	000000	000000		0		0	0	0	
534	T	4	2	107045	614	001	32	000000	T110010001		0		0	0	0	
							32	0000000	T010010001		0		0	0	0	
							32	000000	L110111001		0		0	0	1	
							31	000000	T100110111		0		0	0	0	
							32	000000	000000		0		0	0	1	
							32	000000	000000		0		0	0	0	
58	T	2	2	105303	642	003	32	000000	000000		0		0	0	0	
							31	000000	000000		0		0	0	0	
							31	000000	000000		0		0	0	0	
							31	000000	T100010001		0	L	1	0	0	
							32	0000000	000000		0		0	0	0	
							31	000000	000000		0		0	0	0	
448	T	4	2	107040	404	001	61	000000	000000		0		0	0	0	
							62	000000	000000		0		0	0	0	
							61	000000	000000		0		0	0	0	
							61	000000	T010010001		0		0	0	0	
							61	000000	000000		0		0	0	0	
							61	000000	000000		0		0	0	0	

300045 1638 626 236 322 00 15524 A 4004 6611 25

301053 1664 719 239 343 10 1806 A 4612 6611 19

301068 1702 730 349 440 02 1155 A 4707 6611 18

301076 1651 828 144 283 00 13250 A 1805 6609 42

301079 1727 987 254 323 22 9966 A 2704 6609 39

301082 1600 669 219 292 00 14515 A 4310 6611 22

301092 1714 784 328 399 10 2057 A 4701 6611 19

22	T	1	2	133673	339	000	61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							63	000000	000000		0	0		0	0	1	
							62	0011000001	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							63	000000	000000		0	0		0	0		
925	T	1	2	134573	427	000	61	000000	000000		0	0		0	0		
							62	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	1010010101		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
52	T	0	2	139997	271	000	61	000000	5010001001		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	1010111011		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
537	T	0	2	138987	543	000	61	000000	000000		0	0		0	1	1	
							61	000000	000000		0	1		0	0		
							61	000000	000000		0	0		0	0	1	
							61	000000	1010010000		0	0		0	0	1	
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
215	T	4	2	103096	656	000	31	000000	1010100010		0	0		0	1		
							33	000000	000000		0	0		0	1	1	
							32	000000	1010110110		0	0	L	1	1	1	
							31	0000000000	1011111010		0	0		0	0		
							31	000000	000000		0	0		0	0	1	
							32	000000	000000		0	0		0	0		
281	T	5	2	133773	376	000	61	000000	1010001001	A	0	0		0	0		
							61	000000	000000	A	0	0		0	0	1	
							61	000000	000000		0	0		0	0	1	
							61	000000	000000		0	0		0	0	1	
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
610	T	3	2	137059	614	001	31	000000	1010001000		0	0		0	1		
							31	000000	000000		0	0		0	0		
							33	000000	000000		0	0		0	1	1	
							31	000000	1011111011		0	0		0	0		
							32	000000	000000		0	0		0	0		
							31	000000	000000		0	0		0	0		

301037	1823	1343	431	525	00	15038	A		5231	6611	14
301102	1714	592	350	412	00	12672	A		4410	6611	22
301118	1651	704	353	410	00	15064	A		5636	6611	7
301122	1576	752	334	262	00	13473	A		2636	6611	43
301142	1753	618	346	407	00	380	A		2903	6611	31
301143	1660	713	283	375	00	6589	A		3603	6611	19
301144	1646	819	311	279	00	13110	A		4311	6611	26

```
179 T 0 2 107145  653 000 31  000000 T3100100   0  0  0 0
                  31  000000 T1101101   0  0  0 0
                  32  000000 T1101101   0  0  0 0 1
                  31  000000 T1000101   0  0  0 0
                  31  000000  000000   0  0  0 0
                  31  000000  000000   0  0  0 0

 28 T 3 2 143373  241 000 61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 1
                  61  000000  000000   0  0  0 0

383 T 4 2 137553  533 004 61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  62  000000  000000   0  0  0 0
                  61  000000  000000  R 0  0  0 0
                  62  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0

293 T 0 2 104051  634 001 61  000000  000000  LD 1  0 LB 1 0
                  61  000000  000000   L 1  0 LB 2 0
                  61  000000  000000  FB 1  1 WBL 3 0
                  61  000000 T1000101   B 1  0 LD 2 0
                  61  000000  000000   R 2 L 0 LB 1 0
                  61  000000  000000   R 2  0 LD 2 0

 78 T 3 2 114251  532 000 61  000000  000000   0  0  0 0
                  61  000000  000000   L 1  0  1  0
                  61  000000  000000     0  0  0 0 1
                  61  000000  000000   R 1  0  0 0 1
                  61  000000  000000  R1  0 -1  1 0
                  61  000000  000000   0  0 -1  1 0

671 T 4 2 133667  574 001 61  000000  000000   0  0  0 0
                  61  000000 T1101101   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000 T1101101   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0

 97 T 4 2 176007  415 001 61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 1
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
                  61  000000  000000   0  0  0 0
```

301146	1714	908	196	285	00	6594	A		2735	6611	34
301147	1758	871	465	554	00	7953	A		6233	6611	3
301171	1547	687	170	240	00	2650	A		2735	6611	30
301189	1634	713	259	319	10	3056	A		2938	6611	31
301199	1575	553	219	256	10	12414	A		4203	6611	24
301229	1689	666	225	286	10	7790	A		4336	6611	32
301230	1685	636	412	436	00	11762	A		4536	6611	21

336	T	A	2	137439	613	301	61	000000	000000	L	1	0	0	0	0		
							61	000000	11000011001	L	0	0	0	0	0		
							61	01201111010	000000	R	0	R	0	0	1	1	
							61	000000	11001111011		R	1	0	0	0	1	
							61	000000	11001111000			0	0	0	1		
							61	000000	000000	L	0	0		0	1		
86	T	A	2	175620	414	000	61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000	R	0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
105	T	S	2	135757	621	002	31	000000	000000	R	0	0	R	0	0		
							31	000000	000000	R	0	0		0	0		
							31	000000	000000	R	0	0	R	1	0		
							31	000000	000000	R	0	0		0	0		
							31	00000000	00000000	R	0	0	R	1	0		
							31	00000000	00000000	R	0	0	R	1	0	1	
928	T	S	2	106899	605	003	61	000000	000000	R	1	0		0	0		
							61	000000	000000		0	0		0	0		
							62	000000	000000		0	0		0	0	1	
							61	000000	11001111011		R1	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
376	T	1	2	105715	624	111	32	000000	00110011000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							62	000000	000000		0	0		0	0	1	
							31	000000	000000		0	0		0	0		
							31	000000	000000		0	0		0	0		
							32	000000	000000		0	0		0	0		
409	T	A	2	133031	375	001	61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	10100111011		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
152	T	S	2	117242	641	001	61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	00101011	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		
							61	000000	000000		0	0		0	0		

331232	1664	554	269	332	00	14378	A	2736	6611	32
331238	1603	653	262	348	00	9606	A	4601	6611	20
331258	1511	489	245	299	00	13677	A	5309	6611	13
331259	1702	760	132	251	20	14340	A	3609	6611	50
331269	1580	648	232	337	10	4130	A	2131	6611	43
331276	1727	866	444	542	30	13247	A	4603	6611	23
331277	1524	584	240	295	20	9848	A	4432	6611	17

301300	1651	621	338	366	00	6941	A		2809	6611	38	1159
301303	1714	665	296	370	13	795	A		3401	6611	30	904
301311	1681	748	236	318	10	8885	A		2408	6611	19	613
301319	1613	665	259	370	00	816	A		4211	6611	23	325
301321	1651	719	304	382	00	1581	A		3703	6611	29	94
301324	1697	916	283	485	10	3133	A		4238	6611	24	134
301349	1727	838	334	424	00	1552	A		2212	6611	43	457

2	2	103040	654	001	32	000000	101001001	0	0	0	0	
					31	000000	000000	0	0	0	0	1
					32	000000	000000	0	0	0	1	1
					31	000000000	101011011	0	0	0	0	1
					31	000000	000000	0	0	0	0	
					32	000000	000000	0	0	0	0	
1	2	127782	397	003	61	000000	101001011	0	0	0	0	
					62	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	0	
					61	000000	101011011	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
1	2	120023	473	001	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	1	1
					61	000000	101011001	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
5	2	104676	599	003	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	0	
					61	000000	101001001	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	0-000000	0-000000	0	0	0	0	
5	2	117564	498	003	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	101001011	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
4	2	104903	636	003	31	000000	101001001	0	0	0	0	
					31	000000	000000	1 1	0	0	0	
					31	000000	000000	0	0	0	0	
					31	000000	000000	0	0	0	0	
					31	000000	000000	0	0	0	0	
					32	001100000	000000	0	0	0	0	
1	2	105912	617	001	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	

301353	1613	938	185	205	02	716	A	2806	6611	35	548	T
301380	1783	856	384	437	00	7067	A	4308	6611	23	151	T
301386	1638	804	347	406	00	2999	A	4604	6611	20	32	T
301411	1727	900	285	385	00	10506	A	4601	6611	20	29	T
301414	1638	615	258	320	00	9973	A	3707	6611	20	815	T
301446	1732	766	220	336	00	4023	A	2507	6611	37	2965	
301447	1778	866	251	361	00	15005	A	2905	6611	20	88	

301469	1631	574	278	353	0C	12708	A	3134	6611	45	183	T	0	2	108754	586	001	61	000000	000000		0		0	B	1	0	
																		61	000000	000000		0		0	B	1	0	
																		61	000000	000000		0		0	B	1	0	
																		61	000000	000000		0		0	B	1	0	
																		61	000000	000000		0		0	B	1	0	
																		61	000000	000000		0		0	B	1	0	
301472	1570	553	140	250	10	9568	A	3205	6611	34	849	T	5	2	105159	633	002	31	000000	T01001001		0		0		0	0	
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
301486	1740	610	415	562	00	6726	A	6235	6611	1	11	T	4	2	135720	318	001	61	000000	000000		0		0		0	0	
																		61	000000	000000		0	R	0		0	0	
																		61	000000	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
																		62	000000	000000		0		0		0	0	
301493	1748	764	303	376	00	178	A	2701	6611	29	261	T	4	2	107634	608	000	31	000000	000000		0		0		0	0	
																		31	000000	110011001		0		0		0	0	
																		31	000000	111111001		0		0		0	1	1
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
																		31	000000	000000		0		0		0	0	
301499	1664	789	316	372	00	13601	A	2811	6611	33	494	T	4	2	111817	556	000	61	000000	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
																		61	000000	T01011001		0		0		0	0	
																		61	000000	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
301511	1631	737	233	328	20	5151	A	4103	6611	23	140	T	1	2	119840	475	001	61	000000	000000		0		0		0	0	
																		62	000000	000000		0		0		0	0	
																		62	000000	000000		0		0		0	0	
																		61	000000	L01001001		0		0		0	1	
																		61	001010010	000000		0		0		0	0	
																		61	000000	000000		0		0		0	0	
301523	1613	883	184	247	12	4233	A	4208	6611	26	127	T	1	2	110247	572	002	61	000000	000000	5	0	1	0		0	0	
																		61	000000	000000	4	0		0		0	0	
																		61	000000	000000	[illegible]	0	1	0		0	0	
																		61	000000	000000	[illegible]	0	1	0		0	1	
																		61	000000	000000	[illegible]	0	1	0		0	0	
																		61	000000	000000	7	0		0		0	0	

```
633 T 2 2 106179  623 030 32  000000 S12011010      0  0    0 0
                          32  000000    000000      0  0    0 0
                          32  000000    000000      0  0    0 0  1
                          32  000000 T10011011      0  0    0 0
                          31  000000    000000      0  0    0 0
                          32  000000    000000      0  0    0 0

487 T 3 2 105726  517 030 61 P01010010 T01001001      0  0    0 0
                          61  000000 S11011011      0  0    0 0
                          61 P22011011    000000    0  0    0 0
                          61 P01211001 T10011001    0  0    0 0
                          61  000000    000000      0  0    0 0
                          61 P10100000 T11001001    0  0    0 0

468 T 4 2 106373  621 033 61 P11010010 S11001001      0 H 0 B  0 0
                          61  000000 S11111111      0  0 BR   1 0
                          61  000000 T12111111      0 H 0 BB 1 0
                          61  000000 T22111111      0 H 0 BR 1 0
                          61  000000 S11111110      0 P 0 BL 1 0  1
                          61 P22110110 S11001000    0 L 0 LL 1 0

 57 T 4 2 125131  424 031 61  000000    000000      0  0    0 1  1
                          61  000000    000000      0  0    0 2
                          62  000000    000000      0  0    0 2
                          61  000000    000000      0  0    0 1  1
                          61  000000    000000      0  0    0 1
                          61 P11010000    000000    0  0    0 0  1

 75 T 4 2 127276  431 033 61  000000    000000   B  0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000   B  0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000      0  0    0 0

359 T 3 2 124394  431 001 61  000000    000000      0  0    0 0
                          61  000000    000000   B  0  0    0 0
                          61  000000    000000   B  0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000   B  0  0    0 0

1491 T 4 2 111176  562 001 61  000000    000000      0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000    000000      0  0    0 0
                          61  000000 T11111011      0  0    0 0
                          61  000000 T11010000      0  0    0 0
                          61  000000    000000      0  0    0 0
```

301543	1727	915	236	291	10	12371	A		2295	6611	44
301545	1714	633	274	343	00	2950	A		3534	6611	31
301558	1595	541	183	214	22	15080	A		1210	6611	43
301569	1753	703	408	468	12	242	A		5036	6611	15
301575	1714	434	293	365	02	7013	A		4836	6611	18
301591	1464	692	243	424	32	3907	A		4536	6611	23
301613	1497	633	241	322	10	14232	A		7636	6611	33

4	2	108653	539	001	61	000300	300000		0	0		0	0	
					61	000000	000000		0	0		0	0	
					62	000000	000000	F	1	0		0	0	1
					62	000000	T01011011		0	0		0	0	1
					61	000000	000000		0	0		0	0	
					62	000000	000000	F	2	0		0	0	
4	2	107650	639	002	42	000000	T01001001		0	F	0		0	
					41	000000	000000		0		0		0	0
					33	000000	000000		0		0		0	0
					31	000000	T01011001		0		0		0	0
					41	000000	000000		0		0		0	0
					32	000000	000000		0		0		0	0
4	2	105519	619	100	61	000000	000000	F	1		0		0	0
					61	000000	000000		0		0		0	0
					62	000000	000000	F	2		0		0	0
					61	000000	T01011001	F	1		0		0	0
					61	000000	000000	F	1		0		0	0
					61	000000	000000	F	1		0		0	0
3	2	106701	619	000	31	000000	000000		0		0		0	0
					31	000000	000000		0		0		0	0
					41	000000	000000		0		0		0	0
					31	000000	T01001001		0		0		0	0
					31	000000	000000		0		0		0	0
					41	000000	000000		0		0		0	0
1	2	102247	654	001	61	000000	000000		0		0		0	0
					62	000000	000000		0		1		0	1
					63	000000	000000		0		0		0	1
					62	000000	T12011011	F	1		0		0	1
					63	000000	000000		0		0		0	0
					62	000000	000000		0		0		0	0
4	2	114977	525	000	61	000000	000000		0		0		0	0
					61	000000	000000	F	1		0		0	0
					61	000000	000000		0		0		0	0
					61	000000	000000		0		0		0	0
					51	000000	000000		0		0	L	1	0
					51	000000	000000		0		0		0	0
3	2	104381	621	000	31	000000	000000		0		0		0	0
					31	000000	000000		0		0		0	0
					41	000000	000000		0		0		0	1
					31	000000	000000		0		0		0	0
					31	000000	000000		0		0		0	1
					41	000000	000000		0		0		0	0

301641	1702	767	182	252	20	15472	A		2302	6611	26	49 T
301643	1575	834	219	276	20	10335	A		4305	6611	22	184 T
301647	1626	689	254	327	00	12743	A		2813	6611	18	383 T
301649	1697	666	314	395	00	12100	A		2331	6611	43	364 T
301655	1613	786	265	105	12	4090	A		1405	6611	32	290 T
301657	1626	576	177	246	10	7361	A		3636	6611	30	353 T
301658	1638	545	220	302	00	7356	A		2612	6611	31	406 T

```
0 2 104760  637 000 32   000000    000000      0  0    0 0
                31   000000    000000      0  0    0 0
                32   000000 T10011000      0  0    0 0
                31   000000 T10011011      0  0    0 0
                31   000000 L01010000      0  0    0 1
                41 P0111000   000000      0  0    0 0

4 2 124379  432 111 61   000000    000000      0  0    0 0
                61   000000    000000      0  0    0 0
                61   000000    000000      0  0    0 0 1
                61   000000 T01001001      0  0    0 0
                62   000000    000000      0  0    0 0
                61   000000    000000      0  0    0 0

4 2 127585  398 101 61 P01011011 T01101001      0  0    0 0
                61   000000    000000      0  0    0 0
                62   000000 T01101000    1 0  0    0 0
                61   000000    000000    1 0  0    0 0
                61   000000 S10010000      0  0    0 0
                61   000000    000000      0  0    0 0

0 2 137024  414 001 32   000000 T01001001      0  0    0 0
                32   000000    000000      0  0    0 0
                32   000000    000000      0  0    1 0 1
                31   000000 T01001001      0  0    0 0
                31   000000    000000      0  0    0 0
                32   000000    000000      0  0    0 0

4 2 132515  351 000 61   000000    000000      0  0    0 2
                61   000000    000000      0  0    0 1 1
                61   000000    000000      0  0    0 1 1
                61   000000    000000      0  0    0 1 1
                61   000000    000000      0  0    0 0 1
                61   000000    000000      0  0    0 0 1

4 2 135035  435 000 31   000000    000000      0  0    0 0
                31   000000    000000      0  0    0 0
                32   000000    000000      0  0    0 1
                31   000000 T01011001      0  0    0 0
                31   000000    000000      0  0    0 0
                31   000000    000000      0  0    0 0

2 2 131415  448 000 32   000000 T22011011    1  0    0 0
                32   000000 T11001001      0  0    0 0
                33   000000 T22111011    1 2  3    0 0
                31   000000 T22111011    1 1  1    0 0
                31   000000 T22111111    1 1  1    0 0
                32   000000 T22111011    1  0  0    0 0
```

331664	1471	729	235	306	00	15055	A		1936	6611	41	278 T
331733	1621	743	306	364	00	2738	A		4208	6611	23	224
331726	1664	739	271	310	10	600	A		4834	6611	17	305
331736	1626	753	248	303	00	14321	A		2991	6611	27	324
331755	1554	517	336	360	00	4693	A		4839	6611	15	58
331759	1681	826	236	511	00	1151	A		3727	6611	29	16
331416	1405	599	169	235	10	13222	A		2834	6611	34	725

301819	1668	558	204	242	00	3936	A	2201	6611	40
301822	1562	636	242	324	02	15647	A	4238	6611	34
301835	1638	577	184	276	20	9539	A	2130	6611	35
301833	1526	551	239	306	20	12206	A	2335	6611	32
301844	1638	762	193	272	20	10795	A	2635	6611	30
301845	1714	644	332	366	00	6491	A	4309	6611	15
301861	1707	785	311	407	00	5342	A	3601	6611	14

5	2	105193	622	001	31	0000000	T010010001			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
3	2	104434	640	000	31	0000000	S100110011		R	1	0		0	0			
					31	0000000	0000000			0	0		0	0			
					32	0000000	0000000			0	0		0	0	1		
					31	0000000	T100110011			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
					31	P01 0130100	0000000000			0	0		0	0			
2	2	104359	644	001	31	0000000	0000000			0	0		0	2	1		
					31	0000000	0000000			0	0		0	1			
					31	0000000000	0000000000			0	0		0	1			
					31	0000000000	0000000000			0	0		0	3	1		
					31	0000000	0000000			0	0		0	2			
					31	0011001100	0000000			0	0		0	1			
0	2	106434	621	002	31	0000000	0000000			0	0		0	1			
					31	0000000	0000000			0	0		0	0			
					32	0000000	0000000			0	0		0	0	1		
					31	0000000	0000000			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
					31	0000000	0000000			0	0		0	0			
3	2	134924	334	000	41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	T310100310			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
5	2	110325	523	001	41	0000000	0000000			0	0	H	0	0			
					41	0000000	0000000			0	0	H	1	0			
					41	0000000	0000000			0	0	H	1	0			
					41	0000000	0000000			0	0	H	1	0			
					41	0000000	0000000		L	0	0	H	1	0			
					41	0000000	0000000			0	0	H	1	0			
4	2	131040	743	000	41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	0			
					41	0000000	0000000			0	0		0	1			
					41	0000000	0000000			0	0		0	0			

331869	1651	713	302	401	10	8677	A		4234	6611	23	56
331890	1722	745	266	438	00	13626	A		2639	6611	40	374
331899	1645	619	287	367	00	12260	A		3737	6611	29	159
331902	1748	956	335	441	00	6485	A		4837	6611	16	42
331935	1751	737	319	439	00	6745	A		4012	6611	16	263
331946	1681	733	274	358	10	8329	A		3830	6611	17	19
331951	1714	781	430	455	10	14659	A		4338	6611	18	37

```
A 2 133247  341 000 61      000000      000000      0  0    0 0
                61      000000      000000      0  0    0 0
                62      000000      000000      0  0    0 0
                61      000000  T01001001       0  0    0 0
                61      000000      000000      0  0    0 0
                62      000000      000000      0  0    0 0

A 2 111037  564 000 62      000000      000000    L  1    0    0 0
                61      000000      000000        0    0    0 0
                61      000000  T31001001           L1   1  L 1 0
                62      000000  T10011111           L1   0    0 0
                61  P100010010      000000          0    0    0 0
                61      000000      000000      0   2    0    0 0

A 2 107537  609 112 31      000000  T01001001       0  0    0    0 1
                31      000000      000000          0    0    0 0 1
                31      000000      000000          0    0    0 1 1
                31      000000  T01001001           0    0    0 0 1
                31  C0C000000   00000000            0    0    0 0 1
                31      000000      000000          0    0    0 0 1

A 2 104760  647 001 32      000000  T11011010       0  0    0    0 0
                31      000000  L11011010       F   0  0    0    0 1
                31  00000000    T21010010           0  0    0    0 0
                31  00000000    T21111011           0  0    0    0 0
                31      000000  L31010000       2   0  0    0    0 0
                32      000000      000000          0  0    0    0 0

S 2 122056  453 000 61  P01000011    T01001000       0  0    0    0 0
                61      000000      000000          0  0    0    0 0
                61  P10000001       000000          0  0    0    0 0
                61  P01011011       000000          0  0    0    0 0
                61      000000      000000          0  0    0    0 0
                61  P11001001       T10001000       0  0    0    0 0

A 2 104432  641 001 31  P2011110    T11001001   R   0  0    0    0 0
                31  P2111111        000000          0  0    0    0 1
                31  P3111111        000000          0  0    0    0 1
                31  P2111110    00000000            0  0    0    0 1
                31  P2111110    00000000            0  0    0    0 1
                31  P2111110    00000000            0  0    0    0 1

A 2 104601  [illegible] 012 31      000000  T01001001       0  0    0    0 0
                31      000000      000000          0  0    0    0 0
                31      000000      000000          0  0    0    0 1
                31      000000  T01111011           0  0    0    0 0
                31      000000      000000          0  0    0    0 0
                31      000000      000000          0  0    0    0 1
```

301	382	1689	681	342	367	00	1673	A	5136	6011	11	82
332005	1626	694	248	299	00	15123	A	2732	6011	29	591	
332024	1587	739	214	294	00	2207	A	3613	6011	29	302	
332026	1638	733	238	280	10	4059	A	4335	6011	29	316	
332049	1656	653	305	302	10	2441	A	4534	6011	21	48	
402050	1707	503	202	254	00	4205	A	2307	6011	43	2347	
332092	1824	671	291	390	00	12561	A	2805	6011	43	165	

37	T	0	2	117148	505	000	61	000000	000000		0	0		0	0	
							61	000000	111001001		0	0		0	0	
							62	000000	112011011		0	0		0	0	
							61	000000	110011011		0	0		0	0	
							61	000000	111010010		0	0		0	0	
							61	000000	000000		0	0		0	0	
243	T	3	2	110881	504	101	61	000000	111001001		0	0		0	0	
							61	000000	111001001		0	0		0	0	
							62	000000	111011001		0	0		0	0	1
							61	000000	110001001		0	0		0	0	
							62	000000	112011001		0	0		0	0	
							62	000000	111001001		0	0		0	0	
679	T	0	2	106782	617	001	32	000000	922011011		0	0		0	0	
							11	000000	511111111		0	0		0	0	
							32	000000	000000		0	0		0	0	1
							32	000000	110001011		0	0		0	0	
							32	000000	000000		0	0		0	0	
							12	000000	000000		0	0		0	0	
131	T	0	2	107497	598	001	61	000000	000000		0	0		0	0	
							61	P10001001	110001001		0	0		0	0	
							61	001001000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
113	T	4	2	123734	437	000	61	000000	000000		0	0		0	0	
							61	000000	000000		0	0		0	0	
							61	000000	101010010	5	0	0		0	0	
							61	000000	110110110		0	0		0	0	1
							61	000000	000000	5	0	0		0	0	
							62	000000	111100100	5	0	0		0	0	
474	T	4	2	116273	511	001	61	000000	000000	5	1	0	R	1	0	
							61	000000	000000		0	0	R	1	0	
							61	000000	000000		0	0	RR	1	1	
							61	000000	000000		0	0	R	1	0	
							61	000000	000000		0	0	R	1	0	
							61	000000	000000		0	0	R	1	0	
61	T	4	2	117420	498	000	61	000000	000000	LL 2		0		0	1	
							61	101001000	110011000	L 2		0		0	0	
							62	000000	111011000	LL 3		0		0	0	
							61	000000	110011000	L 3		0		0	0	
							62	000000	112011000	L 3		0		0	0	
							62	000000	000000	LL 3		0		0	0	

302101	1575	622	264	307	00	11324	A	3713	6611	29
302126	1664	925	242	272	00	15612	A	2906	6611	36
302130	1575	719	218	262	30	2864	A	3630	6611	33
302156	1732	749	324	342	00	2826	A	4304	6611	23
302159	1651	713	197	286	00	13754	A	4009	6611	26
302163	1638	580	335	304	30	5150	A	3512	6611	33
302179	1676	735	284	325	10	4796	A	4604	6611	23

302185	1546	708	264	336	10	2769	A	4005	6611	26	419	T	4	2	107346	611	000	31	000000	101001001		0	0		0	1	
																		31	000000	501001001		0	0		0	0	
																		31	000000	000000		0	0		0	0	
																		31	000000	000000		0	0		0	0	
																		31	000000	000000		0	0		0	0	
																		31	00000050	000000		0	0		0	1	
302213	1671	807	333	387	00	15617	A	4409	6611	22	194	T	4	2	116142	512	000	61	000000	000000		0	0		0	0	
																		61	000000	000000		0	0		0	0	
																		62	000000	000000		0	0		0	0	
																		61	001001011	000000		0	0		0	0	
																		61	000000	000000		0	0		0	0	
																		61	000000	000000		0	0		0	0	
302255	1676	903	255	384	11	10097	A	2503	6611	37	183	T	5	2	109032	596	001	61	000000	101001001		0	0	R	1	0	
																		61	000000	000000		0	0	P	1	0	
																		61	000000	000000		0	0	F	0	0	I
																		61	000000	L10001001		0	1	R	1	0	
																		61	000000	000000		0	0	F	1	0	I
																		61	000000	000000		0	0		0	0	
302268	1595	742	215	276	00	8773	A	2410	6611	36	1731	T	3	2	106828	616	001	31	000000	111011001		0	0		0	1	
																		31	000000	U11011001		0	0		0	0	
																		32	000000	000000		0	0		0	0	
																		31	00000000	111111011		0	0		0	1	I
																		31	00000000	L01011000		0	0		0	0	
																		32	000000	101001000		0	0		0	0	
302269	1605	720	214	275	12	1915	A	1305	6611	37	188	T	4	2	104687	638	002	31	000000	000000		0	0		0	1	
																		31	000000	000000		0	0		0	0	
																		31	000000	101010000	H	1	0		0	1	
																		31	00000000	00000000		0	0	PR	0	0	I
																		31	000000	000000		0	0		0	0	
																		31	000000	000000	H	1	0		0	0	
302313	1722	693	293	442	00	5467	A	5402	6611	12	80	T	4	2	119790	477	000	61	000000	000000		0	0		0	0	
																		61	000000	000000		0	0		0	0	
																		61	000000	000000		0	0		0	0	I
																		61	000000	000000		0	0		0	0	
																		62	000000	110010000	M	1	0	P	1	0	
																		61	000000	000000		0	0		0	0	
302317	1549	726	237	311	00	10045	A	2609	6611	36	1155	T	0	2	104650	638	000	31	000000	101001001	R	0	0		0	0	
																		31	000000	000000		0	0		0	0	
																		32	000000	000000		0	0		0	0	
																		32	000000	101011111		0	0		0	0	
																		31	000000	000000		0	0		0	0	
																		32	000000	000000		0	0		0	0	

302185	1546	708	264	336	10	2769	A	4005	6611	26	419	T	4	2	107346	611	000	31	000000	T01001001	0	0		0	1	
																		31	000000	501001001	0	0		0	0	
																		31	000000	000000	0	0		0	0	
																		31	000000	000000	0	0		0	0	
																		31	000000	000000	0	0		0	0	
																		31	00000000	000000	0	0		0	1	
302213	1671	507	333	387	00	15617	A	4409	6611	22	194	T	4	2	116182	512	000	61	000000	000000	0	0		0	0	
																		61	000000	000000	0	0		0	0	
																		62	000000	000000	0	0		0	0	
																		61	001001011	000000	0	0		0	0	
																		61	000000	000000	0	0		0	0	
																		61	000000	000000	0	0		0	0	
302255	1676	903	255	384	11	10097	A	2502	6611	37	183	T	5	2	109032	596	001	61	000000	T01001001	0	0	R	1	0	
																		61	000000	000000	0	0	R	1	0	
																		61	000000	000000	0	0	R	0	0	1
																		61	000000	U10001001	0	1	R	1	0	
																		61	000000	000000	0	0	R	1	0	1
																		61	000000	000000	0	0		0	0	
302268	1595	742	215	276	00	8773	A	2410	6611	36	1731	T	3	2	106828	616	001	31	000000	T11011001	0	0		0	1	
																		31	000000	U11011001	0	0		0	0	
																		32	000000	000000	0	0		0	0	
																		31	00000000	T11111011	0	0		0	1	1
																		31	00000000	U01011000	0	0		0	0	
																		32	000000	T01001000	0	0		0	0	
302269	1605	720	214	275	12	1915	A	1205	6611	37	188	T	4	2	104687	638	002	31	000000	000000	0	0		0	1	
																		31	000000	000000	0	0		0	0	
																		31	000000	T01010000	R 1	0		0	1	
																		31	00000000	00000000	0	0	OR	0	0	1
																		31	000000	000000	0	0		0	0	
																		31	000000	000000	R 1	0		0	0	
302313	1722	693	283	442	00	5467	A	5402	6611	12	80	T	4	2	119790	477	000	61	000000	000000	0	0		0	0	
																		61	000000	000000	0	0		0	0	
																		61	000000	000000	0	0		0	0	1
																		61	000000	000000	0	0		0	0	
																		62	000000	T10010000	R1	0	R	1	0	
																		61	000000	000000	0	0		0	0	
302317	1549	726	237	311	00	10045	A	2609	6611	36	1155	T	0	2	104652	638	000	31	000000	T01001001	R 0	0		0	0	
																		31	000000	000000	0	0		0	0	
																		32	000000	000000	0	0		0	0	
																		32	000000	T01011111	0	0		0	0	
																		31	000000	000000	0	0		0	0	
																		32	000000	000000	0	0		0	0	

172	1	3	2	104768	627	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	001001000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
320	1	4	2	107981	594	001	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	101011001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
142	1	5	2	124145	431	002	61	000000	000000	L	1	L 0	0	0	
							62	000000	000000	L	0	0	0	0	
							61	010011000	000000	L	0	0	0	0	
							61	000000	110011001	L	0	0	0	0	
							61	000000	000000	L	0	0	0	0	
							61	000000	000000	L	0	0	0	0	
636	1	4	2	103739	636	001	61	000000	501011011		0	0	0	2	
							61	000000	501011011		0	0	0	0	1
							62	001010010	000000		0	0	0	1	1
							61	000000	501011011		0	0	0	1	1
							61	000000	510011010		0	0	0	0	1
							61	000000	000000		0	0	0	1	
23	1	4	2	125562	419	000	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	101011001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
927	1	5	2	116682	506	100	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	110111010		0	1	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
240	1	5	2	125870	415	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	1	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	

002325	1714	780	222	124	22	114	A	3617	6611	23
002335	1631	731	251	297	00	8016	A	3305	6611	27
000305	1613	674	260	301	22	10127	A	4213	6611	23
000317	1580	562	235	274	00	12070	A	1696	6611	49
000338	1505	693	315	388	00	12350	A	4710	6611	19
000340	1681	687	310	361	00	14628	A	7101	6611	35
000342	1626	626	307	429	00	12661	A	4232	6611	24

107	T	S	2	128773	385	032	61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	P01011011	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
287	T	S	2	119728	477	000	61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	T01010000			0	0	0	0				
							61	000000	000000			0	0	0	0				
130	T	S	2	115044	526	000	61	000000	T10001011		6	0	0	0	0				
							61	P10000001	T11011011			0	0	0	0				
							61	P22011011	000000			0	0	0	0	1			
							61	P10001001	000000		53	0	0	0	0				
							61	000000	T10011010		3	1	0	0	0				
							61	000000	T11001001		8	1	0	0	0				
31	T	S	2	123825	476	001	61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							62	000000	000000			0	0	0	0				
							62	000000	T01001001		L	1	0	0	0				
							62	000000	000001			0	0	0	0				
							62	000000	000000			0	0	0	0				
48	T	4	2	129116	342	011	61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	T01011011			0	0	0	0				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
105	T	4	2	111212	564	001	61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	1				
							61	000000	000000			0	0	0	0				
							61	000000	T01001001			0	0	0	1				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				
22	T	4	2	141754	236	100	61	000000	000000			0	0	0	1				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	1				
							61	000000	000000			0	0	0	0				
							61	000000	000000			0	0	0	0				

400350	1580	986	136	158	00	13901	A		6701	6611	19
430053	1549	569	243	283	00	14744	A		3937	6611	27
430091	1714	628	208	399	00	67	A		4911	6611	17
430109	1714	1323	251	396	13	12348	A		4911	6611	17
430118	1681	648	394	421	00	6797	A		5513	6611	11
430122	1791	928	324	435	00	7628	A		5313	6611	16
430128	1765	776	144	537	00	342	A		6337	6611	3

74 T 5 2 137570 598 001	61	000000	000000		0		0		0	0	
	61	000000	000000		0		0		0	0	
	62	000000	110011011		0		0		0	0	
	61	000000	101011017		0		0		0	0	
	61	000000	000000		0		0		0	0	
	61	000000	000000		0		0		0	0	1
279 T 5 2 115540 529 002	61	000000	000000		0		0		0	0	
	61	000000	000000		0	L	0		0	0	
	62	000000	000000		0		0		0	0	
	61	000000	000000		0		0		0	0	
	61	000000	000000		0	L	0		0	0	
	61	000000	000000		0		0		0	0	
71 T 3 2 110156 574 000	61	000000	000000	G	1		0	H	1	0	
	61	000000	000000		0		0	HR	1	0	
	61	000000	000000		0		0	HR	1	0	
	61	000000	000000		0		0	HR	1	0	
	61	000000	000000		0		0	HR	1	0	
	61	000000	000000		0		0	HR	1	0	
40 T 4 2 114734 525 000	61	000000	000000		0		0		0	0	
	61	000000	000000		0	L	0		0	0	
	61	000000	000000		0		0		0	0	
	61	000000	501011000		0		0		0	0	
	61	000000	000000		0		0		0	0	
	61	000000	000000		0		0		0	0	
385 T 0 2 107195 602 000	61	P01011011	101001001	D	0		0		0	1	
	61	000000	101001001	A	0		0		0	2	1
	61	P01010000	000000		0		0		0	2	1
	61	000000	L01001001		0		0		0	1	1
	61	000000	511011010		0		0	R	1	1	1
	61	000000	000000	F	1		0		0	0	1
75 T 4 2 127268 602 000	61	000000	000000		0	5	0		0	0	
	61	000000	000000		0		0		0	0	
	62	000000	000000		0		0		0	0	1
	61	000000	000000		0	=	0		0	0	
	61	000000	000000		0	=	0		0	0	
	62	000000	000000		0	^	0		0	0	
18 T 4 2 109743 579 000	61	000000	000000	-	1		0		0	0	
	61	000000	000000		0	B	0		0	0	
	61	000000	000000		0		0		0	1	
	61	000000	000000		0	⊓	0		0	0	
	61	000000	000000		0	B	0		0	0	
	61	000000	000000		0		0		0	0	

400153	1681	692	221	293	23	579	A	2535	6611	36
400162	1549	581	217	285	02	13873	A	3305	6611	30
400164	1554	499	292	305	00	11830	A	3307	6611	27
400154	1538	509	273	282	00	3832	A	4704	6611	19
400159	1524	680	283	317	10	10699	A	2705	6611	38
400164	1664	735	357	422	10	2378	A	4407	6611	4
400182	1671	479	247	337	10	15057	A	3502	6611	31

100	T	A	2	133382	372	001	61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	T01311011		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
38	T	A	2	137096	302	000	61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	P01000011	000000		0	0	0	0
							61	000000	000000		0	0	0	1
							62	000000	000000		0	0	0	0
110	T	A	2	124720	430	000	62	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							62	000000	000000		0	0	0	0
							61	P01001001	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
2	T	3	2	142970	244	000	61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	000000		0	0	0	0
							61	000000	T01111011		0	0	0	0
							61	000000	T10111011		0	0	0	0
							61	P10100100	000000		0	0	0	0
26	T	3	2	127431	309	011	61	000000	000000		0	0	0	0	1
							61	000000	000000	E	0	0	0	0	1
							61	000000	000000		0	0	0	0	1
							61	000000	000000	EE	1	0	0	1	1
							61	000000	000000	EE	0	0	0	0	
							61	000000	000000	E	0	0	0	1	
191	T	3	2	113104	545	000	61	000000	000000		0	0	0	1	
							62	000000	T01301001		0	0	0	1	
							61	000000	000000	E	1	0	0	0	1
							61	000000	T01001001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
172	T	3	2	113504	510	001	61	000000	000000		0	0	0	0	
							62	000000	T01000001		0	0	0	0	
							61	000000	T10011001		0	0	0	0	1
							61	000000	T12011011		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	

430191	1803	742	615	429	32	10794	A	4634	6611	18
430199	1481	763	362	445	03	6595	A	6133	6611	5
430205	1938	841	400	569	00	5269	A	5335	6611	16
430214	1727	591	432	511	00	14114	A	6237	6611	1
430219	1803	845	419	537	00	1288	A	5010	6611	16
430220	1714	701	295	346	00	11932	A	3713	6611	23
430221	1740	849	249	293	00	296	A	3936	6611	27

5 2 111284	762 001	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		61	000000	101001001	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
4 2 101529	659 001	61	000000	000000	0	0	0	0	
		61	000000	501001001	0	0	0	0	1
		61	000000	000000	0	0	0	0	
		61	000000	101001001	0	0	0	0	
		61	000000	000000	0	0	0	1	
		61	000000	000000	0	0	0	0	
5 2 111292	363 001	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	101001001	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
5 2 126406	412 001	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
		61	000000	110011001	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
4 2 113801	516 000	61	P01011001	101001001	0	0	0	0	
		61	000000	101001001	0	0	0	0	
		62	000000	000000	0	0	0	0	1
		61	000000	101001001	0	0	0	0	
		61	010001000	000000	0	0	0	0	1
		62	000000	000000	0	0	0	0	
5 2 114962	524 000	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	1	1
		61	P01001010	110011011	0	0	0	0	1
		61	000000	000000	0	0	0	0	
		62	000000	000000	0	0	0	0	
4 2 114951	526 000	61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	101001001	0	0	0	0	
		61	000000	000000	0	0	0	0	
		61	000000	000000	0	0	0	0	

030228	1859	919	439	538	12	3700	A	5210	6611	A	27	T
000234	1651	626	224	267	03	8072	A	1607	6611	50	545	T
000246	1605	687	337	404	10	13272	A	5210	6611	14	94	T
030276	1564	770	307	403	10	14265	A	1336	6611	27	191	T
000301	1676	792	289	387	00	1045	A	2803	6611	39	480	T
000309	1765	1051	344	432	10	2774	A	3303	6611	22	76	T
000317	1773	861	376	487	13	10832	A	5135	6611	15	132	T

0	2	133532	638	001	61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					62	000000	000000	R	0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					62	000000	000000		0	0		0	0
4	2	140659	268	002	61	P01010001	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	P01010011	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
5	2	111384	561	002	61	000000	000000		0	0		0	1
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	S01001011		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
4	2	125237	424	002	61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000	H	1	0		0	0
					61	0-000000	0-000000		0	0		0	0
1	2	124067	434	000	61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	000000		0	0		0	0
					61	000000	L01001001		0	0		0	0
					61	010011010	000000		0	1		0	0
					61	000000	000000		0	0		0	0
1	2	120034	476	001	61	000000	000000	H	0	0		0	0
					61	000000	T01001001	H	0	0		0	0
					61	000000	000000	H	0	0		0	0
					61	P01011011	T01001101		0	0		0	0
					61	000000	000000	H	0	0		0	0
					61	000000	000000	H	0	0		0	0
1	2	109071	595	001	61	000000	T01001011	F	1	0		0	0
					61	000000	000000	F	0	0		0	0
					61	000000	000000	FL	0	0	H	1	0
					61	000000	112011011	FH	0	0		0	0
					61	101010010	000000	P	0	0		0	0
					61	000000	000000	L	0	0		0	0

400320	1600	671	325	288	13	15278	A	2305	6611	41	331	T
400327	1656	586	368	499	12	3591	A	6107	6611	5	24	T
400346	1714	644	179	234	00	9062	A	2805	6611	29	116	T
400349	1638	658	194	296	20	6792	A	4901	6611	17	119	T
400371	1646	699	279	339	00	3823	A	4410	6611	22	117	T
400380	1727	730	283	406	00	7399	A	4908	6611	17	135	T
400383	1732	700	211	282	00	2707	A	2305	6611	39	602	T

228	T	0	2	105357	621	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	101001000		0	0	0	1	
							62	000000	001001001	B	1	0	0	1	
							62	000000	101001001		0	0	0	0	
							62	000000	000000	B	1	0	0	0	
98	T	A	2	126762	407	001	61	000000	000000	L	0	0	0	0	
							61	000000	000000	L	0	0	0	0	
							62	000000	000000	LL	1	0	0	0	
							61	000000	101001001	LL	0	0	0	0	
							61	000000	000000	LL	1	0	0	0	
							62	000000	000000	L	0	0	0	0	
40	T	5	2	131309	341	002	61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	101011011		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
96	T	4	2	115784	519	001	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	1
							61	000000	101011001		0	0	0	0	
							61	000000	000000		0 1	0	0	0	
							61	000000	000000		0	0	0	0	
248	T	A	2	120234	471	002	61	000000	000000	L	1	0	0	0	
							61	000000	000000	L	1 L	1	0	0	1
							61	000000	000000	LL	1	0	0	1	
							61	000000	000000	LL	1	0	0	0	
							61	000000	000000	1	2	0	0	0	
							61	000000	000000	L	1	0	0	0	
11	T	1	2	124835	428	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							62	000000	000000		0	0	0	0	1
							61	000000	000000		0	0	0	0	
							61	000000	000000		0 5	0	0	0	
							62	000000	000000	5	1	0	0	0	1
102	T	4	2	125623	417	000	61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	501011001		0	0	0	0	
							61	000000	000000		0	0	0	0	
							61	000000	000000		0	0	0	0	

403385	1758	992	254	322	00	11132	A		1607	6611 44
403400	1753	857	330	409	10	201	A		5210	6611 14
403401	1753	749	342	490	22	12746	A		5513	6611 11
403404	1656	566	216	286	20	12716	A		3306	6611 27
403408	1626	695	187	314	12	3576	A		4307	6611 23
403429	1676	749	303	397	00	4155	A		6113	6611 5
403457	1765	578	214	343	00	6977	A		5013	6611 16

2 T A 2 138784	588 001	61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	1	0	0		
		62	000000	000000		0	0	0	1	1		
		62	000000	101011000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
2 T S 2 138661	290 000	61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	101111111		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
2 T A 2 124473	429 001	61	000000	000000		0	0	0	0			
		61	000000	101001001		0	0	0	0			
		61	000000	101100000		0	0	0	0			
		61	000000	101111110		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
2 T S 2 111926	559 000	61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	1			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
2 T 0 2 140545	268 000	61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	101001011		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
169 T S 2 133193	392 000	61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	101000001		0	0	0	0			
		61	000000	000000		0	0	0	0			
		61	000000	000000		0	0	0	0			
2 T A 2 115140	521 100	61	000000	000000	R	0	0	0	1	1		
		61	000000	000000		0	0	0	0	1		
		62	000000	000000	L	0	0	0	0	1		
		61	000000	000000		0	0	0	1	1		
		61	000000	000000		0	0	0	0			
		61	000000	000000	R	0	0	0	0	1		

500004	1646	671	329	395	13	9364	A		6511	6611 1
500014	1803	755	389	444	00	3509	A		6511	6611 1
500043	1613	517	285	393	13	8286	A		6511	6611 1
500064	1613	565	248	324	00	13763	A		6511	6611 1
500072	1631	574	443	504	00	4414	A		6511	6611 1
500079	1748	303	394	491	00	13824	A		5335	6611 13
500093	1732	595	322	421	00	1445	A		6511	6611 1

500084	1778	609	331	417	00	10342	A	6511	6611	1	2	T	3	2	129607	373	000	61	000000	000000	LL 1	L 0	L 0 0	
																		61	000000	000000	LL 1	0	0 0	1
																		61	000000	000000	L 0	0	L 1 0	
																		61	000000	000000	LL 1	0	0 0	
																		61	000000	000000	LL 1	0	L 1 0	
																		61	000000	000000	LL 1	0	0 0	
500089	1664	710	254	325	00	11794	A	6511	6611	1	7	T	4	2	102798	645	001	61	000000	000000	0	0	0 0	
																		61	000000	110001001	L1	0	0 0	1
																		62	000000	101011000	0	0	0 0	
																		61	000000	110011001	0	0	0 0	
																		61	011010000	000000	0	0	0 0	
																		61	000000	110000001	0	0	0 0	
500099	1748	884	360	444	00	14283	A	6511	6611		1	T	0	2	123570	440	000	61	000000	000000	0	0	0 1	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 2	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	1
500102	1651	798	269	314	10	10544	A	6511	6611	1	2	T	2	2	110465	570	000	61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	1
																		62	000000	000000	0	0	0 0	1
																		61	000000	110011001	0	0	0 0	
																		62	000000	000000	0	0	0 0	
																		62	000000	000000	0	0	0 0	
500109	1740	637	282	337	00	2694	A	6511	6611	1	3	T	5	2	121679	457	001	61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	000000	111001001	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		62	000000	000000	0	0	0 1	
500115	1803	823	467	536	00	2007	A	6511	6611	1	2	T	0	2	143365	243	000	61	000000	101011011	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	012011011	000000	0	0	0 0	
																		61	000000	L01011011	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
500125	1613	825	350	387	00	14161	A	6511	6611	1	2	T	3	2	141340	263	001	61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		61	000000	000000	0	0	0 0	
																		62	000000	101011001	0	0	0 0	
																		62	000000	000000	0	0	0 0	
																		62	000000	000000	0	0	0 0	

3	2	102765	687	001	61	000000	000000	0	0	0	1	
					61	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	1	
					61	000000	000000	0	0	0	1	
					62	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	0	
4	2	129573	399	002	61	000000	000000	0	0	0	1	
					61	000000	000000	0	0	0	1	
					61	000000	000000	0	0	0	1	1
					61	000000	000000	0	0	0	0	1
					61	000000	000000	0	0	0	0	1
					61	000000	000000	0	0	0	0	1
5	2	175593	320	000	61	000000	000000	0	0	0	0	
					61	000000	T10001001	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
1	2	123262	443	000	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	0	1
					62	000000	T01011011	0	0	0	0	
					61	000000	000000	0	0	0	0	
					62	000000	000000	0	0	0	0	
3	2	116451	609	000	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	Q10011000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	T10001001	0	0	0	0	
					62	000000	000000	0	0	0	0	
4	2	112495	552	000	61	000000	000000	0	0	0	1	
					61	000000	000000	0	0	0	0	
					62	000000	000000	R	1	0	0	1
					61	000000	T10011010	R	1	0	0	
					61	000000	000000	R	1	0	0	1
					61	000000	000000	R	1	0	0	1
3	2	114401	543	000	61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	T01001001	0	0	0	0	
					61	000000	000000	0	0	0	0	
					61	000000	000000	0	0	0	0	

500132	1664	780	210	301	00	11045	A		6511	6611	1	2
500138	1714	573	350	475	00	166	A		6511	6611	1	2
500140	1676	699	390	487	00	7795	A		6511	6609		2
500159	1707	880	397	474	00	10617	A		6511	6611	1	2
500179	1727	821	306	414	00	738	A		6511	6611	1	6
500193	1605	712	266	317	10	15276	A		6511	6611	1	
500203	1714	720	318	390	00	11158	A		6511	6611	1	2

```
2 T 1 2 128242  391 000 61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000  T01011001         0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0

7 T 4 2 119881  477 002 61      000000      000000        0   0     0 0
                    61      000000  T11001001         0   0     0 0
                    61      000000  T21111010         0   0     0 0
                    61      000000  T10011001         0   0     0 0
                    61      000000  T12011010       H 1 R 1     0 1
                    61  010101000       000000        0   0     0 1

2 T 4 2 107001  635 001 61      000000      000000        0   0     0 1
                    61      000000      000000        0   0     0 0 1
                    61  001010000       000000      L 0   0     0 1 1
                    61      000000  T01111000         0   0     0 0
                    61      000000      000000        0   0     0 0
                    61  011100000       000000        0   0     0 0

2 T 4 2 117862  495 000 61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000  U01001001         0   0     0 0
                    61      000000  T01010010         0   0     0 0
                    61      000000      000000        0   0     0 0

2 T 4 2 120817  470 011 61      000000      000000      L 0   0     0 0 1
                    61      000000      000000      L 0   0     0 0
                    61      000000      000000      L 0   0     0 0
                    61      000000  T01111011         0   0     0 0
                    61      000000      000000      L 1   0     0 0
                    61      000000      000000      L 0   0     0 0

6 T 0 2 125095  422 002 61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 1
                    61      000000  T01001001         0   0     0 1
                    61      000000      000000        0   0     0 0 1
                    61      000000      000000        0   0     0 0

2 T 5 2 115578  518 000 61      000000      000000        0   0     0 0
                    61      000000      000000        0   0     0 0
                    62      000000      000000        0   0     0 0
                    61      000000  T01011011         0   0     0 0
                    61      000000      000000        0   0     0 0
                    62      000000      000000        0   0     0 0
```

```
500203 1656  707  375  457 20 13357 A        6511 6611  1
500212 1626  635  219  286 00  4050 A        6511 6611  1
500215 1773  679  303  327 10 12674 A        6511 6611  1
500226 1651  685  276  348 00  9668 A        6511 6611  1
500237 1697  603  285  352 10  5662 A        6511 6611  1
500244 1727  848  319  401 10  3098 A        6511 6611  1
500248 1626  744  317  341 00 14779 A        6511 6611  1
```

7 T 4 2 139962	540 000	61	000000	T11001001		0	0	0	0					
		41	000000	000000		0	0	0	0					
		42	000000	000000		0	0	0	0					
		41	000000	T01011011		0	0	0	0					
		41	000000	000000		0	0	0	0					
		42	000000	000000		0	0	0	0					
2 T 5 2 132432	349 002	61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					
		62	000000	000000		0	0	0	0	1				
		61	000000	L01001001		0	0	0	0	1				
		61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					
2 T 4 2 120384	470 002	61	000000	T01001001		0	0	0	0					
		61	000000	T01001001		0	0	0	0					
		61	000000	T10011000		0	0	0	0					
		61	000000	T11011001		0	0	0	0					
		61	000000	000000		0	0	0	0					
		61	000000	T10001001		0	0	0	0	1				
2 T 4 2 118798	486 001	61	000000	000000	LL	1	0	0	0					
		61	000000	000000	L	0	0	0	0					
		61	000000	000000	L	0	0	0	0					
		61	000000	T01011011	L	0	0	0	0					
		61	000000	000000	L	0	0	0	0					
		61	000000	000000		0	0	0	0					
2 T 3 2 141010	266 002	41	000000	501001001		0	0	0	0					
		31	000000	000000		0	0	0	0					
		42	000000	T01011000		0	0	0	0					
		31	000000	T01001011		0	0	0	0					
		31	000000	000000		0	0	0	0					
		42	000000	000000		0	0	0	0					
2 T 4 2 110701	358 001	61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					
		62	001010000	000000		0	0	0	1	1				
		61	001001011	000000		0	0	0	0					
		62	000000	000000		0	0	0	0					
		62	000000	000000		0	0	0	0					
2 T 4 2 144674	333 000	61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	1	1				
		61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					
		61	000000	000000		0	0	0	0					

500252	1638	665	141	216	10	15649	A		6511	6611	1
500258	1732	511	381	490	00	12931	A		6511	6611	1
500276	1638	628	284	361	20	13971	A		6511	6611	1
500288	1773	709	301	451	00	14504	A		6511	6611	1
500293	1803	1082	413	463	00	1954	A		6511	6611	1
500291	1626	650	289	343	00	315	A		6511	6611	1
500297	1791	714	507	600	10	9765	A		6511	6611	1

2	T	3	2	129356	382	000	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	P0101000	000000	0	0	0 0
							61	P0111111	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
2	T	5	2	118468	492	000	61	000000	T1000 1010	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	U1201 1011	0	0	0 0 1
							61	000000	T1001 1011	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
12	T	5	2	107987	546	302	61	000000	000000	0	0	0 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 1 1
							61	000000	T0110 0100	0	0	0 1 1
							61	000000	000000	0	0	0 0
							61	G1110 0100	000000	0	0	0 0
19	T	4	2	137650	247	300	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
							61	000000	T0100 1001	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
172	T	5	2	114237	531	001	61	000000	T0100 1011	0	0	0 0
							61	000000	T0100 0011	0	0	0 0
							62	000000	000000	0	0	0 0
							61	000000	T0121 1011	0	0	0 0
							61	0110 10010	000000	0	0	0 0
							61	000000	000000	0	0	0 0
167	T	4	2	124517	433	010	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	P0101 0010	000000	0	0	0 0
							61	3-000000	0-000000	0	0	0 0
							61	000000	000000	0	0	0 0
15	T	4	2	116228	511	101	61	000000	T0100 1001	0	0	0 0
							61	000000	S2211 1111	0	0	0 0
							62	000000	U2211 1111	0	0	0 0 1
							61	000000	T2001 1011	0	0	0 0 0
							61	000000	000000	0	0	0 0 0
							61	000000	T0110 0100	0	0	0 0

500309	1714	658	367	417	00	1062	A		6611	6611	1
500338	1753	780	370	452	00	219	A		6611	6611	1
500344	1651	658	214	262	02	6534	A		6611	6611	1
500302	1791	854	359	522	00	4102	A		5508	6611	5
500313	1581	644	288	395	00	1236	A		6607	6611	17
500325	1651	635	297	430	10	13735	A		5507	6611	11
500332	1587	655	198	207	10	10485	A		6604	6611	20

36	T	5	2	123176	392	000	61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	1	1
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
127	T	4	2	122598	444	000	61	000000	000000	0	0	0	0	
							61	000000	101001001	0	0	0	0	
							61	000000	101011000	0	0	0	0	
							61	000000	000000	0	0	0	0	1
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
275	T	4	2	105379	620	002	61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							63	000000	000000	0	0	0	1	
							61	000000	001001000	0	0	0	1	
							62	000000	000000	0	0	0	0	
							62	000000	000000	0	0	0	1	
9	T	0	2	127145	405	000	61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	101011001	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
4	T	5	2	139984	286	000	61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	001100100	000000	0	0	0	1	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
25	T	5	2	121098	445	100	61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	1	
							61	000000	001001001	0	0	0	0	
							61	000000	000000	0	0	0	0	
							62	000000	000000	0	0	0	0	
221	T	4	2	115262	426	101	61	000000	000000	0	0	0	0	
							61	000000	101000001	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	101001011	0	0	0	0	
							61	000000	000000	0	0	0	0	
							61	000000	000000	0	0	0	0	

600033	1714	692	238	380	10	8550	A		5103	6611	15
600042	1621	583	325	470	02	409	A		5209	6611	14
600056	1621	813	257	297	10	12112	A		4505	6611	20
600059	1689	676	371	521	00	5583	A		5105	6611	4
600064	1748	717	430	469	00	11025	A		5701	6611	9
600058	1748	794	323	406	00	8701	A		5704	6611	3
600047	1745	699	339	402	20	1073	A		4505	6611	20

19	509	T	2	2	102112	652	101	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	1
								61	000000	000000		0	0		0 1	1
								61	000000	000000		0	0		0 0	1
								61	000000	000000		0	0		0 0	1
21	317	T	4	2	121142	463	000	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000	B	0	0		0 1	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
5	84	T	0	2	107575	590	000	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	501001001		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
20	42	T	4	2	108870	596	000	61	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	
								63	000000	000000	B	1	0		0 1	1
								62	000000	112111011	B	1	0		0 1	
								62	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	
11	209	T	3	2	110348	572	011	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0	B	1 0	
								61	000000	000000		0	0		0 0	1
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
21	284	T	5	2	127941	397	001	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								61	000000	000000		0 5	0		0 0	1
								61	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	
21	513	T	5	2	127967	196	001	61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 1	1
								61	000000	000000		0	0		0 0	
								61	000000	000000		0	0		0 0	
								62	000000	000000		0	0		0 0	

600099	1600	440	195	277	02	10819	A	4609	6611
600092	1664	717	310	373	00	6955	A	4502	6611
600105	1758	562	347	377	32	1971	A	5510	6611
600119	1656	976	284	764	00	8249	A	4605	6611
600127	1727	622	318	430	00	15129	A	5501	6611
600133	1664	782	242	312	11	9452	A	4505	6611
600136	1651	339	264	216	00	11176	A	4505	6611

1	2	123343	443	000	62	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					62	000000	000000		0	0		0	0			
					62	000000	T100111011	L	1	0		0	0			
					62	000000	000000		0	0		0	0			
					62	000000	000000		0	0		0	0			
4	2	116651	535	101	61	000000	000000		0	0	0	1	0			
					61	000000	000000		0	0	LU	1	0	1		
					61	000000	000000		0	0	NL	1	0			
					61	000000	T0101111010		0	0	H	1	0			
					61	000000	000000		0	0		0	0	1		
					62	000000	000000		0	0	H	1	0			
4	2	113828	535	000	61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	T0101111011		0	0		0	0			
					61	000000	000000		0	0		0	0	1		
					61	000000	T1100010000		0	0		0	0			
5	2	106303	443	001	61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					62	000000	000000		0	0		0	0			
					61	T0101111000	000000	L	0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
4	2	114771	527	001	61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					62	000000	000000	L	0	0	SB	1	0			
					61	000000	T0111111110		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
4	2	114765	486	000	61	T0101100001	000000		0	0		0	0			
					61	000000	S1100011001		0	0		0	0			
					61	T0100111000	000000		0	0		0	0			
					61	000000	S0101111010		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
3	2	115029	515	001	61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	T0111111		0	0		0	0			
					61	000000	000000		0	0		0	0			
					61	000000	000000		0	0		0	0			

600139	1732	708	299	341	00	11095	A		5504	6611	11	111 T
600145	1714	719	318	304	10	7414	A		4511	6611	21	391 T
600147	1656	528	259	323	00	13619	A		4507	6611	16	160 T
600150	1554	642	218	276	20	6125	A		4604	6611	20	612 T
600154	1546	728	293	337	00	2969	A		5702	6611	4	28 T
600157	1656	631	360	454	12	8230	A		4511	6611	21	81 T
700304	1600	780	465	531	00	4285	A		6301	6611	6	13 T

12	25	T	0	2	104640	556	000	61	P01010010	S110001001		H	0		0	L	1	0	
								61	000000	S011111111			0		0	L	1	0	
								62	000000	T120111011			0		0		0	0	
								61	000000	S121111011			0		0		0	0	
								61	000000	S100100000			0		0	L	1	0	
								61	000000	000000			0		0		0	0	
1	19	T	4	2	120260	471	001	61	000000	000000		F	0	F	0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000		F	0	F	0		0	0	
								61	000000	000000			0		0		0	0	1
								61	000000	000000			0		0		0	0	
9	18	T	1	2	102529	579	011	61	P01010000	T010000010			0		0		0	1	
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	1
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		1		0	0	
								61	000000	000000			0		0		0	0	
8	52	T	1	2	111234	560	000	61	000000	000000			0		0		0	0	
								62	000000	000000			0		0		0	0	
								62	000000	000000			0		0		0	0	1
								61	000000	T010001001			0		0		0	0	
								62	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
10	17	T	4	2	134503	727	000	61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	1	1
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
2	19	T	4	2	123540	435	000	61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	T010100000			0		0		0	0	1
								61	000000	000000			0		0		0	0	
								62	000000	T010100000			0		0		0	0	
								61	000000	000000			0		0		0	0	
11	72	T	5	2	113578	479	001	61	000000	000000			0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000		FR	0		0		0	0	
								61	000000	000000			0		0		0	0	
								61	000000	000000		F	1		0		0	0	
								61	000000	000000			0		0		0	0	

703044	1564	674	334	190	00	9093	A	5435	6611
703059	1714	634	340	480	00	15673	A	5704	6611
703071	1816	698	349	456	01	2871	A	5737	6611
703084	1664	798	230	294	00	11491	A	5836	6611
703129	1631	663	356	187	00	4707	A	5639	6611
703147	1575	599	247	132	00	4899	A	5701	6611
703162	1689	855	247	354	00	3308	A	5407	6611

1	0	0		0	0		000000	000000	62	
	1	0		0	1	1	000010101	000000	62	
1	0	0		0	0		110100011	000000	61	
	1	0		0	0	1	010000101	000000	62	
	1	0		0	0		000000	000000	61	
	1	0		1	0	1	100100101	000000	61	2 2 121?60 441 003
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		110110101	000000	61	
1	0	0		0	0		000000	000000	62	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	4 2 1?0440 170 000
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
1	0	0		0	0		111111101	000000	61	
1	0	0		0	0		000000	000000	62	
	0	1	1	0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	1 2 122400 448 000
	0	0		0	0		000000	000000	62	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
1	0	0		0	0		000000	000000	62	
	0	0		0	0		110000101	000000	62	
	0	0		0	0		000000	000000	61	4 2 117184 441 002
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		110000101	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	62	
	0	0		0	0		000000	000000	61	4 2 123432 469 102
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		111111101	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	4 2 141047 254 001
	0	0		0	0		000000	000000	62	
	0	0		0	0		000000	000000	61	
	0	0		0	0		110100101	000000	61	
1	0	0		0	0		010010101	000000	62	
	0	0		0	0		000000	000000	61	
	0	0		0	0		000000	000000	61	3 2 130064 374 003

700165	1737	957	816	466	10	12441	A		5738	6611	9	18	1
700220	1656	635	398	456	00	12555	A		5338	6611	6	19	1
700253	1656	711	296	361	00	8264	A		5407	6611	11	42	1
700264	1798	790	250	386	12	9667	A		5404	6611	8	55	1
700280	1791	658	430	558	00	11871	A		5804	6611	8	17	1
700288	1671	719	289	357	00	4326	A		5639	6611	13	20	1
700298	1595	766	313	391	00	5534	A		6011	6611	5	12	1

```
700313 1740  708  333  427 00 12875 A      5806 6611  9    53 T 3 2 135840  314 002 61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000  T01001001      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0

700325 1714  805  355  432 10 12274 A      5805 6611 12    25 T 0 2 107837  598 000 61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000  T01011001      0  0    0 0
                                                                                      61    000000  T10011000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0

700332 1638  608  348  392 13 15044 A      5805 6611  8    17 T 5 2 138587  288 002 61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 1 1
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000  T01010000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0

700345 1714  746  479  566 00  2682 A      6112 6611  4    34 T 4 2 140287  271 000 61    000000     000000      0  0    0 1
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 1 1
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0 1
                                                                                      61    000000     000000      0  0    0 0 1

700365 1656  622  371  447 00  2822 A      5608 6611 10    33 T 4 2 137659  298 000 61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0 1
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000  S01001000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0 1

700371 1638  744  322  382 00  5048 A      5701 6611  9    19 T 0 2 119467  481 000 62    000000  T01001001      0  0    0 0
                                                                                      62    000000  T01001001      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61 P01111001     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0

700395 1676  685  373  435 00 15010 A      5806 6611  8    20 T 4 2 135159  323 000 61    000000  T01001001      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000  L21011010      0  0    0 0
                                                                                      61    000000  T11011011      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
                                                                                      61    000000     000000      0  0    0 0
```

5 2 104771	597 001	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	000000		0	0	0	0	1	
		61	0010111001	000000		0	0	0	0	1	
		61	000000	000000		0	0	0	0		
		62	000000	000000		0	0	0	0		
4 2 125825	415 001	61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	000000		0	0	0	0		
		61	000000	1011111010		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
4 2 129406	384 000	61	000000	000000		0	0	0	0		
		61	000000	000000	R	0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
4 2 120273	471 000	61	000000	1111011011		0	0	0	0		
		61	000000	1110111011		0	0	0	0		
		61	000000	1100011001		0	0	0	0		
		61	000000	1010011001		0	0	0	0		
		61	0100000010	1111011000	S	1	0	0	0		
		61	000000	000000		0	0	0	0		
4 2 114451	499 000	61	000000	1010011001		0	0	0	0		
		62	000000	1111011001		0	0	0	0		
		63	000000	0221111010		0	0	0	0	1	
		61	000000	1221111011		0	0	0	0		
		62	0100110010	000000		0	0	0	0	1	
		62	000000	000000		0	0	0	0		
5 2 114406	530 001	61	000000	1100111001		0	0	0	0		
		61	000000	000000		0	0	0	0		
		62	000000	1100111000		0	0	0	0	1	
		61	000000	1101111001		0	0	0	0		
		61	000000	1010110110		0	0	0	0		
		61	000000	000000		0	0	0	0		
5 2 110762	606 100	61	000000	1010100011		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	1101111011		0	0	0	0		
		61	000000	000000		0	0	0	0		
		61	000000	000000		0	0	0	0		

730433	1722	817	283	370	00	13265	A		5403	6611	12	25
730436	1676	749	393	481	10	8205	A		5913	6611	7	14
730454	1753	667	455	512	10	3461	A		5409	6611	12	6
730461	1722	826	351	401	22	7683	A		5813	6611	9	45
730462	1691	325	304	370	00	5833	A		5639	6611	10	20
730466	1676	949	233	325	10	909	A		5607	6611	10	20
730486	1651	613	244	244	30	12225	A		5803	6611	9	55

```
 5 T 4 2 120573   469 333 61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000   T10010000        0   0    0 0
                          61      000000      000000        0   0    0 0

52 T 5 2 125432   420 331 61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61   P01011010      000000    1   0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0

25 T 0 2 123553   439 331 61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 1
                          61      000000      000000        0   0    0 0
                          62      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0

35 T 4 2 120965   467 333 61      000000      000000        0   0    0 0
                          61      000000   T01001001        0   0    0 0
                          61   P01010010      000000        0   0    0 0
                          61      000000   T01111000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0

20 T 2 2 112679   547 331 41      000000      000000        0   0    0 0
                          41      000000      000000        0   0    0 0
                          42      000000      000000        0   0    0 0 1
                          41      000000   T01011011        0   0    0 0
                          41      000000      000000        0   0    0 0
                          42   P01100100      000000        0   0    0 0

30 T 5 2 133731   339 333 61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000   T10011011        0   0    0 0
                          61   001010010      000000        0   0    0 0
                          61      000000      000000        0   0    0 0

20 T 4 2 124765   433 331 61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000   101000001        0   0    0 0
                          61      000000      000000        0   0    0 0
                          61      000000      000000        0   0    0 0
```

730689	1714	697	321	508	00	12170	A	5611	6611	10
730551	1753	671	335	459	12	15282	A	5807	6611	9
730509	1537	726	347	445	00	12901	A	5435	6611	12
830032	1546	536	284	387	11	3376	A	5833	6611	8
830019	1416	812	438	517	10	15672	A	5635	6611	10
830020	1676	872	314	366	11	1034	A	5835	6611	8
830024	1753	773	415	483	01	8893	A	5606	6611	10

13	T	3	2	109570	579	010	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
33	T	1	2	134276	430	003	61	000000	000000	0	0	0 1
							61	000000	5010001001	0	0	0 0
							62	000000	000000	0	0	0 1
							61	000000	1010111001	0	0	0 0 1
							61	000000	000000	0	0	R 1 0 1
							61	000000	000000	0	0	0 0 1
18	T	5	2	122337	453	000	61	000000	5010001001	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
52	T	4	2	119120	432	001	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	0010110000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
39	T	3	2	125231	424	002	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 1
							61	000000	1010111010	0	0	0 0
							61	000000	000000	0	0	0 0
							61	0101110000	000000	0	0	0 0
19	T	4	2	125237	421	133	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
							61	000000	1110110000	0	0	0 0
							61	000000	000000	0	0	0 0
30	T	4	2	124203	131	001	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	0010101101	0	0	0 0
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0

800025	1451	744	274	365	00	730	A		6335	6611 6
800032	1476	662	352	392	00	13723	A		5711	6611 9
800055	1758	745	362	462	00	15656	A		5710	6611 9
800104	1438	707	228	303	10	1207	A		5713	6611 9
800117	1581	559	423	523	10	11763	A		5702	6611 7
800141	1702	667	426	523	00	13703	A		5731	6611 9
800152	1707	811	394	440	00	8700	A		5705	6611 10

(SI)

930153	1526	626	242	313	10	3762	A	5807	6611	8	16	T	5	2	117265	501	012	61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	101011010	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
930007	1740	727	361	458	10	5686	A	4705	6611	19	1058	T	5	2	129962	378	001	61	000000	101001011	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		61	000000	101011011	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		61	000000	000000	0	0	0	0	
930024	1740	888	394	487	00	1494	A	4305	6611	26	384	T	5	2	112599	552	000	61	000000	111011011	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		63	000000	000000	0	0	0	0	1
																		62	000000	101001001	0	0	0	0	1
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
930029	1639	676	331	424	02	5887	A	4910	6611	17	8	T	5	2	119701	491	001	61	000000	000000	0	0	0	0	
																		62	000000	101001001	0	0	0	0	
																		62	000000	000000	0	0	0	0	1
																		62	F01001011	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
930033	1631	1066	251	293	20	3786	A	4705	6611	19	490	T	4	2	111637	561	002	62	000000	000000	0	0	0	1	
																		62	000000	000000	0	0	0	1	1
																		63	000000	000000	0	0	0	1	1
																		62	000000	000000	0	0	0	1	
																		64	000000	000000	0	0	0	1	
																		62	000000	000000	0	0	0	1	
930048	1732	949	282	335	20	3434	A	4304	6611	26	1510	T	2	2	111947	553	003	61	000000	101011011	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		63	000000	000000	0	0	0	0	1
																		62	000000	101101011	0	0	0	0	
																		61	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	
930051	1587	549	338	406	12	13905	A	4909	6611	13	36	T	4	2	110731	570	001	62	000000	000000	0	0	0	0	
																		62	000000	101000001	0	0	0	0	1
																		63	000000	000000	0	0	0	0	1
																		61	000000	101001011	0	0	0	0	
																		62	000000	000000	0	0	0	0	
																		62	000000	000000	0	0	0	0	

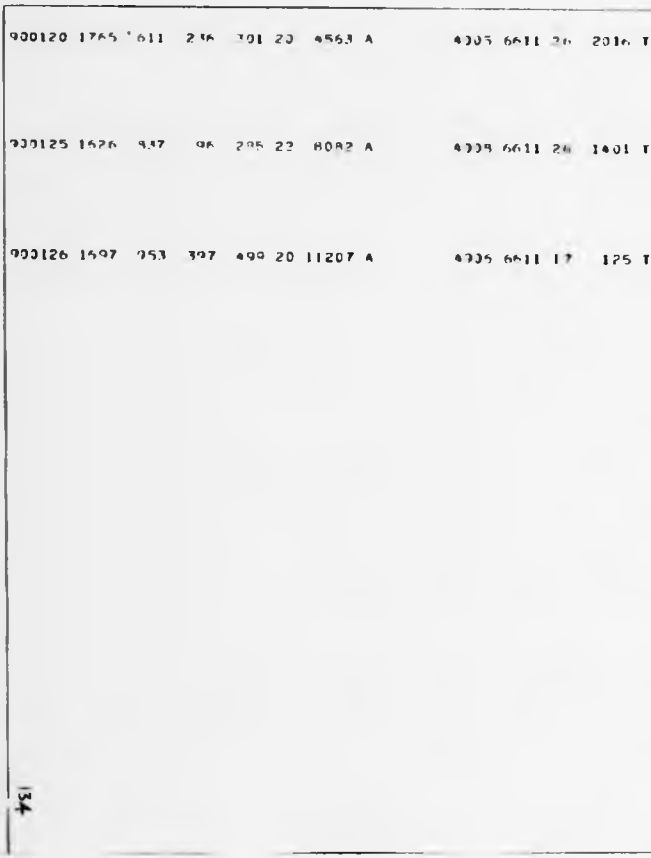
162	T	A	2	122062	457	011	61	000000	000000	0	0	0 0
							62	000000	5010111011	0	0	0 0
							63	000000	000000	0	0	0 0 1
							62	000000	1010001001	0	0	0 0 1
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
579	T	A	2	118825	449	001	61	000000	000000	0	0	0 0
							62	000000	5010110010	0	0	0 0 1
							62	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0 1
							61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
982	T	S	2	119717	480	002	63	000000	5010111011	0	0	0 0
							62	000000	000000	0	0	0 0 1
							63	000000	000000	0	0	0 1 1
							62	000000	000000	0	0	0 0 1
							63	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
560	T	A	2	128473	333	000	61	000000	1110111011	0	0	0 0
							62	000000	000000	0	0	0 0 1
							62	000000	0211111111	0	0	0 0 1
							62	000000	1110111001	0	0	0 0
							61	000000	000000	0	0	0 0
							63	000000	000000	0	0	0 0
552	T	S	2	121448	443	000	61	000000	1010011001	0	0	0 0
							62	000000	000000	0	0	0 0
							62	000000	1010011001	0	0	0 0 1
							62	000000	1010111011	0	0	0 0 1
							61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0
1113	T	S	2	103012	447	001	61	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0 1
							63	000000	000000	0	0	0 0 1
							62	000000	1011111011	0	0	0 0
							62	000000	000000	0	0	0 0
							62	000000	000000	0	0	0 0
46	T	A	2	101776	440	001	61	000000	000000	0	0	0 0
							61	000000	000000	0	0	0 0 1
							63	000000	000000	0	0	0 0 1
							62	000000	1110111011	0	0	0 0 1
							63	000000	000000	0	0	0 0 1
							62	000000	000000	0	0	0 0

900374	1732	749	327	406	00	8059	A	4511	6611	21
900077	1591	658	253	408	10	7657	A	4709	6611	19
900389	1529	898	223	282	22	5711	A	4309	6611	23
900398	1695	728	335	393	11	6330	A	4509	6611	20
900103	1646	674	162	220	20	3520	A	4710	6611	17
900134	1671	950	217	268	00	4304	A	4709	6611	19
900116	1702	907	299	361	10	15177	A	4411	6611	22

162	T	4	2	122062	457	011	61	000000	000000	0	0	0	0
							62	000000	5010111011	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	1010101001	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
579	T	4	2	118825	449	001	61	000000	000000	0	0	0	0
							62	000000	5010100010	0	0	0	0
							62	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
982	T	5	2	119717	450	002	63	000000	5010111011	0	0	0	0
							62	000000	000000	0	0	0	0
							63	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
560	T	4	2	120473	333	000	61	000000	1110111011	0	0	0	0
							63	000000	000000	0	0	0	0
							62	000000	1211111111	0	0	0	0
							62	000000	1110111001	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
552	T	5	2	121448	443	000	61	000000	1010101001	0	0	0	0
							62	000000	000000	0	0	0	0
							62	000000	1010101001	0	0	0	0
							62	000000	1010111011	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
1313	T	3	2	103012	447	001	61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
							64	000000	000000	0	0	0	0
							62	000000	1011111011	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0
46	T	4	2	103776	440	001	61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							61	000000	000000	0	0	0	0
							62	000000	1110111011	0	0	0	0
							64	000000	000000	0	0	0	0
							62	000000	000000	0	0	0	0

900374	1732	749	327	406	00	8050	A		4511	6611 21
900377	1691	658	253	408	10	7657	A		4709	6611 19
900389	1529	898	223	282	22	5711	A		4309	6611 23
900398	1485	728	335	393	11	4330	A		4509	6611 23
900103	1646	674	162	220	20	3520	A		4710	6611 17
900105	1671	950	217	268	00	4304	A		4709	6611 17
900116	1702	907	299	361	10	15177	A		4411	6611 22

3	3	112449	553	001	61	000000	000000		0	0	0 0
					62	000000	000000		0	0	0 0 1
					62	000000	000000		0	0	0 1
					62	000000	T01011001		0	0	0 0
					61	000000	000000		0	0	0 0
					62	000000	000000		0	0	0 0
4	2	112153	557	002	61	000000	L01001001		0	0	0 0 1
					62	000000	T01001000		0	0	0 0
					61	000000	000000		0	0	0 1 1
					62	000000	L01001001		0	0	0 0
					62	000000	000000	H	2	0	0 0
					62	000000	000000		0	0	0 0
5	2	125051	427	001	61	000000	000000		0	0	0 0
					61	000000	000000		0	0	0 0
					62	000000	000000		0	0	0 0 1
					62	000000	L01001001		0	0	0 0
					62	000000	000000		0	0	0 0
					62	000000	000000		0	0	0 0


930120 1765 1611 216 301 23 4563 A 4335 6611 26 2016 T
930125 1526 937 96 295 22 8082 A 4335 6611 26 1401 T
930126 1597 953 397 499 20 11207 A 4335 6611 17 125 T
134

COHORT "A"

"Less-than-normals": Dead

pp. 136 - 151

571	A	A	2	137087	613	111	32	000000	0000000		0	0	0	0	
							31	000000	0000000		0	0	0	0	
							33	000000	0000000		0	0	0	0	
							32	000000	1010111011		0	0	0	0	
							31	000000	0000000		0	0	0	0	
							32	000000	0000000		0	0	0	0	
	T	S	2	115849	518	003	61	000000	0000000		0	0	0	0	
							62	000000	0000000		0	0	0	0	
							61	000000	0000000		0	0	0	0	1
							61	000000	1010111010		0	0	0	0	
							61	0010130000	0000000		0	0	0	0	1
							61	000000	0000000		0	0	0	0	
96	T	2	2	134799	637	001	31	000000	0000000	R	0	0	0	0	
							31	000000	0000000	R	0	0	0	0	
							31	000000	0000000		0	0	0	0	
							31	000000	0000000		0	0	0	0	
							61	000000	0000000		0	0	0	0	
							31	000000	0000000		0	0	0	0	
2	T	S	2	115374	521	000	61	000000	0000000	L	0	0	0	0	
							61	000000	0000000		0	0	0	0	1
							61	1220000	0000000		0	0	0	0	1
							61	0000000	0000000		0	0	0	0	
							61	0000000	0000000		0	0	0	0	1
							61	0000000	0000000		0	0	0	0	
21	A	A	2	104649	637	000	32	0000000	0000000		0	0	0	0	
							31	0000000	0000000		0	0	0	0	
							32	0000000	0000000		0	0	0	1	1
							61	0000000	0000000		0	0	0	2	1
							31	0000000	0000000		0	0	0	0	1
							61	0000000	0000000		0	0	0	0	
18	T	A	2	135351	631	001	31	0000000	5010001001		0	0	0	0	
							31	0000000	0000000		0	0	0	0	
							31	0000000	0000000		0	0	0	0	
							31	0000000	1010111011		0	0	0	0	
							31	0000000	5100100000		0	0	0	0	
							61	0000000	0000000		0	0	0	0	
152	T	S	2	113299	673	131	61	0000000	0000000		0	0	0	0	
							62	0000000	0000000		0	0	0	0	
							62	0000000	0000000		0	0	0	0	1
							61	0000000	1010111011		0	0	0	0	
							62	0000000	0000000		0	0	0	0	
							61	0000000	0000000		0	0	0	0	

131173	1732	859	170	273	00	14793	D	73			2404	6611	32
533193	1562	565	261	341	11	6078	D	75			6511	6611	1
332336	1456	672	196	315	10	10235	D	72	144		4339	6611	26
533261	1651	535	319	392	10	8819	D	69	153		6511	6611	1
233373	1783	633	255	456	00	13966	D	76	151		3339	6611	36
333247	1626	653	392	379	00	6940	D	73	151		3209	6611	32
433359	1732	937	285	407	00	8120	D	73	151		4335	6611	27

930066	1732	903	354	461	03	3853	D	75	151	4511	6611	21	68	T	5	2	116771	510	000	61	000000	000000		0	1		0 0	
																				62	000000	000000		0	1		0 0	
																				62	000000	000000		0	0		0 0	1
																				62	000000	121011011		0	0		0 1	
																				62	000000	000000		0	0		0 0	
																				62	000000	000000		0	0		0 0	
131076	1626	560	259	301	00	3803	D	74	151	3201	6611	34	1213	A	5	2	107901	606	002	61	000000	000000		0	0		0 0	
																				61	000000	501011011		0	0		0 0	1
																				62	001001000	101010000		0	0		0 0	1
																				62	000000	000000		0	0		0 0	
																				61	000000	000000		0	0		0 0	
																				62	000000	000000		0	0		0 0	
230233	1613	661	166	205	13	8279	D	69	153	2302	6611	40	226	A	4	2	106739	616	003	33	000000	000000		0	0		0 0	1
																				32	000000	000000		0	0		0 0	
																				33	000000	000000		0	0		0 2	1
																				33	000000	110011110		0	0		0 1	1
																				33	000000	000000		0	0		0 0	
																				33	000000	000000		0	0		0 0	
430336	1681	665	207	234	00	15642	D	70	154	2409	6611	37	406	T	5	2	103576	637	002	41	000000	511001001	FR	1	0		0 0	
																				41	000000	000000	F	0	0		0 0	1
																				41	000000	000000	F	0	0	F	1 0	
																				41	000000	510011010	FF	0	0		0 1	1
																				41	000000	000000	FF	1	0		0 0	
																				41	000000	111001000	F	1	0		0 0	
301615	1554	674	194	226	00	13412	D	75	156	2205	6611	34	4622	T	3	2	107226	613	011	32	000000	522011011		0	0		0 0	
																				31	000000000	511011011		0	0		0 1	
																				31	000000	000000		0	0		0 2	1
																				41	000000000	110011001	L	0	0		0 1	
																				32	000000	101001001		0	0		0 1	
																				32	000000	111001001		0	0		0 0	
90236	1714	601	275	346	13	1635	D	69	157	2935	6611		2	T	4	2	113627	547	001	61	000000	000000		0	0		0 0	
																				61	000000	000000		0	0		0 0	
																				61	000000	000000		0	0		0 1	
																				61	F01011010	101011011		0	0		0 0	
																				61	000000	000001		0	0		0 0	
																				61	000000	000000		0	0		0 0	
302097	1575	585	260	370	20	8201	D	75	157	5324	6611	13	6	T	5	2	110419	571	001	61	000000	000000	L	0	0		0 0	
																				61	000000	501001001		0	0		0 0	
																				61	000000	000000		0	0		0 0	1
																				61	000000	101011011		0	0		0 0	
																				61	000000	000000		0	0		0 0	
																				61	100000	000000		0	0		0 0	

400331 1707 680 271 239 00 12497 D 75 157 3911 6611 34 54 T 2 2 117762 497 000	61	000000	000000	R 0	0		0 0
	61	000000	000000	0	0		0 0
	61	000000	000000	R 0 L	0		0 0
	61	000000	101111011	0	0		0 0
	61	000000	000000	R 0	0		0 0
	61	000000	000000	0	0		0 0
10284 1576 796 242 423 10 9770 D 70 161 2701 6611 31 209 T 5 2 106728 637 003	61	000000	111011011	0	0		0 0
	61	000000	511111111	0	0		0 0
	61	022111111	000000	0	0		0 0
	61	011111111	000000	0	0		0 0
	61	000000	L1C011010	0	0		0 0
	62	011100100	000000	0	0		0 0
140 1537 687 137 247 10 11435 D 72 162 2209 6611 29 206 T 4 2 107556 639 000	61	000000	000000	0	0		0 0
	61	000000	000000	0	0		0 0
	61	000000	000000	L 0	0		0 0
	61	000000	000000	0	0		0 0
	61	001011010	000000	0	0		0 0
	61	000000	000000	0	0		0 0
40159 1689 751 120 163 23 14543 D 67 162 1904 6611 36 108 T 5 2 102835 646 003	61	000000	000000	LR 1	0		0 0
	61	000000	000000	LL 1	0		0 0
	62	000000	000000	LR 2 L	0		0 0
	61	000000	110001011	LR 2	0		0 0
	61	000000	110001001	LL 1	0		0 0
	61	000000	000000	L 0	0		0 0
80031 1695 840 174 160 20 14535 D 69 162 2005 6611 33 500 T 3 2 135765 627 003	32	000000	111001011	R 0	2		0 1
	31	000000	511011011	L 0	2		0 1
	31	00000000	U12011011	L 1	3		0 1 1
	31	000000	U22111011	L 1	3		0 0
	33	00000000	00000000	L 0	0		0 0
	32	000000	122111011	0	2		0 0
80088 1651 739 165 227 20 4833 D 71 162 2301 6611 33 344 T 5 2 105523 620 001	61	000000	101011001	R 1	0	R	1 0 1
	61	000000	000000	0	0	HE	1 0 1
	62	000000	000000	R 1	0	HB	1 0 1
	61	000000	110011001	B 1	0	RR	1 0 1
	61	000000	000000	B 1 L	0	BR	1 0 1
	61	000000	000000	R 1	0	HE	1 0
101517 1691 829 284 364 13 5285 D 71 162 1701 6611 29 576 A 5 ? 105150 622 003	31	000000	101001001	L 0	0		0 0
	31	000000	000000	0	0		0 0
	31	000000	000000	0	0		0 0 1
	31	000000	000000	0	0		0 0 1
	31	000000	000000	0	0		0 0
	32	000000	000000	0	0		0 0

```
122 A 4 2 123414  444 301 61     000000 T0130131c1          0   0     0 0
                  61     000000     000000               0   0     0 0
                  62     000000 T1113311001          R  0   0     0 0 1
                  61     000000 T0131111011             0   0     0 0
                  61     000000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0

926 T 5 2 135625  628 301 31 P01001000 SJ1030001    LL  0 L  0     0 0
                  41     C0000000 T1101111011    LL  1     0     0 0
                  31     0000000  000000000     LL  2     0     0 0
                  41     000000 T1110011011    LL  1 L  0     0 0
                  31     000000     000000     L LL      0     0 0
                  32     000000     000000     LL  2     0     0 0

867 T 4 2 114151  532 000 61     000000     000000          0   0     0 0
                  61     000000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0
                  61 P111000000     000000              0   0     0 0

178 T 4 2 122004  454 000 61     000000     000000          0   0     0 0
                  61     000000     000000              0   0     0 0
                  61 P01111000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0
                  61     000000     000000              0   0     0 0
                  62     000000     000000              0   0     0 0

467 T 5 2 119041  436 000 61     000000 T1101111011          0   0     0 0
                  61     000000 T1111111111          0   0     0 0
                  61     000000 T2111111110          0 L 0     0 0
                  61     000000 T1211110110          0   0     0 0
                  61     000000 T1111101110          0 L 0     0 0
                  61 P111000100     000000          0   0     0 0

 39 T 4 2 139000  570 301 62     000000 S1100010001    L 2 L  0     0 0
                  61     000000     000000              0   0     0 0 1
                  62     000000 T1211111000          0   0     0 0 1
                  61     000000 T1111110111    L   0 L  0     0 1 1
                  61     000000 T1001110000    LL  1     0     0 0
                  62 P011000000     000000              0   0     0 0 1

318 T 3 2 111325  561 000 61     000000 T1100010001          0   1     0 0
                  61     000000 L1130010001          0 R 2     0 0
                  61     000000 T1201111001    L     0 R 1     0 0
                  61     000000 L1161111111          0 L 2     0 0
                  62 R100001001 S1300111010          0 R 0     0 0
                  61     000000 T1130010001          0 R 1     0 0
```

230350	1638	583	253	326	10	11084	0	69	162	4239	6611	24	
331132	1651	613	234	295	30	1139	0	73	162	3738	6611	29	
400083	1681	657	262	190	33	11152	0	73	162	2912	6611	32	
430282	1600	578	308	342	03	6782	0	74	162	3931	6611	27	
600304	1575	572	211	276	23	9784	0	72	162	4732	6611	19	
900070	1714	841	286	153	01	15643	0	73	162	4713	6611	19	
30156	1638	563	254	316	22	10623	0	73	153	3911	6611	27	

80164	1519	525	221	273	00	14162	D	74	163	1337	6611	33	619	T
103966	1537	558	175	263	10	3228	D	74	163	2711	6611	24	77	A
300253	1587	726	148	245	20	9724	D	74	163	3609	6611	30	746	T
303451	1676	557	281	402	00	13798	D	74	163	2313	6611	36	238	T
303339	1639	705	147	216	00	12059	D	75	163	2707	6611	31	767	T
303937	1676	494	132	264	00	11512	D	73	177	2303	6611	17	350	T
303140	1651	726	261	384	30	3822	D	73	177	1312	6611	16	219	T

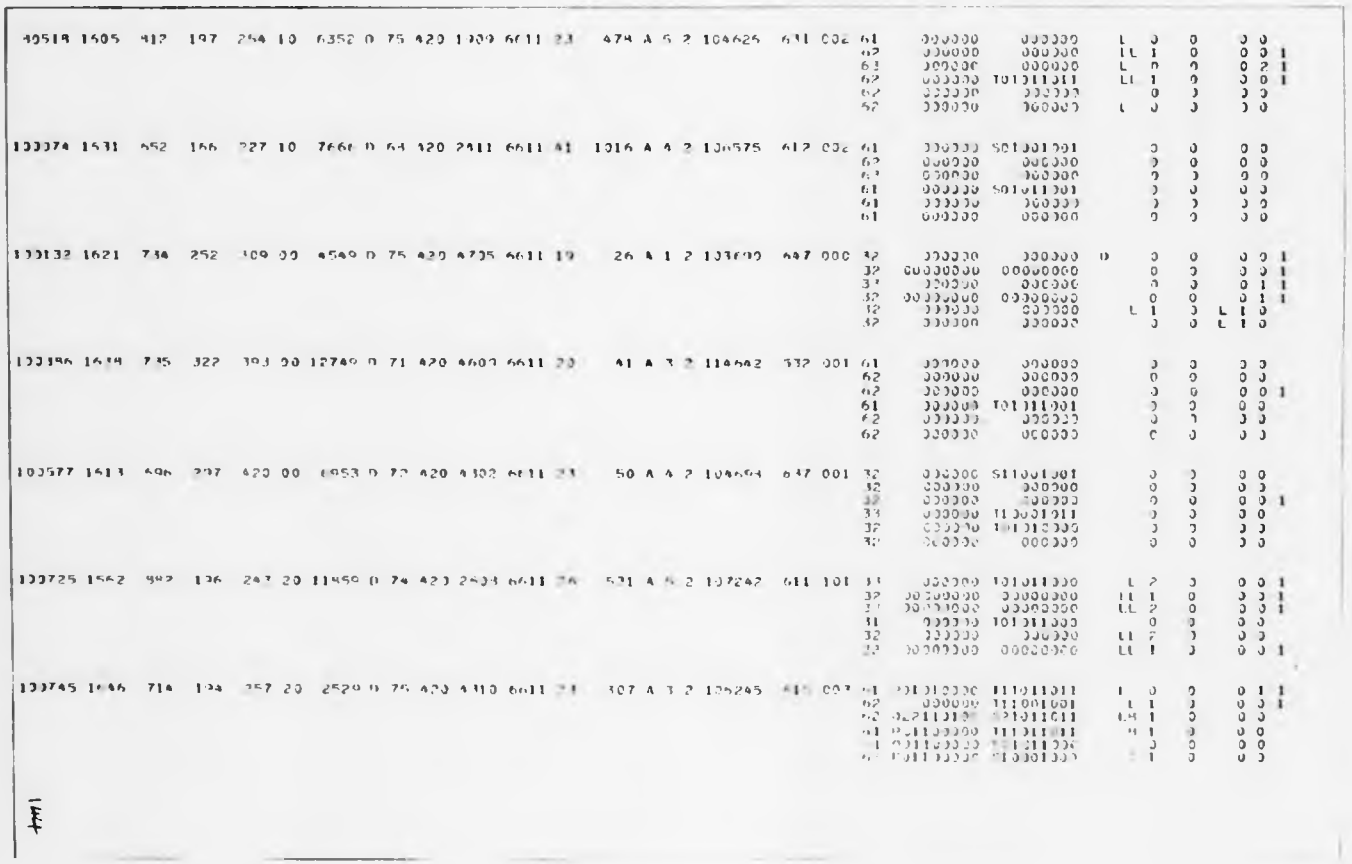
100716	1707	585	274	322	00	378	D	72	190	2393	6611	25	279	A	4	2	107593	608	011	31	000000	101000011		0	0		0	0	
																				32	000000	000000		0	0		0	0	
																				31	000000	000000		0	0		0	0	
																				31	000000	101001011		0	0		0	0	
																				31	000000	000000		0	0		0	0	
																				32	000000	000000		0	0		0	0	
200031	1689	616	312	395	00	13023	D	74	180	4729	6611	19	56	A	4	2	103619	641	002	61	P10010010	000000	L	0	0		0	2	
																				61	P11111111	000000	L	0	0		0	0	
																				62	P11111111	000000	L	0	0		0	1	
																				62	P22110110	000000	L	0	0		0	1	1
																				61	022110110	000000	L	0	0		0	0	
																				61	P22110110	000000	L	0	0		0	0	
400304	1773	867	423	414	00	9707	D	75	197	4811	6611	18	36	T	2	2	113962	533	000	61	000000	000000		0	0		0	0	
																				62	000000	000000		0	0		0	0	
																				62	000000	101001000		0	0		0	0	
																				62	000000	101001001		0	0		0	0	
																				61	000000	000000		0	0		0	0	
																				62	000000	000000		0	0		0	0	
301974	1549	481	231	294	00	10147	D	75	199	2703	6611	17	2087	T	4	2	106238	622	000	31	000000	000000		0	0	H	2	0	
																				31	00000000	101001001		0	0	H	1	0	
																				31	000000	000000		0	0	[illegible]	2	0	
																				31	000000	101011001		0	0	R	1	0	
																				31	000000	000000		0	0	E	1	0	
																				31	00000000	00000000		0	0	R	1	0	
302176	1791	731	389	512	00	14317	D	72	227	2101	6611	33	226	T	4	2	110301	571	111	61	000000	000000		0	0	H	1	0	
																				61	000000	000000		0 8	0	HL	1	0	
																				61	000000	000000		0	0	BH	1	0	
																				61	000000	L10111011		0	0	HB	1	0	1
																				61	000000	101110000		0	0	B	1	0	
																				61	P01100000	000000		0	0	HL	1	0	
101739	1646	608	94	175	02	7665	D	69	253	2434	6611	47	1459	T	5	2	103478	641	003	62	000000	101011010	H3	1	0	P	1	0	
																				61	000000	101011000	LL	2	0	FX	1	0	
																				64	000000	101011110	H3	1	0	FL	1	0	1
																				62	000000	111011010	F3	1	0	PX	1	1	
																				62	000000	000000	F4	3	0	FL	1	1	
																				64	000000	000000		0	0		0	0	
30411	1727	1012	271	311	00	5194	D	70	260	2507	6611	14	506	T	5	2	101959	655	001	61	000000	000000	H	1	0		0	0	
																				61	000000	000000	H	2	0		0	1	
																				62	000000	000000		0	1	HB	3	1	
																				61	000000	101001011	H2		0		0	0	
																				61	000000	000000	H3		0		0	0	
																				62	000000	000000	H4		0		0	0	1

4

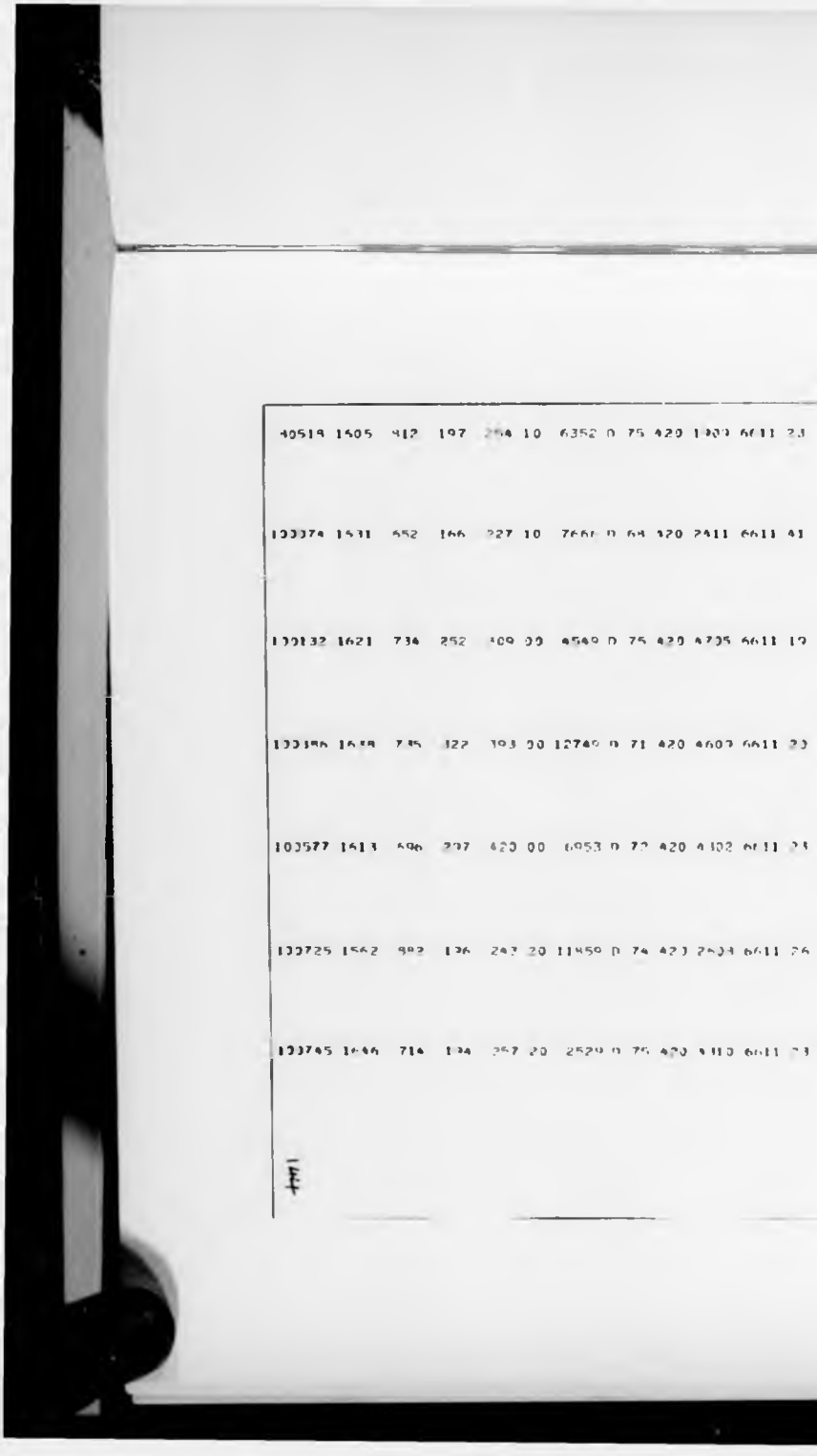
101163	1575	556	275	336	00	6368	D	74	260	2407	6611	42	169	A	5	2	103879	645	000	32	000000	S1C001001		0	0	0	0	
																				31	000000	000000		0	0	0	0	
																				32	000000	000000		0	0	0	0	1
																				31	000000	000000		0	0	0	0	
																				31	000000	000000		0	0	0	0	
																				31	000000	000000		-0	0	0	0	
400216	1702	939	269	731	00	10534	D	72	260	4234	6611	24	13	T	3	2	117851	494	003	61	000000	000000	LL	0	0	0	0	
																				62	000000	000000	LL	1	0	0	0	
																				62	000000	000000	LL	2	0	0	0	
																				62	000000	101011010	L	2	0	0	0	
																				61	000000	000000	LL	3	0	0	0	
																				61	000000	000000	L[illegible]	2	0	0	0	
10035	1689	835	245	343	10	10647	D	75	322	2703	6611	28	162	T	4	2	110978	556	000	61	000000	000000	F	1	0	0	0	
																				61	000000	000000	F	0	0	0	0	
																				61	000000	000000	F	0	0	0	0	
																				61	000000	101011001	F	0	0	0	0	
																				61	000000	000000	F	0	0	0	0	
																				61	000000	000000	F	0	0	0	0	
100279	1671	558	270	344	10	5989	D	75	340	3007	6611	27	667	A	4	2	107507	609	000	31	000000	000000 A		0	0	0	0	
																				31	00000000	00000000		0	0	0	0	1
																				32	000000	000000		0	0	0	2	1
																				31	000000	000000 A		0	0	0	1	1
																				31	00000000	00000000		0	0	0	2	1
																				32	000000	000000		0	0	0	1	
100325	1575	489	170	197	10	8547	D	73	331	2623	6611	38	1311	A	4	2	104645	638	002	31	000000	101001001	F	0	0	0	0	
																				31	000000	000000	F	0	0	0	0	
																				32	000000	000000		0	0	0	0	
																				31	00000000	101011010		0 S	0	0	0	
																				31	000000	000000		0	0	0	0	
																				31	000000	000000		0	0	0	0	
100798	1621	704	226	287	10	11162	D	72	331	5206	6611	14	282	T	4	2	112929	543	001	61	000000	000000		0	0	0	0	
																				62	000000	101000011		0	0	0	0	1
																				62	000000	000000		0	0	0	0	1
																				61	000000	000000		0	0	0	0	
																				61	000000	000000		0	0	0	0	
																				61	000000	000000		0	0	0	0	
100115	1571	902	206	226	00	1261	D	75	332	2511	6611	32	226	A	0	2	106212	615	002	62	000000	000000	L	0	0	0	0	
																				62	000000	000000		0	0	0	0	
																				63	000000	000000		0	0	0	1	1
																				61	000000	000000	L	1	0	0	1	
																				62	000000	000000		0	0	0	0	
																				62	000000	000000		0	0	0	0	

```
147 T A 2 105263  632 300 32    000000 1010101001        0   0 RR 2 0
                  31    000000   000000                 0   0 RR 2 0
                  32  0000000000  000000000             0 R 0 RR 2 0
                  31  0000000000 1011111001          L 0   0 RR 2 0
                  32  0000000000  000000000             0   0 RRL1 0
                  32    000000   000000                 0   0 RR 2 0

264 T A 2 107742  536 001 61    000000 1100111011      F 1   0     0 2 1
                  61    000000 0010001001 R            0   0     0 1 1
                  61    000000 1010010000              0   0     0 1 1
                  61    000000 1011111011              0   0     0 1 1
                  61    000000   000000                0   0     0 1
                  61    000000   000000                0   0     0 1

702 A 1 2 105448  623 002 63    000000 1210111011        0   0     0 0
                  62    000000 1010111011              0   0     0 0 1
                  63    000000 0321111011              0 F 1     0 1 1
                  62 R2 1111011 1101111010          L 1   1       0 1
                  63    000000   000000                0   0     0 0
                  62    000000   000000                0   0     0 0

 37 T A 2 114497  497 000 61    000000   000000          0   0     0 0
                  61    000000   000000                0   0     0 0
                  62    000000   000000                0   0     0 1 1
                  61    000000 L0010001001             0   0     0 0
                  62    000000   000000                0   0     0 0
                  61    000000   000000                0   0     0 0

434 T A 2 113115  653 003 31    000000 1221111011      FR 1   1 R   1 0
                  31  0000000000 1111111011            0 L 0 L   1 0
                  32    000000 1101110000            R 2 1 0 RR  1 1
                  31  0000000000 1211111013          R 1 L 0 LR  2 0
                  31    000000 1121110110            R 2 L 0     0 0 1
                  32  0000000000 1221110110          R 1   0     0 0

172 T A 2 107669  597 001 61    000000 1100111001      F RR1   0     0 0
                  61    000000 0010001000              R1    0     0 0
                  62    000000 1010011000            RR 2    0     0 0 1
                  61    000000 1010111010            RR 2    0     0 0 1
                  61    000000 0100111000            R  1    0     0 0
                  61    000000   000000              R  2    0     0 0

647 T A 2 109204  502 003 61    000000   000000          0   0     0 1 1
                  62    000000   000000                0   0     0 0
                  62    000000   000000                0   0     0 0
                  61    000000   000000              F 0   0     0 0
                  63    000000   000000                0   0     0 0
                  62    000000   000000                0   0     0 0
```

10396	1600	755	236	247	00	781	0	74	356	1302	6611	34
331346	1651	693	233	242	00	7423	0	73	410	4111	6611	35
101524	1613	663	227	241	10	1443	0	71	412	2310	6611	43
13568	1740	1002	358	422	00	4070	0	71	420	1703	6611	0
90386	1621	696	165	213	12	8928	0	71	420	1704	6611	33
93144	1627	767	214	282	00	12193	0	62	420	2404	6611	41
90232	1791	941	358	401	20	1200	0	75	420	1804	6611	22



474	A	5	2	104625	641	002	61	000000	000000		L	0	0		0	0	
							62	000000	000000		LL	1	0		0	0	1
							63	000000	000000		L	0	0		0	2	1
							62	000000	101011011		LL	1	0		0	0	1
							62	000000	000000			0	0		0	0	
							62	000000	000000		L	0	0		0	0	
1016	A	4	2	106575	612	002	61	000000	501001001			0	0		0	0	
							62	000000	000000			0	0		0	0	
							63	000000	000000			0	0		0	0	
							61	000000	501011001			0	0		0	0	
							61	000000	000000			0	0		0	0	
							61	000000	000000			0	0		0	0	
26	A	1	2	103699	647	000	32	000000	000000	0		0	0		0	0	1
							32	00000000	00000000			0	0		0	0	1
							32	000000	000000			0	0		0	1	1
							32	00000000	00000000			0	0		0	1	1
							32	000000	000000		L	1	0	L	1	0	
							32	000000	000000			0	0	L	1	0	
41	A	3	2	114642	332	001	61	000000	000000			0	0		0	0	
							62	000000	000000			0	0		0	0	
							62	000000	000000			0	0		0	0	1
							61	000000	101011001			0	0		0	0	
							62	000000	000000			0	0		0	0	
							62	000000	000000			0	0		0	0	
50	A	4	2	104694	637	001	32	000000	511001001			0	0		0	0	
							32	000000	000000			0	0		0	0	
							32	000000	000000			0	0		0	0	1
							33	000000	110001011			0	0		0	0	
							32	000000	101110000			0	0		0	0	
							32	000000	000000			0	0		0	0	
571	A	5	2	107242	611	101	33	000000	101011000		L	2	0		0	0	1
							32	00000000	00000000		LL	1	0		0	0	1
							31	00000000	00000000		LL	2	0		0	0	1
							31	000000	101011000			0	0		0	0	
							32	000000	000000		LL	2	0		0	0	
							32	00000000	00000000		LL	1	0		0	0	1
307	A	1	2	105285	615	007	61	101010000	111011011		L	0	0		0	1	1
							62	000000	111001001		L	1	0		0	0	1
							62	022110100	221011011		LB	1	0		0	0	
							61	001100000	111011011		B	1	0		0	0	
							61	001100000	101011000			0	0		0	0	
							62	001100000	010001000			1	0		0	0	



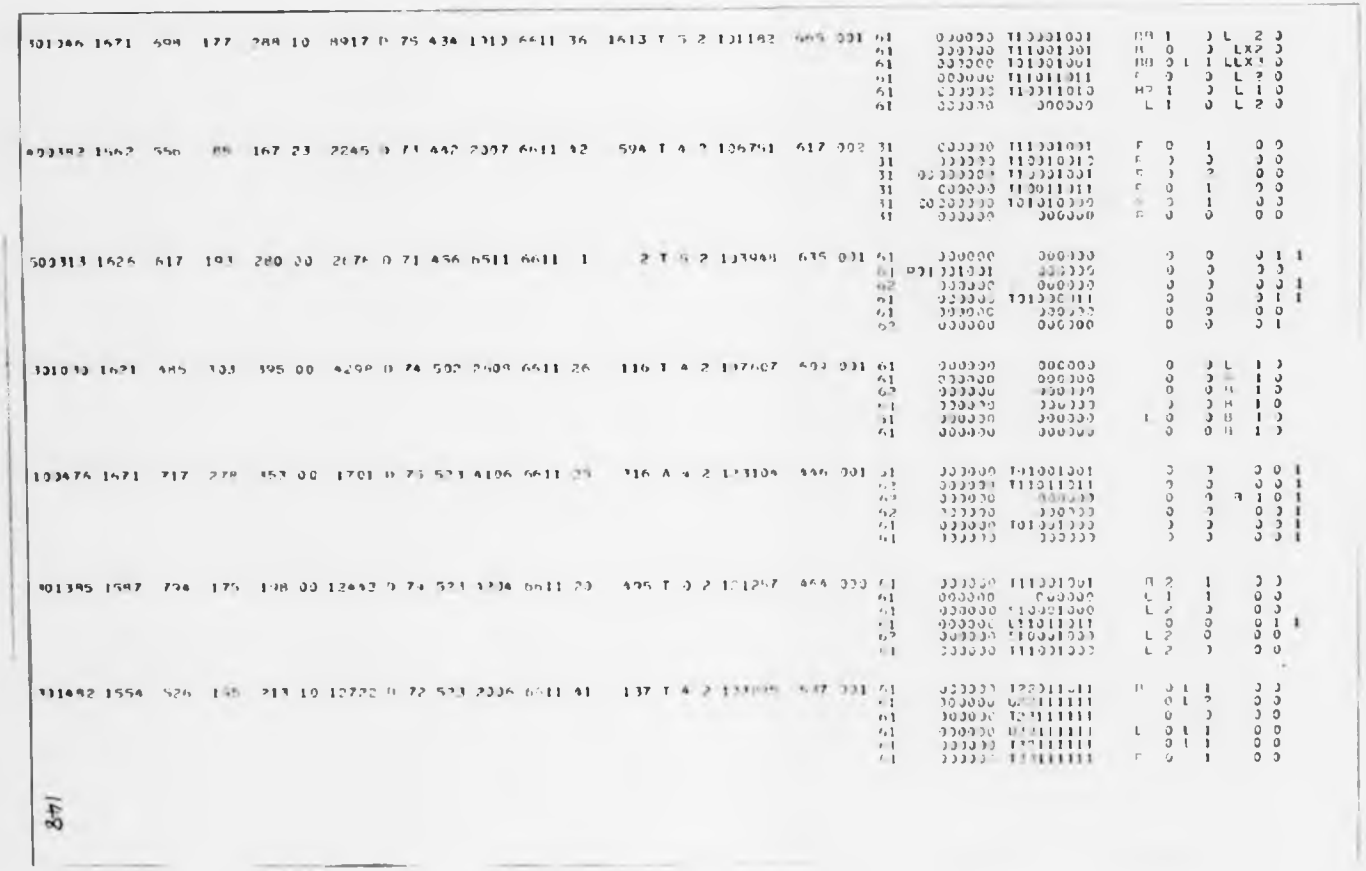
```
548 A 4 2 134260  635 101 61    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0
                  62    000000     000000        0  0    0 0
                  61    000000 T1000011011        0  0    0 0
                  61    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0

594 A 5 2 136590  617 000 61    000000 T1000011011        0  0    0 0
                  62    000000 S1100011001        0  0    0 0 1
                  62    000000 T1100111010        0  0    0 0 1
                  62    000000 T1000111001        0  0    0 0
                  62    000000     000000        0  0    0 0
                  62    000000     000000        0  0    0 0

 96 A 4 2 105290  625 001 62    000000 S1100111011        0  0    0 0
                  62    000000 T0100101001        0  0    0 0 1
                  61    000000 T0100100000        0  0    0 0 1
                  61    000000 T1001111001        0  0    0 0
                  62    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0

157 A 3 2 105484  623 000 61    000000 T0100101001        0  0    0 0 1
                  61    000000     000000 A      0  0    0 0 1
                  62    000000     000000        0  0    0 2 1
                  62    000000 T0100111000        0  0    0 0 1
                  62    000000     000000        0  0    0 1 1
                  62    000000     000000        0  0    0 1

1139 T 4 2 117443 633 000 61    000000     000000        0  0    0 0
                  62    000000     000000        0  0    0 0
                  62    000000     000000        0  0    0 0
                  61    000000 T1000111011        0  0    0 0
                  61    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0

101 T 4 2 106026  610 001 61    000000 T0100101001        0  0    0 0
                  61    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0
                  61    000000 T0100111011        0  0    0 0 1
                  61    000000     000000        0  0    0 0
                  61    000000     000000        0  0    0 0

1138 T 1 2 [illegible]  [illegible]  61    000000 T0100101001        0  0    0 0
                  61    000000     000000        0  0    0 0
                  62    000000     000000        0  0    0 0
                  61    000000 T1100111011        0  1    0 0
                  62    000000     000000        0  0    0 0
                  [illegible]  000000 T1100101001        0  0    0 0
```

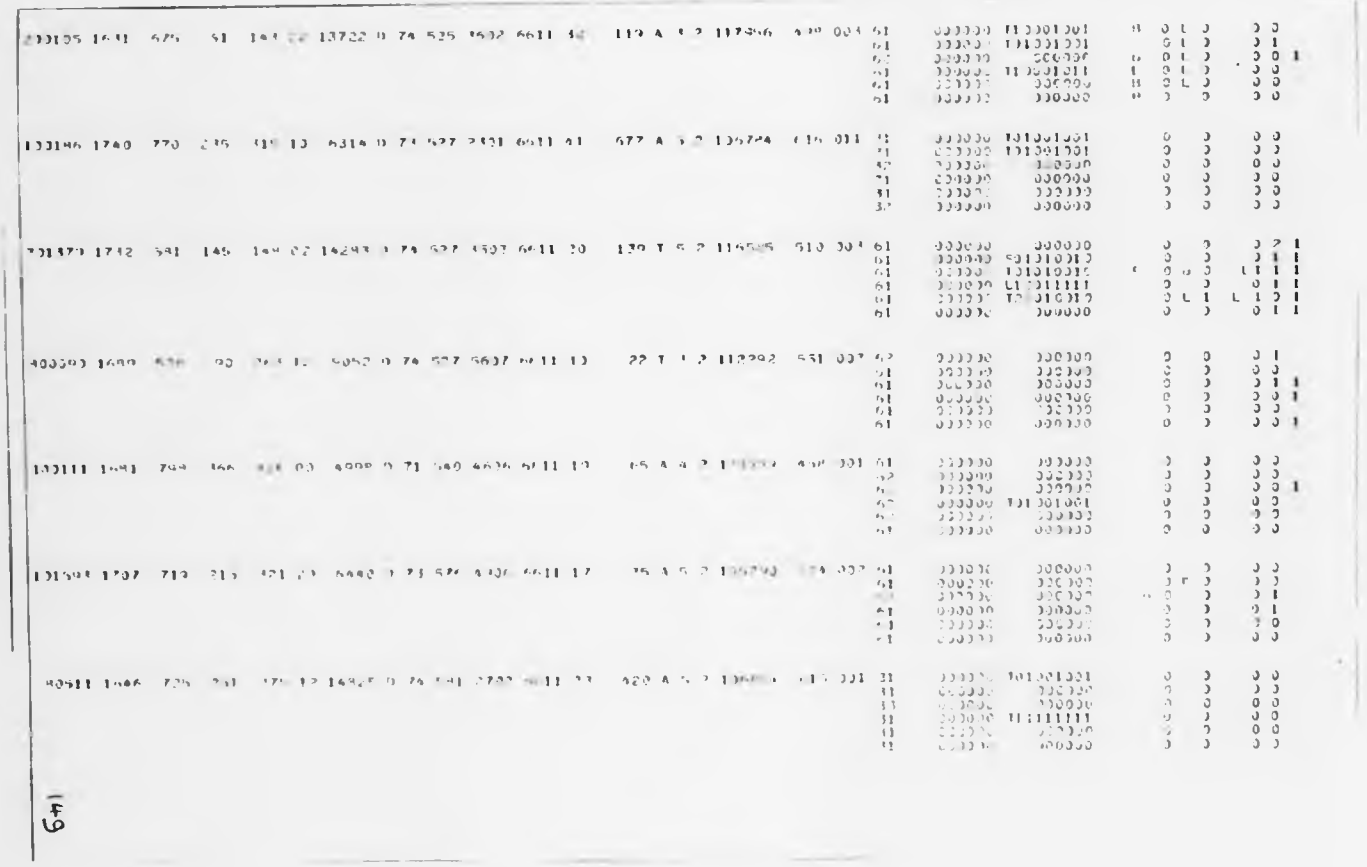
333930	1581	718	230	388	10	13371	D	69	423	2639	6611	29	
331019	1546	717	270	329	11	10564	D	74	420	3733	6611	29	
333309	1656	766	238	384	12	9232	D	73	420	2710	6611	39	
330391	1413	749	155	262	22	10759	D	68	420	2513	6611	38	
330326	1576	721	271	327	00	3316	D	73	423	3636	6611	33	
330662	1580	551	285	381	00	2072	D	71	423	3610	6611	35	
331939	1570	703	192	250	33	8414	D	69	423	2726	6611	39	

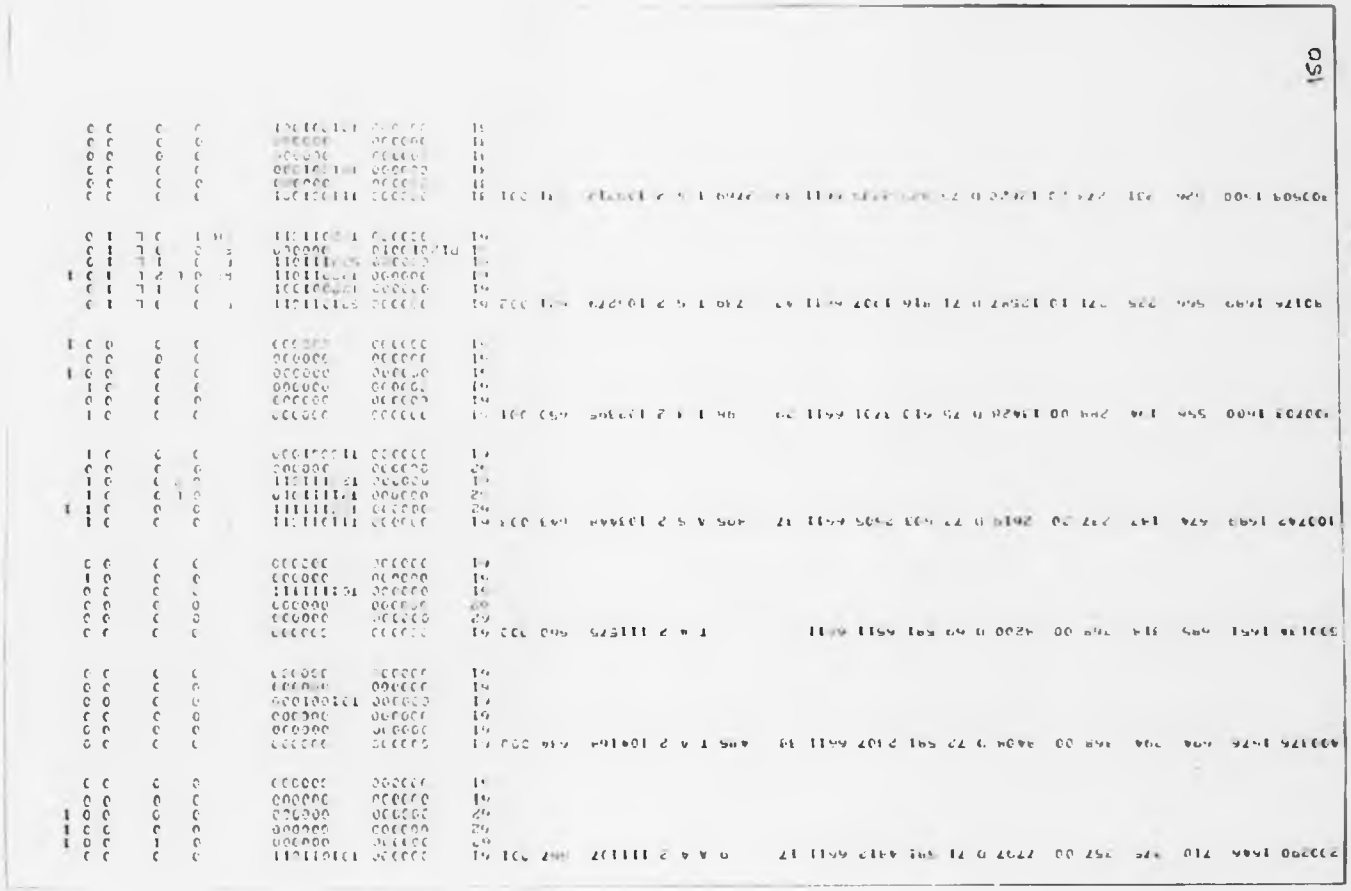
433081	1664	624	292	404	10	7747	0	70	420	6611	6611	27
433302	1587	671	204	256	00	9342	0	69	420	1311	6611	47
433332	1664	755	236	266	01	7578	0	70	420	2530	6611	40
533124	1697	586	302	366	10	10973	0	73	420	7330	6611	33
533224	1438	772	180	367	00	12947	0	75	420	6511	6611	1
533268	1758	863	314	366	10	846	0	72	420	7530	6611	31
533345	1656	533	131	232	00	5147	0	69	333	6511	6611	1

146

6301E7	1A00	628	1D4	77A	10	0092	D	75	420	4905	6A11	14
630149	1A06	6A2	1D7	7J1	00	7E01	D	75	420	4911	6A11	14
730212	1A05	736	1D7	7H4	20	15E7B	D	72	420	5A19	6A11	13
730324	1A1A	742	1D7	611	02	11947	D	75	420	5A19	6A11	13
730540	1A05	740	215	103	11	12561	D	73	420	5911	6A11	13
730178	1A51	6A0	234	7H1	21	10206	D	7E	432	1H04	6A11	4A
730538	1A1A	710	250	7J7	10	6051	D	72	432	2705	6A11	11







RECORD LAY-OUT: COHORT "B"

#	Length	Item, including units and "format"
1	6	Identity number
2-4	6	Date of birth (day/month/year)
5	5	Film reading sequence number
6	1	Status (Alive, Dead or Lost to view)
7	2	Year of death, or loss (blank if alive)
8	3	Cause of death * (blank if alive or lost to view)
9	4	Date of start of first job (year/month)
10	4	Date of end of last recorded job (year/month)
11	2	Net service (years: truncated) (I2)
12	5	Accumulated dust exposure (mpcf.y: truncated) (I5)
13	1	Mining area (Asbestos or Thetford Mines)
14	1	Reader (as recoded, see p. 180)
15	1	"Normal" or "Less-than-normal"
16	1	Smoking code (see p. 180)
17	43	X-ray readings (see next page)

* First character R or S for accidents at asbestos work

LAY-OUT OF X-RAY READINGS: COHORT "B"

#	Length	Print cols.	Item
1	1	59	Film quality (+; +/-; +/--)
2	9		Small rounded opacities
		61-63	type; profusion
		64-69	zones (RU; RM; RL; LU; LM; LL)
3	9		Small irregular opacities
		71-73	type; profusion
		74-79	zones (RU; RM; RL; LU; LM; LL)
4	2		Large opacities
		81-82	well defined; poorly defined
5	1	84	Costophrenic angle(s)
6	3		Pleural thickening
		85-87	diffuse; plaques; grade
7	1	89	Irregular diaphragm
8	1	91	Irregular cardiac border
9	4		Pleural calcification
		93-96	diaphragm; wall; other; grade
10	1	98	"Additional symbols" (count)
11	1	100	"Comments" (1 = Yes)

COHORT "B"

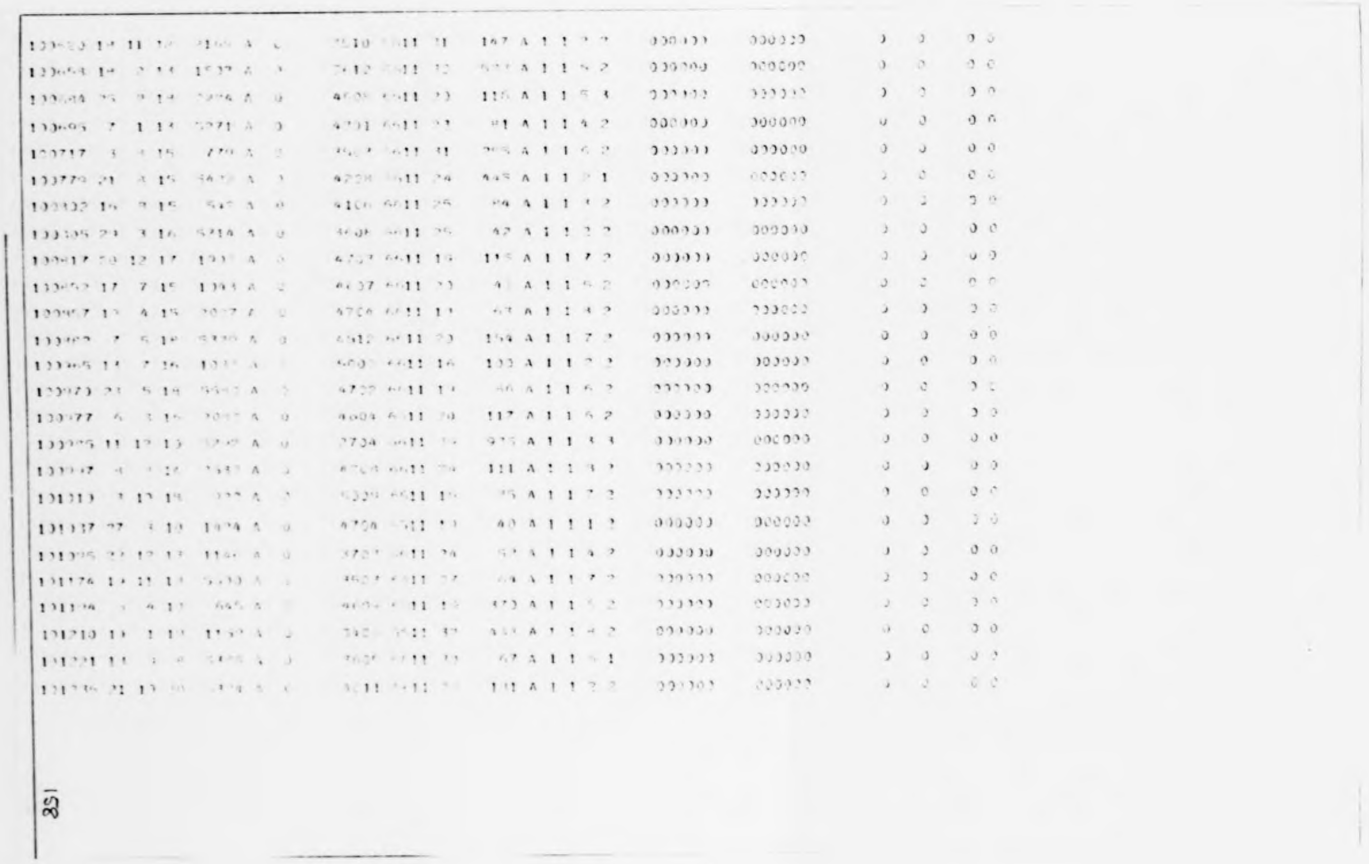
Reader 1

"Normals"

pp. 155 - 177

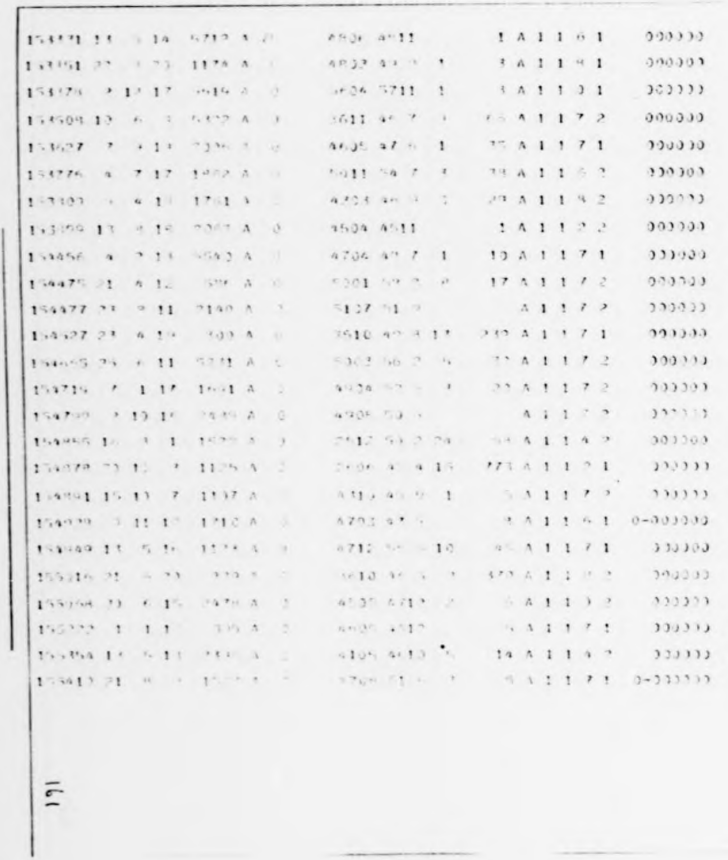
"Less-than-normals"

pp. 178 - 184

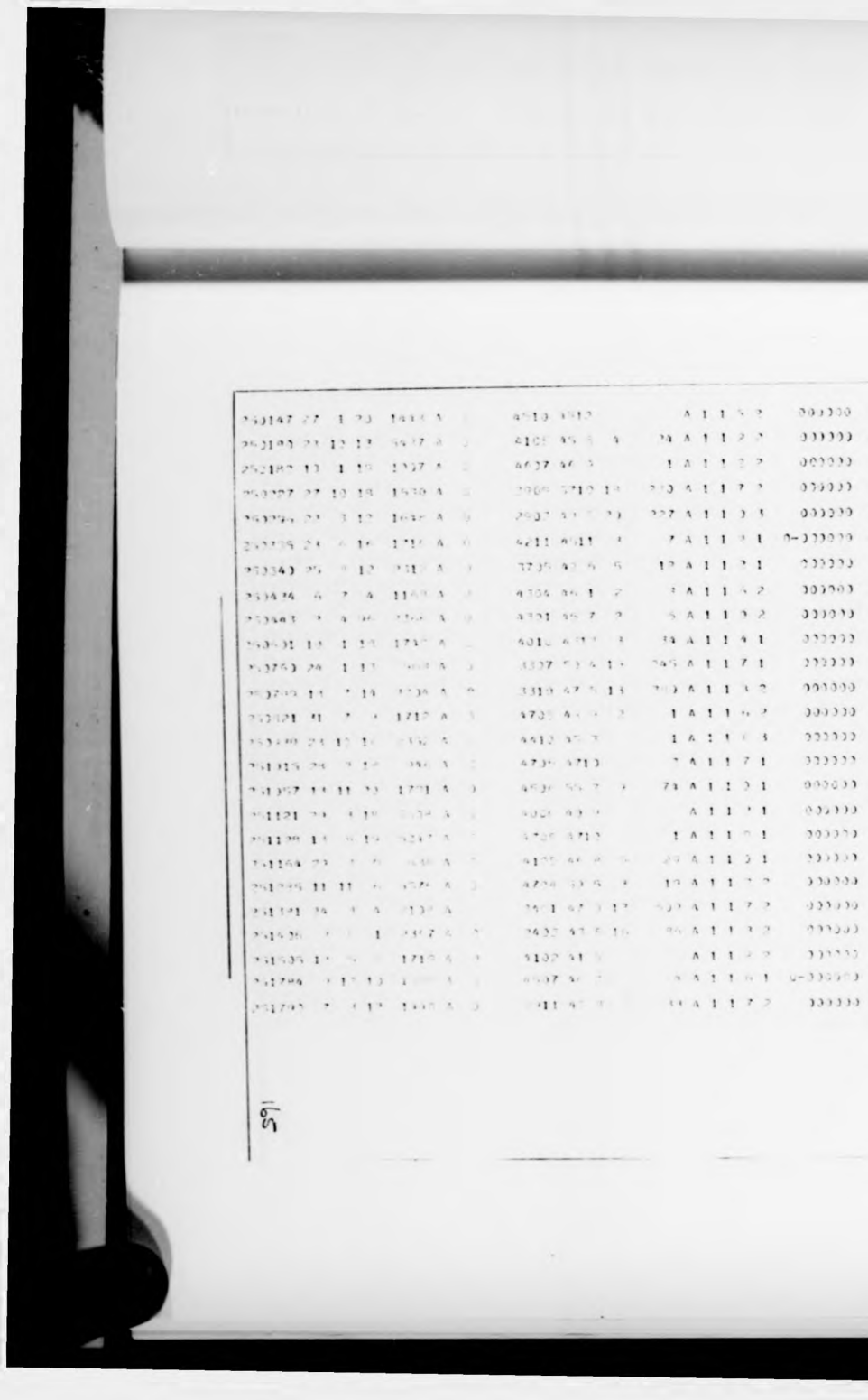


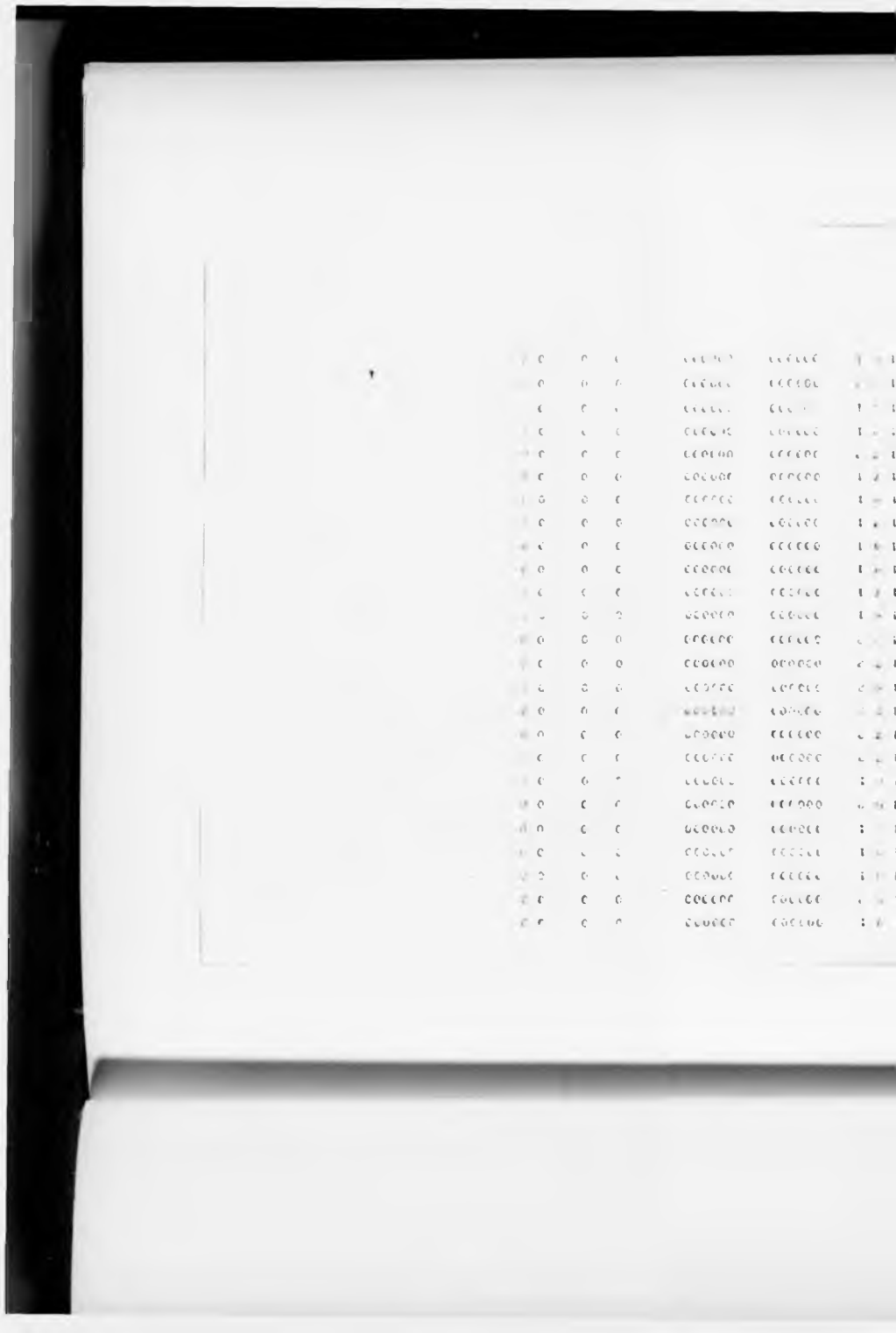
251

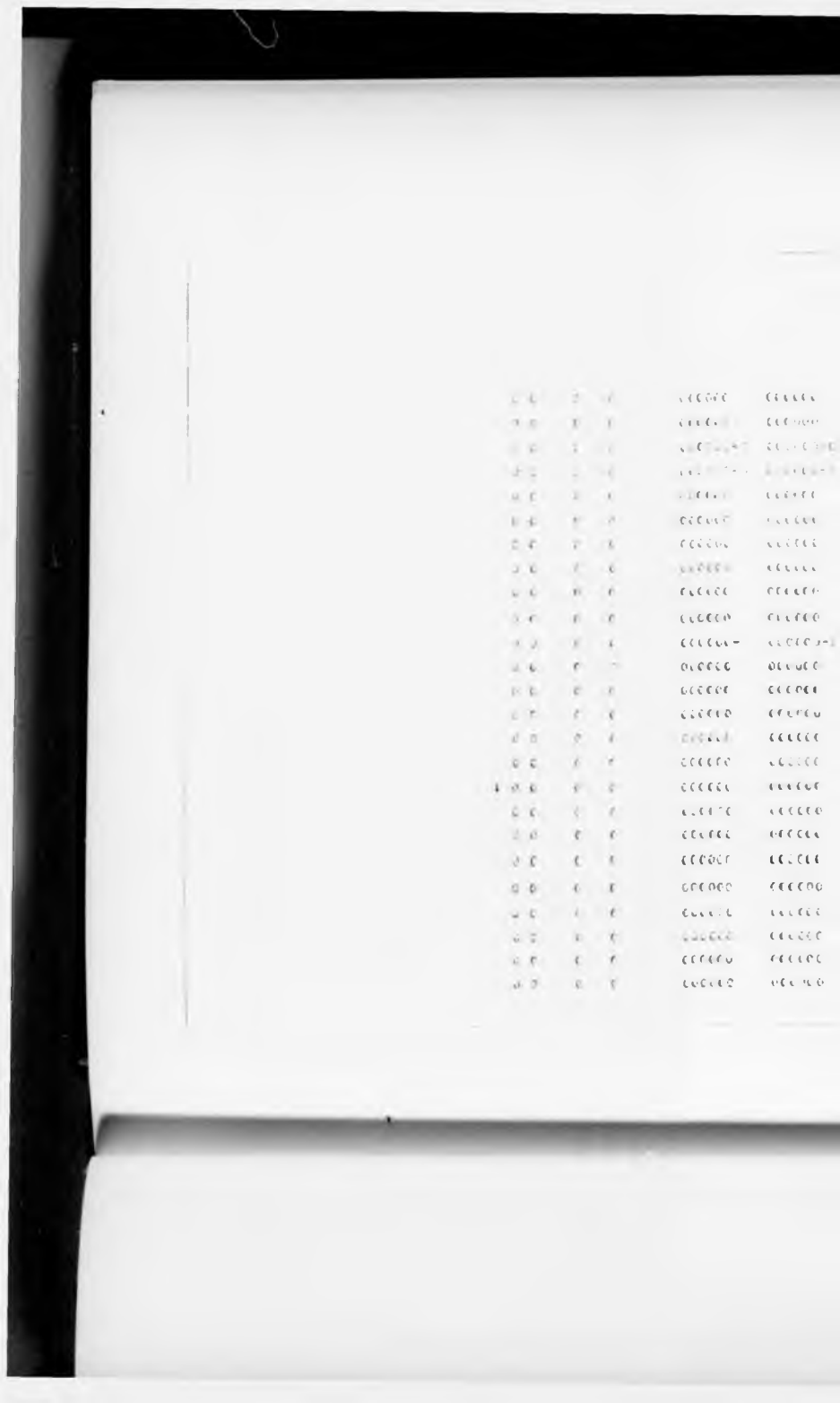
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000

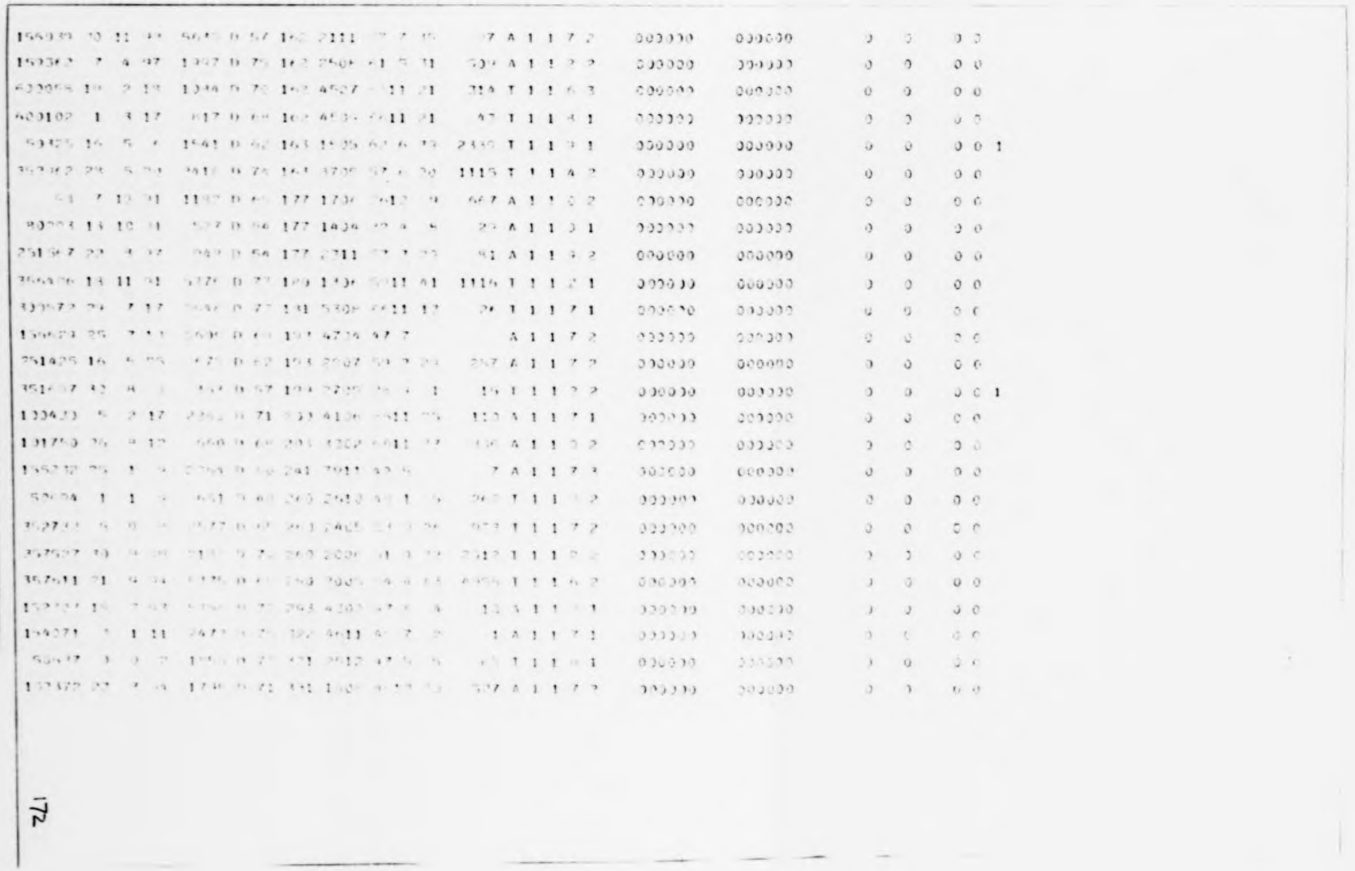


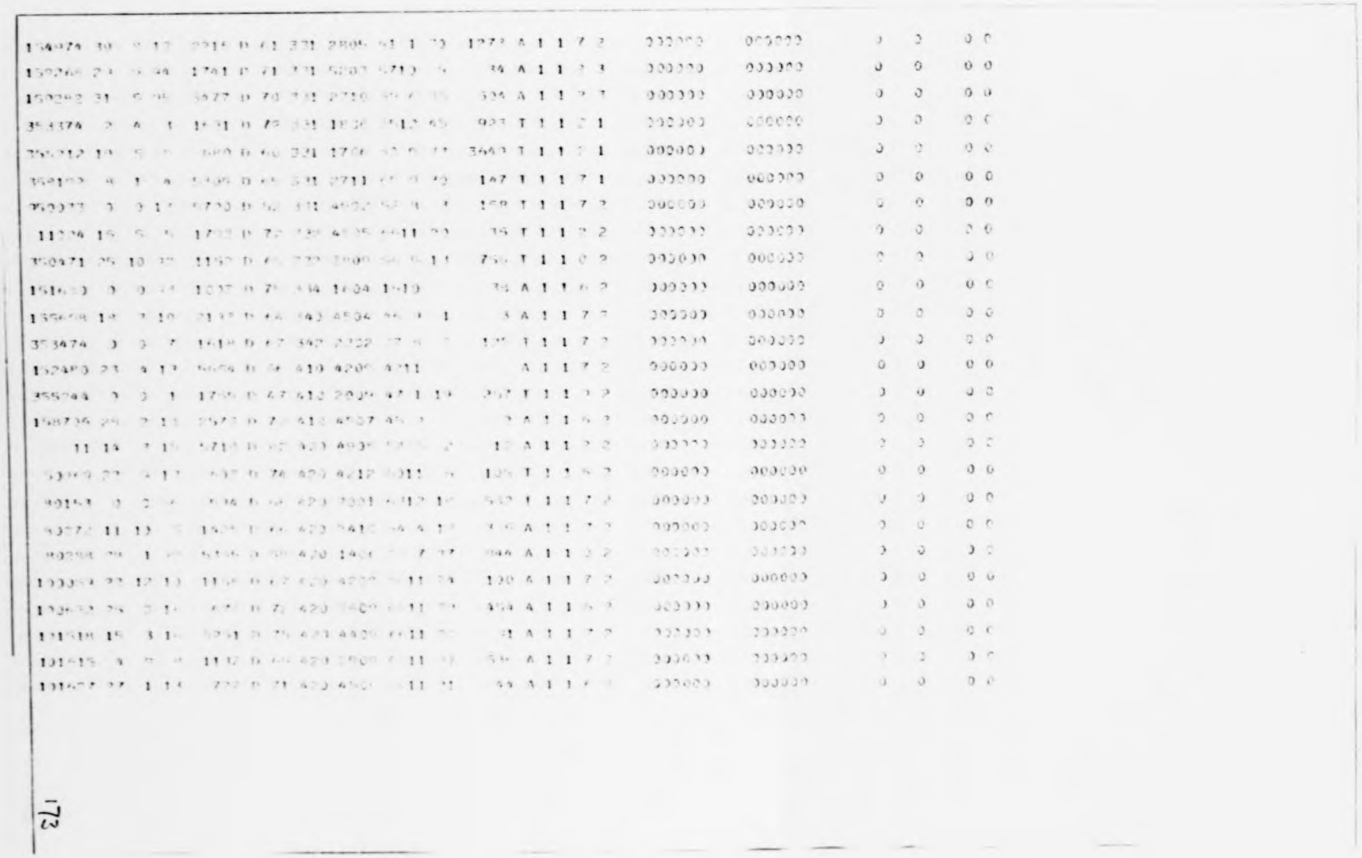
155414	8	11	23	2101	A	2	4504	55	2	23	353	A	1	1	4	2	000000	000000	0	0	0	0	
155427	1	2	14	1751	A	2	4430	47	7	2	6	A	1	1	9	1	0-000000	0-000000	0	0	0	0	
155531	30	3	15	719	A	3	4229	51	11	11	26	A	1	1	3	1	000000	000000	0	0	0	0	
155540	15	1	19	1473	A	0	5105	51	6			A	1	1	9	1	000000	000000	0	0	0	0	
155779	21	5	6	1221	A	0	3606	47	5	11	542	A	1	1	7	2	000000	000000	0	0	0	0	
155902	15	9	3	2301	A	2	3508	35	1	3	98	A	1	1	2	1	000000	000000	0	0	0	0	1
156016	21	6	7	591	A	3	4912	53	7		1	A	1	1	2	1	000000	000000	0	0	0	0	
156201	13	8	12	1557	A	3	4010	47	2	1	10	A	1	1	6	2	000000	000000	0	0	0	0	
156211	14	5	20	5557	A	3	3913	50	3	13	24	A	1	1	6	1	000000	000000	0	0	0	0	
156517	26	6	15	5513	A	2	4597	4513			3	A	1	1	9	2	000000	000000	0	0	0	0	
156555	4	3	17	1852	A	2	4712	48	7		1	A	1	1	7	1	0-000000	0-000000	0	0	0	0	
156662	7	10	3	1233	A	0	2608	4512	17		159	A	1	1	2	2	000000	000000	0	0	0	0	
156561	30	8	9	5620	A	0	2407	29	4	1	90	A	1	1	4	2	000000	000000	0	0	0	0	
156592	16	1	20	3356	A	2	4136	4712		2	76	A	1	1	7	2	000000	000000	0	0	0	0	
156671	17	1	17	[illegible]	A	0	5104	51	6			A	1	1	4	1	0-000000	0-000000	0	0	0	0	
156702	2	8	10	355	A	2	4710	4912	17		31	A	1	1	7	2	000000	000000	0	0	0	0	
156764	16	6	4	321	A	2	4110	46	7	6	16	A	1	1	2	2	000000	000000	0	0	0	0	
156791	25	5	27	3452	A	[illegible]	2406	43	4	22	174	A	1	1	6	2	000000	000000	0	0	0	0	
156794	2	3	0	4330	A	0	4208	50	[illegible]	22	440	A	1	1	3	2	000000	000000	0	0	0	0	
156927	11	12	15	1374	A	3	4010	45	5	4	26	A	1	1	7	2	000000	000000	0	0	0	0	
156955	21	7	14	5686	A	[illegible]	3706	48	3	11	37	A	1	1	3	1	000000	000000	0	0	0	0	
156966	23	5	16	5507	A	2	3611	4512	20		437	A	1	1	7	2	000000	000000	0	0	0	0	
157051	25	13	13	1371	A	3	4806	53	2		3	A	1	1	7	2	000000	000000	0	0	0	0	
157107	16	7	15	1376	A	3	4610	47	1		3	A	1	1	7	1	000000	000000	0	0	0	0	
157123	11	2	23	3474	A	2	3607	38	3		13	A	1	1	3	2	000000	000000	0	0	0	0	

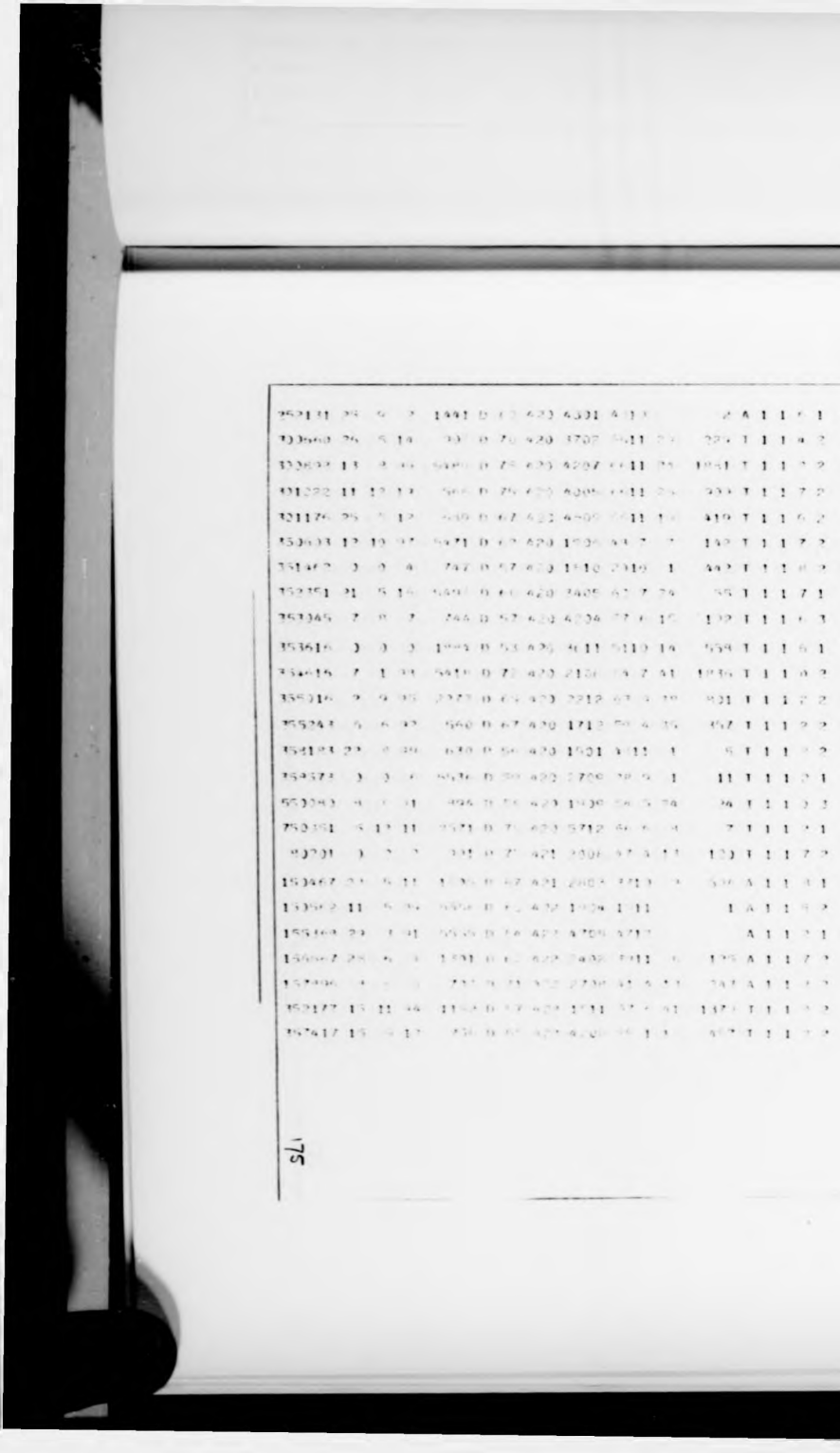






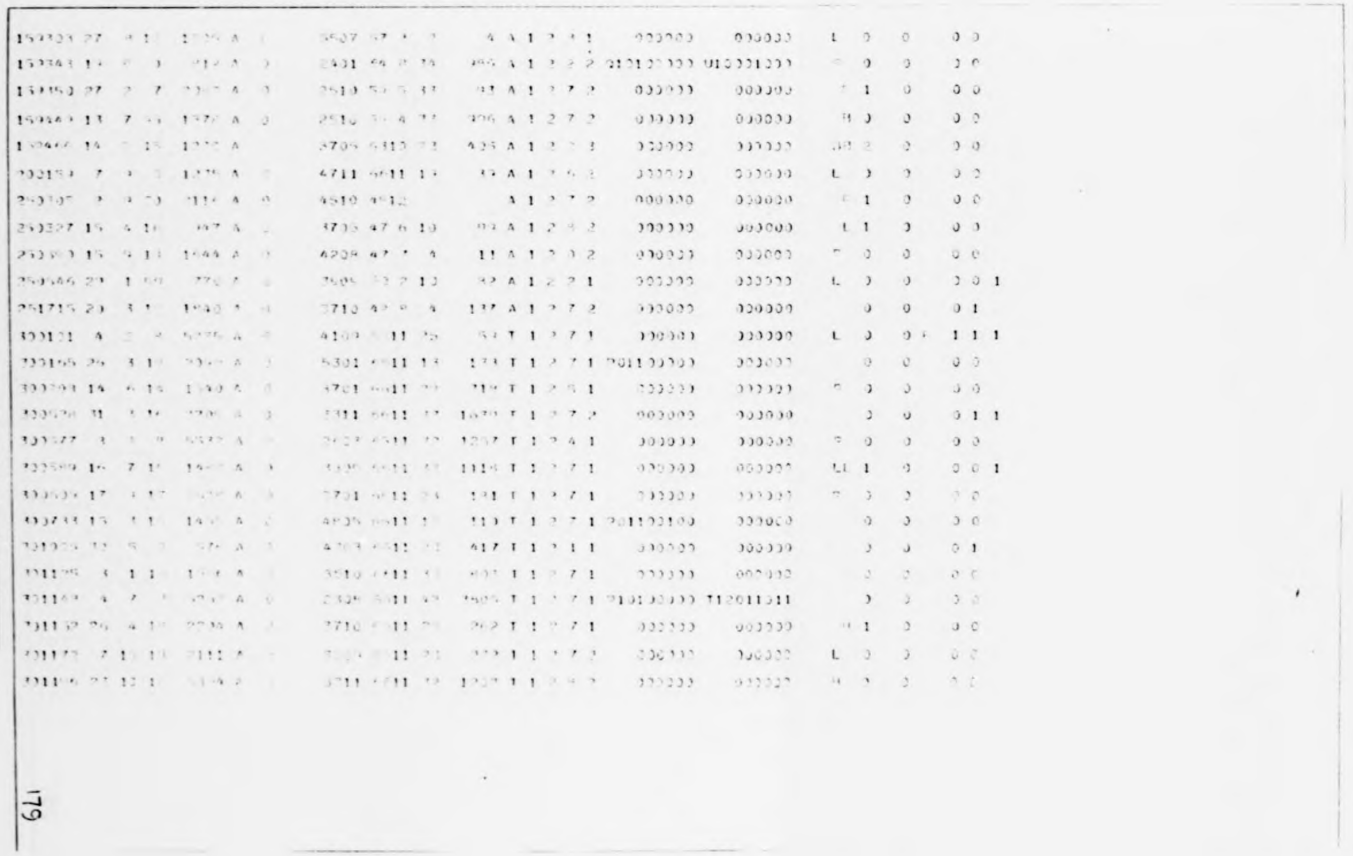


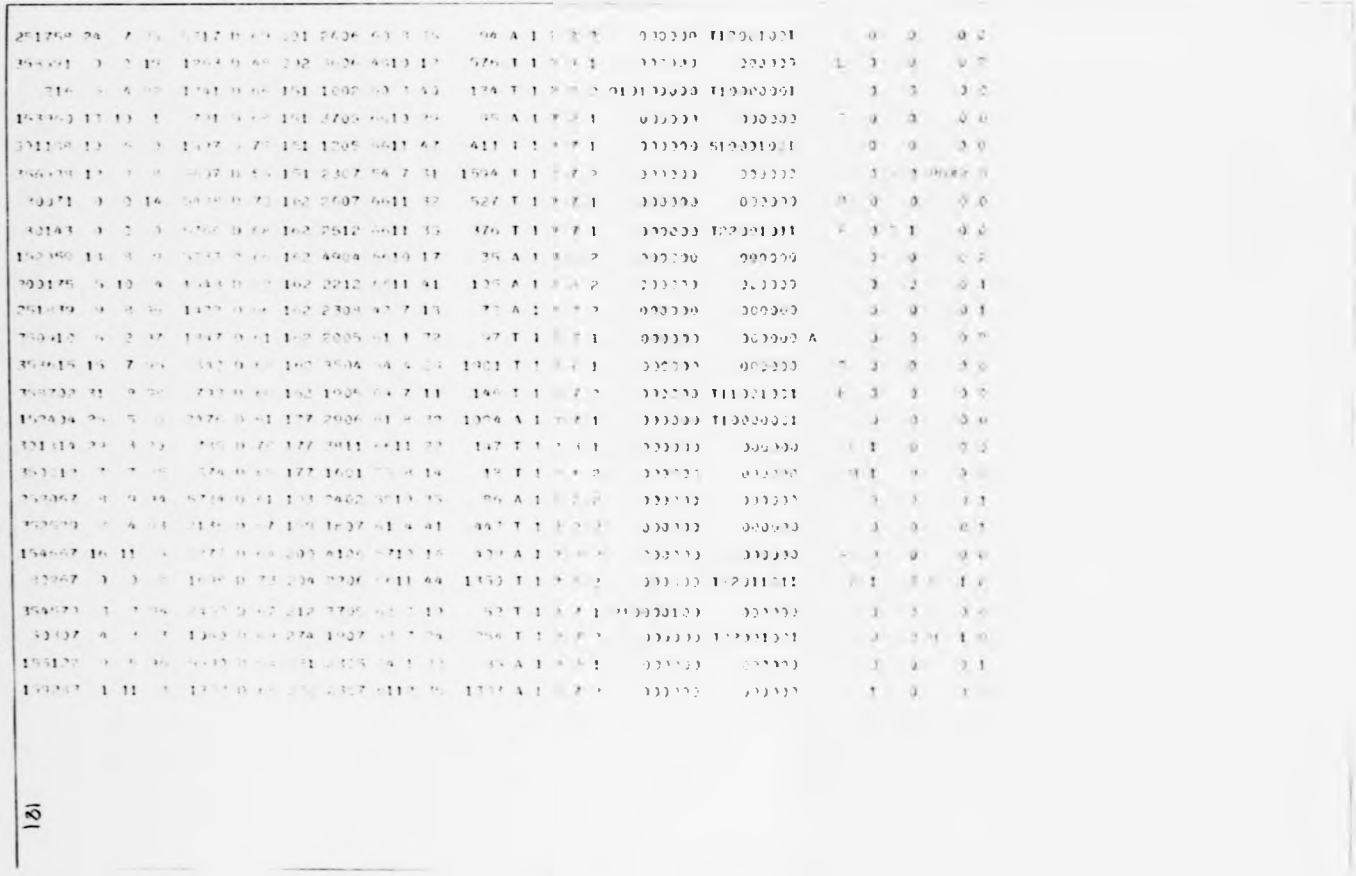


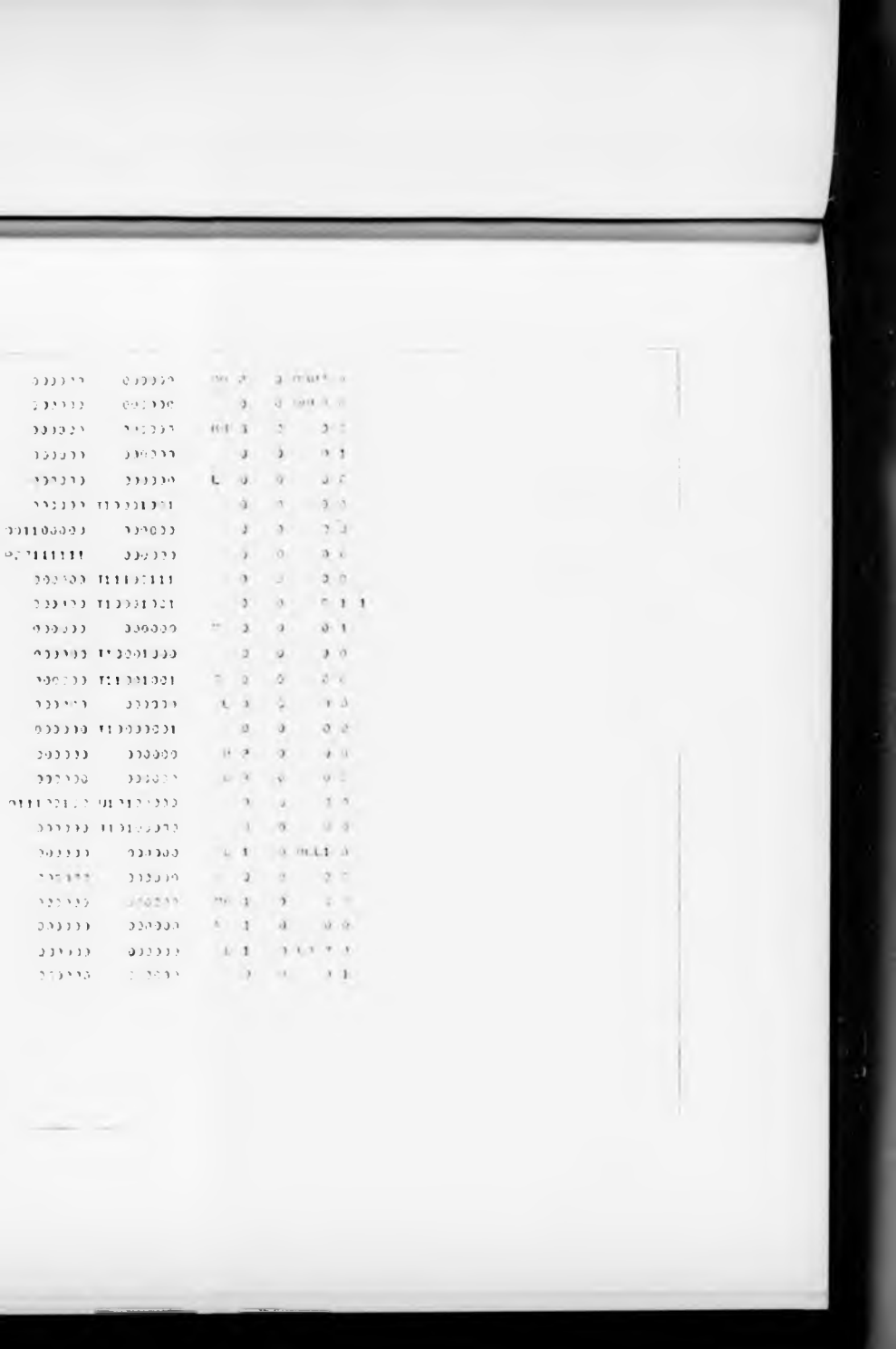


	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000

41	17	3	32	2154	D	41	733	3632	35	7	11	131	A	1	1	[illegible]	2
152277	23	7	10	1361	D	48	787	4709	4712				A	1	1	9	1
83141	3	7	3	1401	D	52	910	4417	57	9	7	102	T	1	1	7	2
152736	13	4	4	2674	D	70	812	4706	3711				A	1	1	9	1
251987	9	11	13	5674	D	52	812	4212	5212		12	131	A	1	1	6	2
151117	3	9	20	1815	D	56	815	4708	5612		9	45	A	1	1	7	2
153152	31	13	15	843	D	49	879	4208	34	6		5	A	1	1	7	2
154574	24	9	34	2365	D	69	823	2710	36	2	13	187	A	1	1	7	2
157149	1	5	5	636	D	45	832	2306	4711		14	769	A	1	1	9	2
251237	3	2	34	1536	D	72	902	3510	56	1	15	182	T	1	1	2	2
253038	23	4	[illegible]	5610	D	56	904	4512	46	7		2	A	1	1	9	2
157435	5	1	15	1761	D	56	916	3612	46	7	[illegible]	248	A	1	1	7	2
253712	14	7	14	1378	D	72	920	4706	45	8	[illegible]	5	A	1	1	7	2
157406	19	4	34	3112	D	57	949	4701	56	1	17	302	A	1	1	7	1
154843	15	5	15	661	D	62	973	3705	[illegible]	5	26	487	A	1	1	7	1
153621	29	13	[illegible]	1371	D	60	976	4710	4	1		2	A	1	1	9	2
157798	23	6	17	1370	D	51	976	2425	5	3	17	644	A	1	1	6	1
351673	31	3	12	1311	D	44	976	4704	56	6	17	35	T	1	1	7	2
156121	23	7	17	755	D	45	552	7402	43	6	6	221	A	1	1	5	2
52141	12	7	14	1416	1	73		4628	33	1	1	11	T	1	1	[illegible]	1
154591	16	6	14	2291	1	65		4026	41	2	1	3	A	1	1	5	1
155506	17	6	15	759	1	67		4708	47	1			A	1	1	9	1
150396	5	1	14	2575	1	62		5711	63	1	[illegible]	13	A	1	1	4	2
154360	25	7	5	5517	1	56		4708	4712			6	A	1	1	3	2
154398	23	5	15	5490	1	77		3720	2718			23	A	1	1	[illegible]	2







COHORT "B"

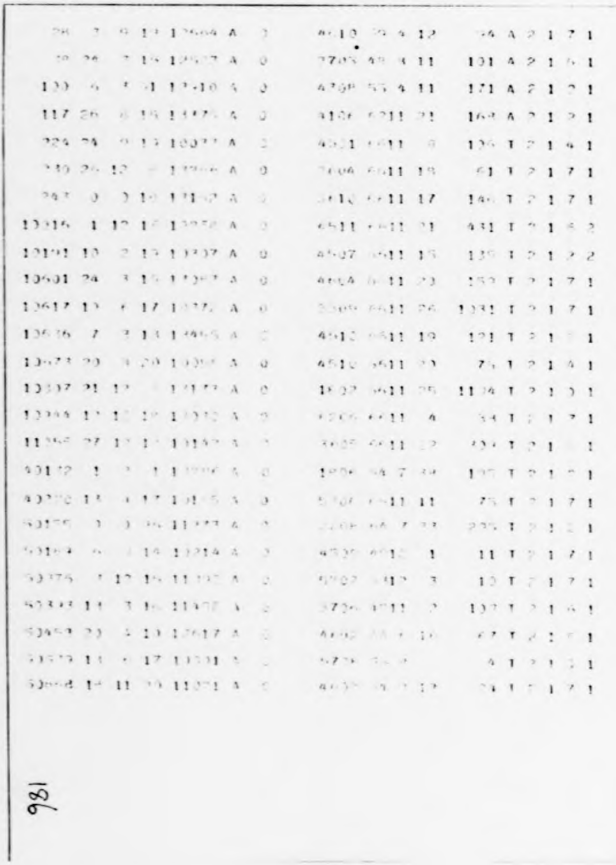
Reader 2

"Normals"

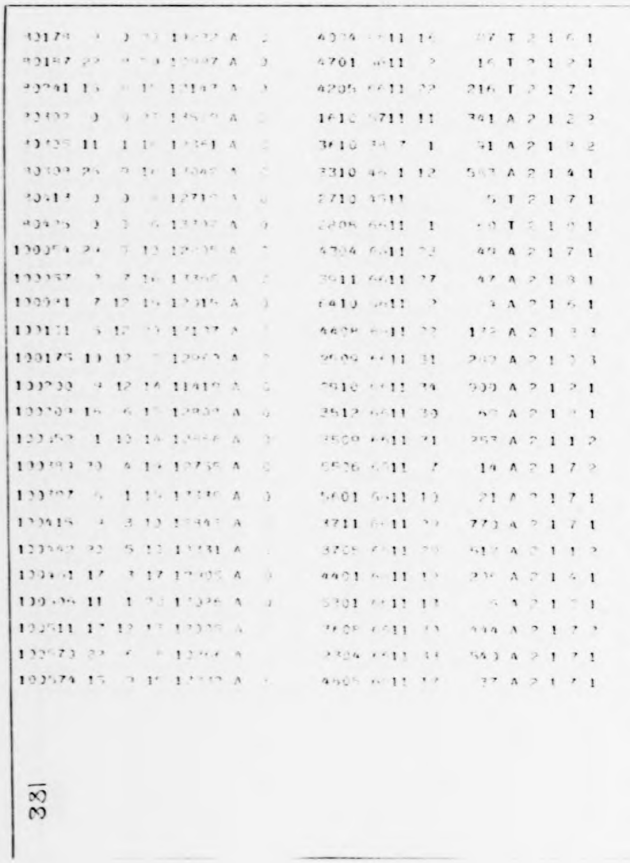
pp. 186 - 208

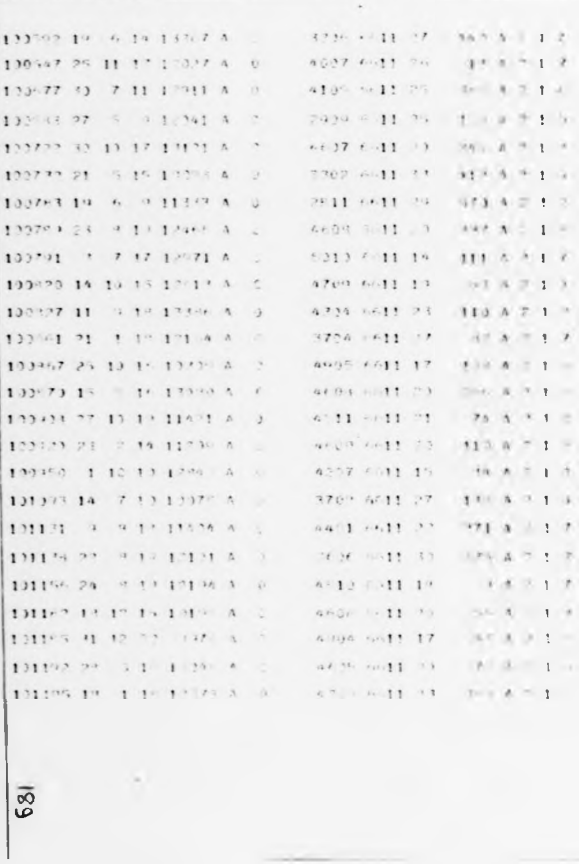
"Less-than-normals"

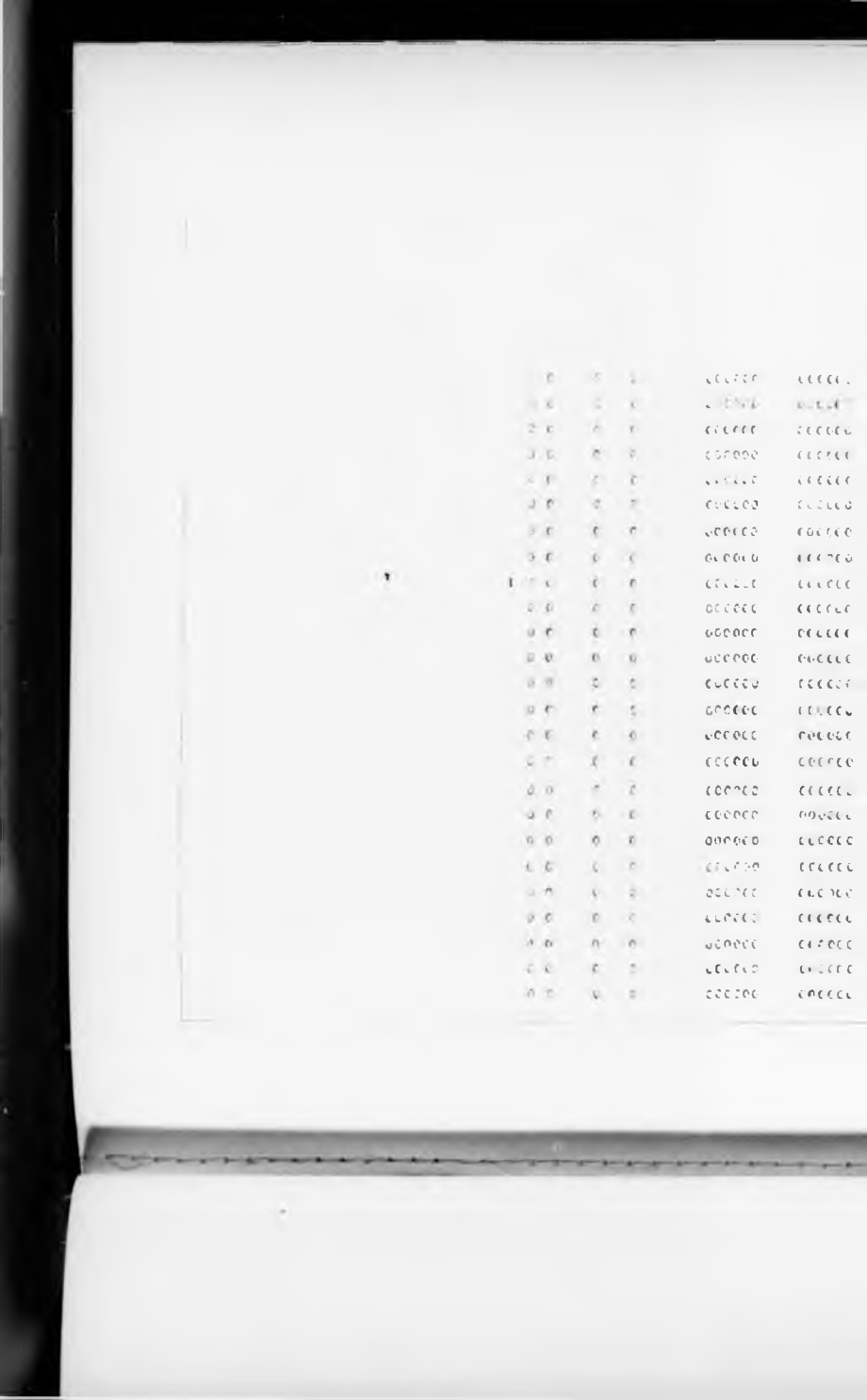
pp. 209 - 216

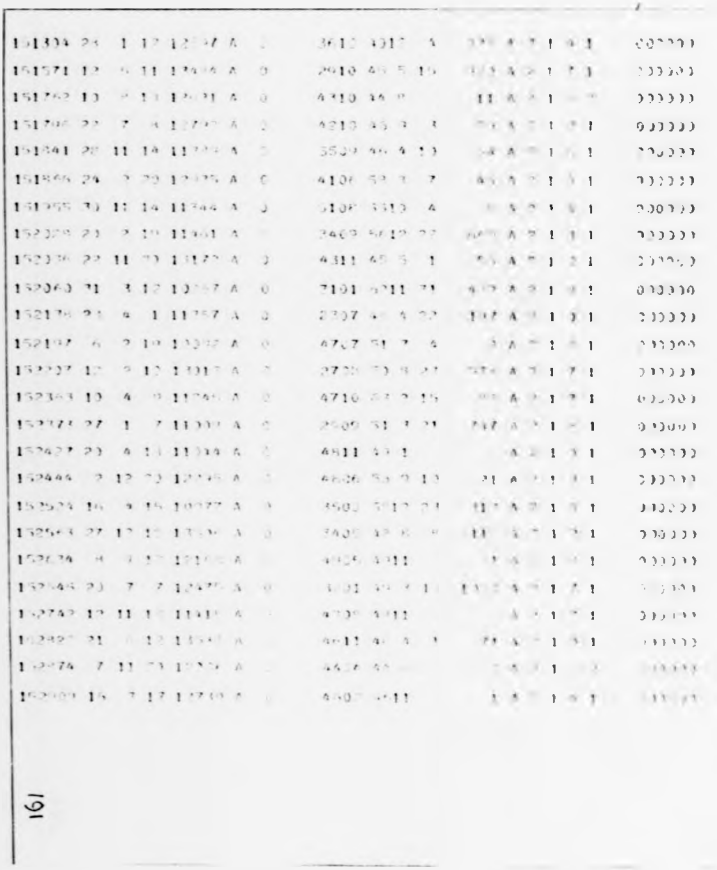


981

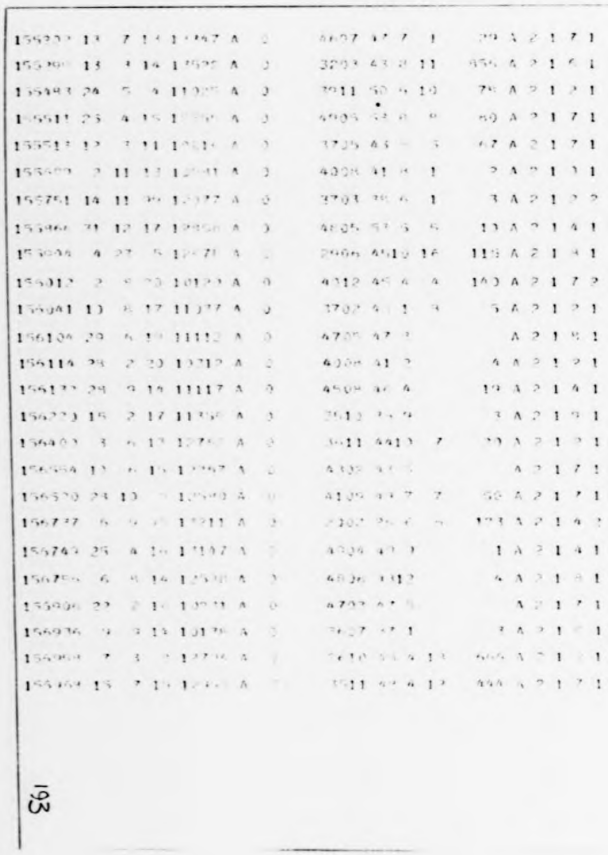






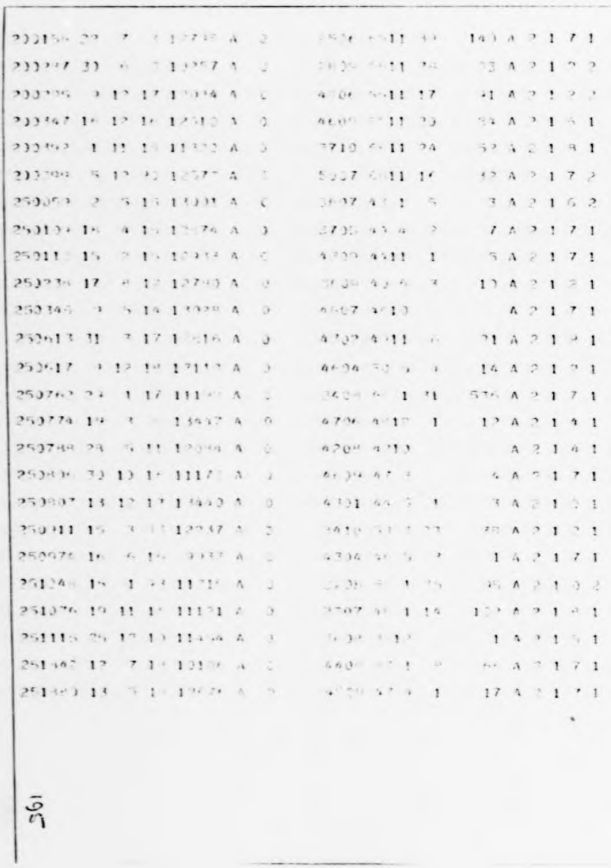


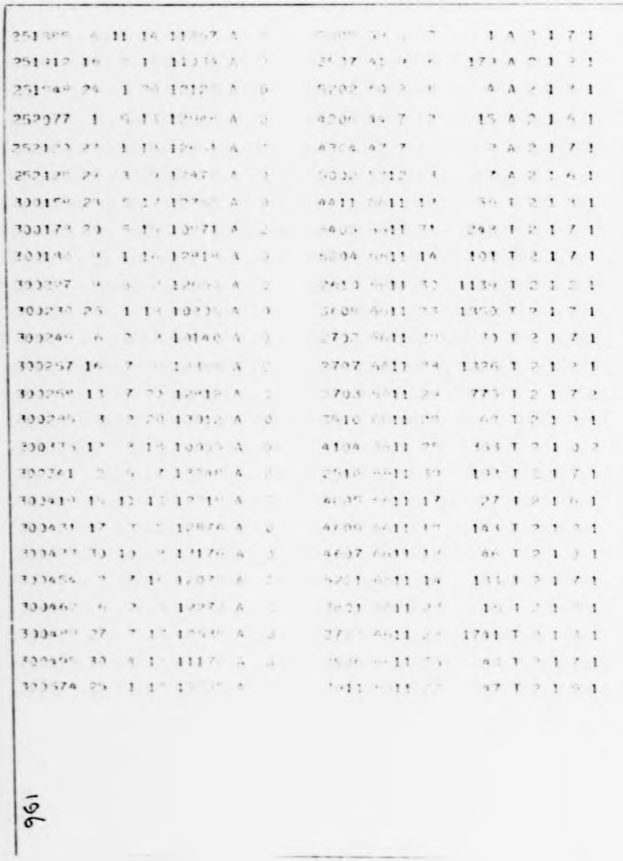
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1



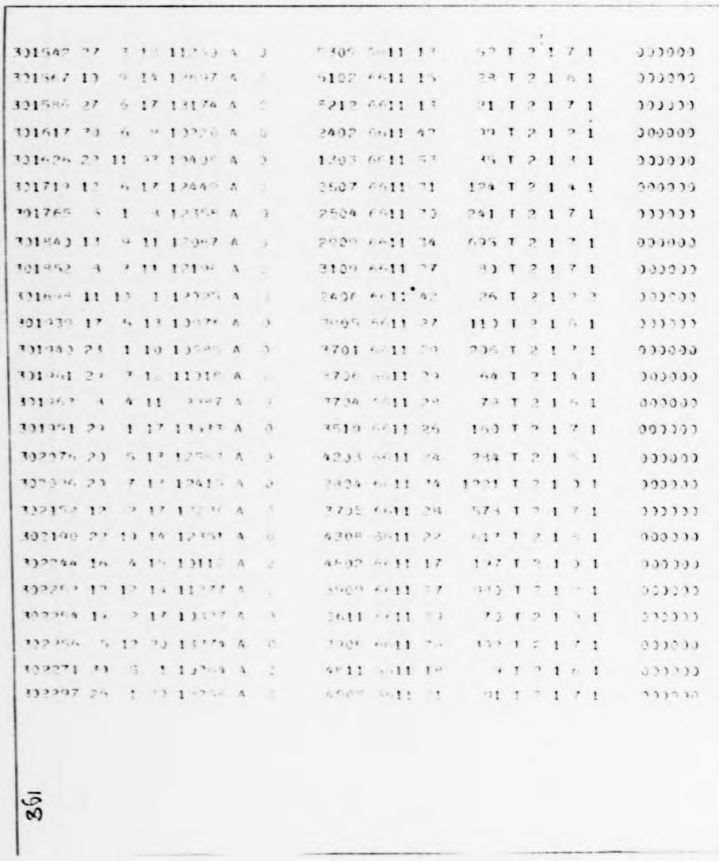
156932	2	8	15	12236	A	0	4509	10	9	4	9	A	2	1	0	1	000000
157069	10	4	17	13023	A	0	3235	56	5	13	391	A	2	1	4	1	000000
157100	1	4	14	12346	A	0	3407	47	5	7	406	A	2	1	4	1	000000
157104	36	4	6	12560	A	0	3611	39	2	9	6	A	2	1	0	1	0-000000
157412	26	7	5	12172	A	0	3303	42	6	3	164	A	2	1	4	1	000000
157643	14	4	11	9342	A	0	4506	5112		7	5	A	2	1	7	1	000000
158030	17	11	13	12991	A	0	4605	49	6			A	2	1	2	1	000000
158175	15	6	12	12575	A	0	4108	3511		14	31	A	2	1	3	1	000000
158162	19	3	37	11209	A	0	2216	45	7	22	412	A	2	1	2	1	000000
158206	1	4	0	9346	A	0	2627	42	5	13	722	A	2	1	0	1	000000
158261	21	5	9	12217	A	0	3602	35	7	3	47	A	2	1	7	1	000000
158413	27	6	10	11370	A	0	5104	56	3	7	45	A	2	1	9	1	000000
158545	16	7	14	13532	A	0	4906	5110		2	4	A	2	1	0	2	000000
159658	22	11	11	11330	A	0	4734	46	2		9	A	2	1	8	1	000000
159226	23	4	97	12072	A	0	1306	62	3	22	436	A	2	1	2	2	000000
159267	30	4	32	12596	A	0	2307	57	6	12	336	A	2	1	7	1	000000
159317	24	7	3	17154	A	0	2909	62	4	22	40	A	2	1	6	1	000000
159330	10	10	34	10390	A	0	2510	5310		36	1175	A	2	1	2	2	000000
159334	24	9	5	11073	A	0	5207	57	6	5	10	A	2	1	2	1	000000
159393	6	7	0	11126	A	0	2505	45	4	35	114	A	2	1	2	3	000000
159451	13	3	17	12225	A	0	4606	47	5	1	2	A	2	1	6	1	000000
159471	17	7	56	12230	A	0	2903	64	3	45	21	A	2	1	5	2	000000
200037	30	4	10	10037	A	2	7702	5611		27	21	A	2	1	3	3	000000
200113	13	1	17	11332	A	0	4116	5611		35	47	A	2	1	7	1	000000
200135	13	1	17	[illegible]	A	0	5602	5611		17	145	A	2	1	3	1	000000

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

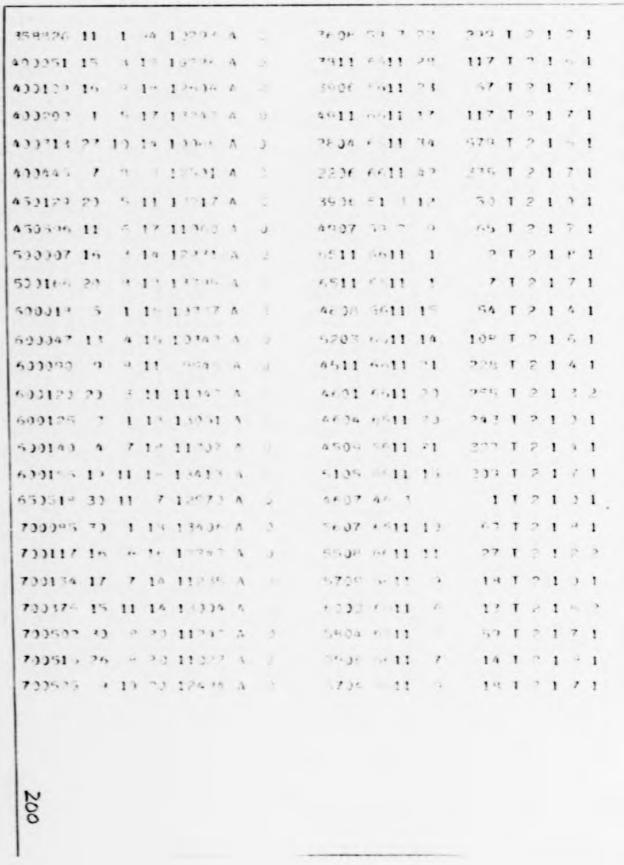




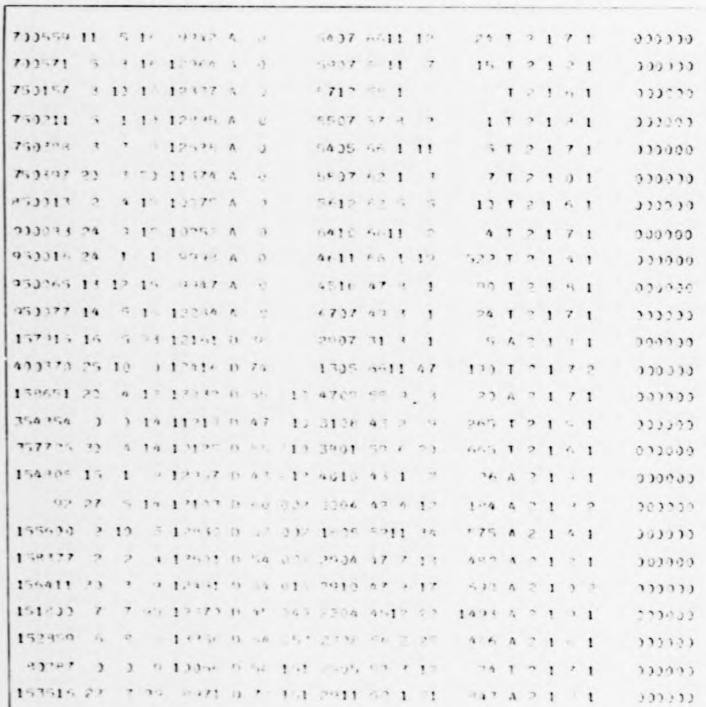
| | | |



361



	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
1	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000
	0 0	0	0	000000



0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000

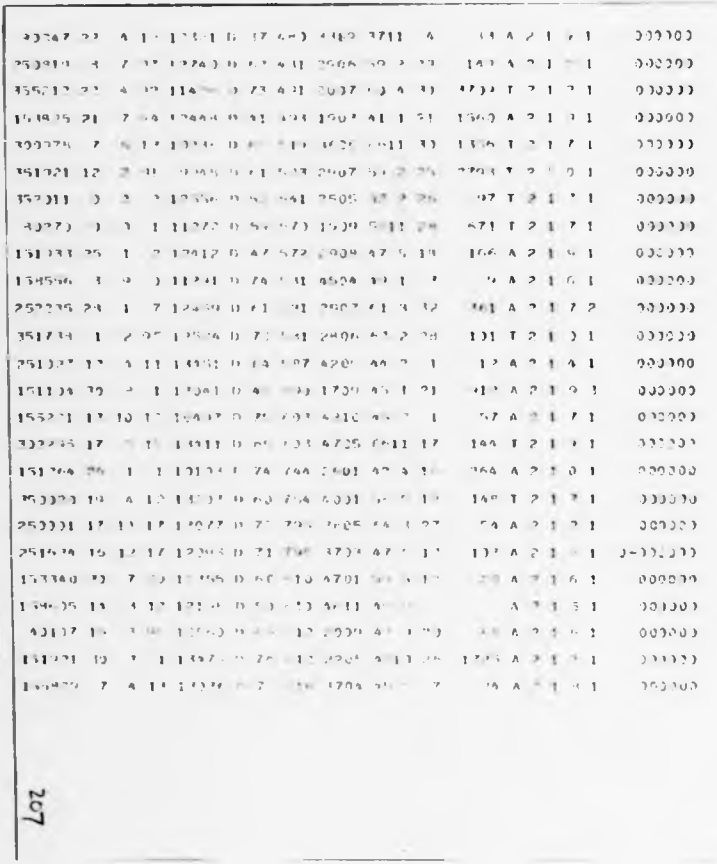
100579	23	7	5	12548	D	75	177	2602	6611	43		577	A	2	1	2	1	000000	000000		0	0	0	0
154353	9	12	95	12151	D	62	177	2510	43	1	23	198	A	2	1	2	2	000000	000000		0	0	0	0
250214	16	3	96	13424	D	57	177	2001	56	4	36	103	A	2	1	2	1	000000	000000		0	0	0	0
227	30	11	14	12509	D	72	197	4510	6611	17		74	T	2	1	3	1	000000	000000		0	0	0	0
153229	31	3	15	11223	D	67	199	4708	6610	14		47	A	2	1	7	1	000000	000000		0	0	0	0
353549	6	9	3	13132	D	54	139	2305	5413	31		1395	T	2	1	9	1	000000	000000		0	0	0	0
356888	6	12	91	12742	D	72	143	1606	56	9	33	262	T	2	1	0	1	000000	000000		0	0	0	0
152463	19	10	14	10711	D	49	201	3911	44	4	4	54	A	2	1	9	1	000000	000000		0	0	0	0
83442	4	7	3	11449	D	60	202	1908	54	8	20	69	A	2	1	8	2	000000	000000		0	0	0	0
253123	17	11	37	10999	D	59	204	3705	51	1	15	66	A	2	1	0	1	000000	000000		0	0	0	0
253566	11	12	39	13432	D	42	204	1912	4813	19		235	A	2	1	9	1	000000	000000		0	0	0	0
157595	1	3	10	13137	D	57	209	4709	53	1	9	38	A	2	1	2	1	000000	000000		0	0	0	0
244	0	3	95	11132	D	69	221	1307	43	8	26	633	A	2	1	0	1	000000	000000		0	0	0	0
156856	30	8	13	12252	D	69	221	3704	56	7	13	432	A	2	1	7	1	000000	000000		0	0	0	0
301533	3	11	17	11397	D	66	221	3510	6611	33		781	T	2	1	2	2	000000	000000		0	0	0	0
154511	8	5	4	11014	D	72	232	2505	42	8	17	52	A	2	1	7	1	000000	000000		0	0	0	0
150276	22	9	96	12538	D	73	242	3010	45	6	13	813	A	2	1	7	2	000000	000000		0	0	0	0
354341	8	7	13	13340	D	62	242	4407	4212	16		154	T	2	1	8	2	000000	000000		0	0	0	0
353058	16	5	92	13046	D	64	322	4005	46	8	5	495	T	2	1	2	2	000000	000000		0	0	0	0
353151	14	12	4	12326	D	66	322	4307	6612	22		213	T	2	1	7	2	000000	000000		0	0	0	0
356334	7	1	98	11740	D	58	326	1403	5613	44		30	T	2	1	6	2	000000	000000		0	0	0	0
351364	24	4	17	12715	D	74	345	3705	63	8	26	784	T	2	1	7	1	000000	000000		0	0	0	0
156336	20	1	14	12144	D	58	413	3702	46	1	8	83	A	2	1	7	2	000000	000000		0	0	0	0
10366	11	1	15	11030	D	75	420	5307	6611	13		62	T	2	1	7	1	000000	000000		0	0	0	0
43376	23	1	17	11315	D	61	423	7005	45	4	5	42	A	2	1	0	1	000000	000000		0	0	0	0

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

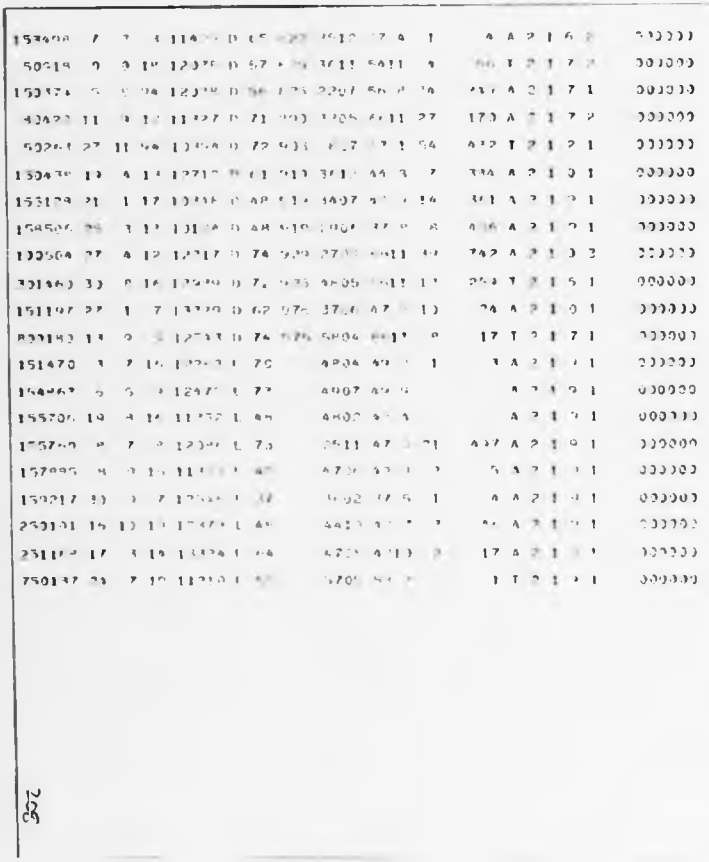
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
10	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

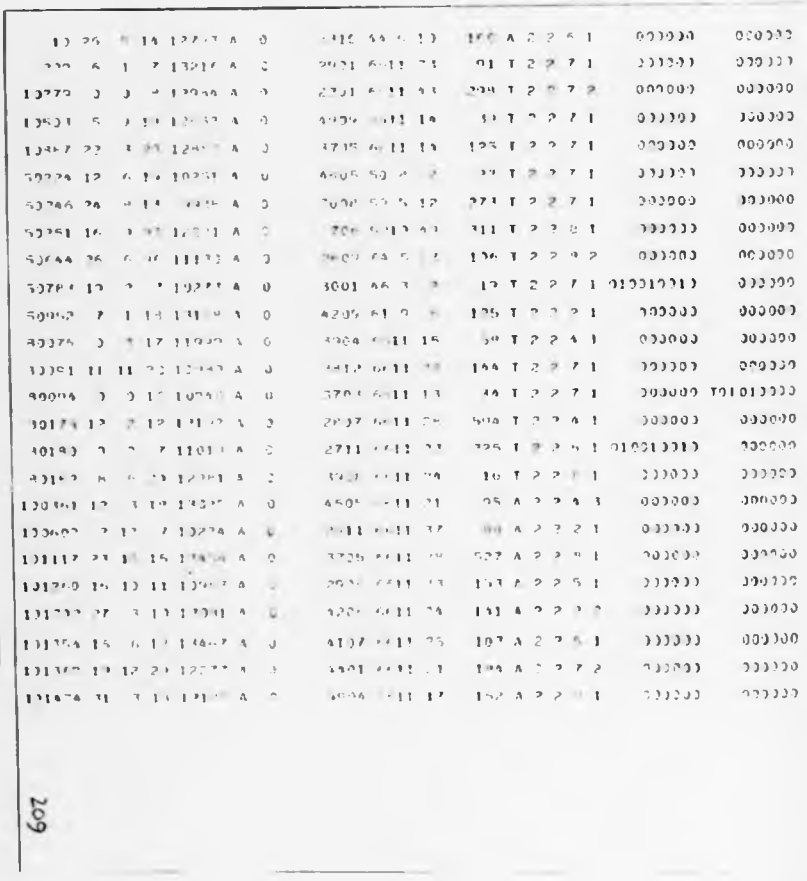
156883	21	1	97	9916	D	65	420	2504	42	1	22	938	A	2	1	6	4
157137	26	6	93	12648	D	65	420	4709	5410		7	15	A	2	1	2	1
157664	23	2	10	12072	D	67	420	3509	46	1	10	25	A	2	1	4	2
157717	25	2	93	13259	D	61	420	2710	53	3	30	1341	A	2	1	7	2
158740	21	5	12	10300	D	75	420	4907	40	9			A	2	1	7	1
158786	12	10	7	12293	D	47	420	2701	4412		17	50	A	2	1	9	2
159196	14	3	4	11126	D	60	420	2607	60	6	33	1171	A	2	1	5	1
159206	24	5	3	12040	D	71	420	3307	43	6	9	589	A	2	1	2	2
159258	25	11	96	12073	D	74	420	2003	6010		31	281	A	2	1	2	1
200002	19	2	7	12500	D	71	420	2908	6611		71	25	A	2	1	3	1
250520	6	10	96	9925	D	71	420	2306	5912		35	61	A	2	1	7	2
250589	23	12	15	10262	D	61	420	3402	47	3	13	433	A	2	1	7	2
252191	11	5	16	11153	D	75	420	4510	4511				A	2	1	2	1
252255	29	10	93	12886	D	62	420	1912	5811		38	744	A	2	1	0	1
300463	3	10	18	13011	D	73	420	4605	6911		20	38	T	2	1	2	1
302195	6	4	14	9754	D	75	420	3609	6611		30	121	T	2	1	7	1
350022	0	0	15	9987	D	74	420	3306	47	5	9	1200	T	2	1	7	1
350423	0	9	94	13155	D	49	420	1506	4910		25	1963	T	2	1	9	1
350452	0	0	99	11119	D	52	420	1612	52	6	27	442	T	2	1	7	2
350466	30	6	95	12175	D	68	420	2605	63	3	34	130	T	2	1	2	1
355100	6	10	11	10034	D	63	420	3611	6310		21	1341	T	2	1	7	1
355163	0	0	4	13242	D	65	420	2101	4711		12	458	T	2	1	7	1
355466	12	9	0	11312	D	74	420	2010	3710		1	23	T	2	1	6	1
355698	28	5	2	12013	D	57	420	1509	57	3	37	938	T	2	1	7	3
357450	11	9	16	11361	D	65	420	4706	49	1	1	12	T	2	1	7	1

357697	15	4	5	13472	0	60	420	3702	6311	18	475	T	2	1	6	1
358743	25	1	9	11443	0	60	420	3610	60	1	23	119	T	2	1	6	2
358832	22	5	2	10087	0	62	420	2409	63	2	36	168	T	2	1	2	1
450134	15	12	21	12574	0	53	420	705	5413	52		236	T	2	1	8	2
450270	3	0	0	12892	0	64	420	2306	25	7	3	3	T	2	1	2	2
450674	7	7	41	9395	0	51	420	1211	5112	36		28	T	2	1	3	1
550171	3	5	20	11190	0	70	420	5609	58	3	1		T	2	1	4	2
750174	4	4	14	12641	0	61	420	5807	61	7	3	13	T	2	1	2	1
157390	23	7	23	11369	0	64	421	2308	58	2	34	102	A	2	1	7	1
250912	4	2	19	13437	0	57	421	4002	46	9	6	4	A	2	1	7	1
101348	5	12	7	12031	0	71	422	2805	6611	28		634	A	2	1	8	2
155367	6	9	11	12514	0	72	422	2909	38	4	8	473	A	2	1	7	1
156821	14	9	2	10340	0	59	422	2906	56	5	24	390	A	2	1	2	2
159428	15	1	24	12099	0	71	422	1905	59	4	32	704	A	2	1	7	2
251350	8	0	26	12513	0	65	422	2403	6110	37		122	A	2	1	7	1
350088	1	3	26	12802	0	75	422	2405	64	3	29	736	T	2	1	0	1
355696	0	0	7	12122	0	48	422	2506	45	1	22	368	T	2	1	0	1
950073	24	12	22	12468	0	67	422	4005	47	0	27	2325	T	2	1	0	2
351254	3	3	13	13410	0	54	430	2418	54	1	25	1167	T	2	1	7	2
50323	20	5	22	12674	0	66	431	2308	60	3	25	105	T	2	1	7	1
950367	25	5	14	13379	0	57	434	4710	57	2	5	11	T	2	1	7	1
156304	26	4	24	12257	0	71	442	1210	50	3	2	46	A	2	1	7	1
354431	12	13	2	13878	0	73	453	4726	64	6	14	137	T	2	1	5	1
353575	6	5	24	12432	0	72	454	2306	61	5	34	1733	T	2	1	2	2
153077	12	6	2	13767	0	65	465	4008	42	6	1	21	A	2	1	0	1



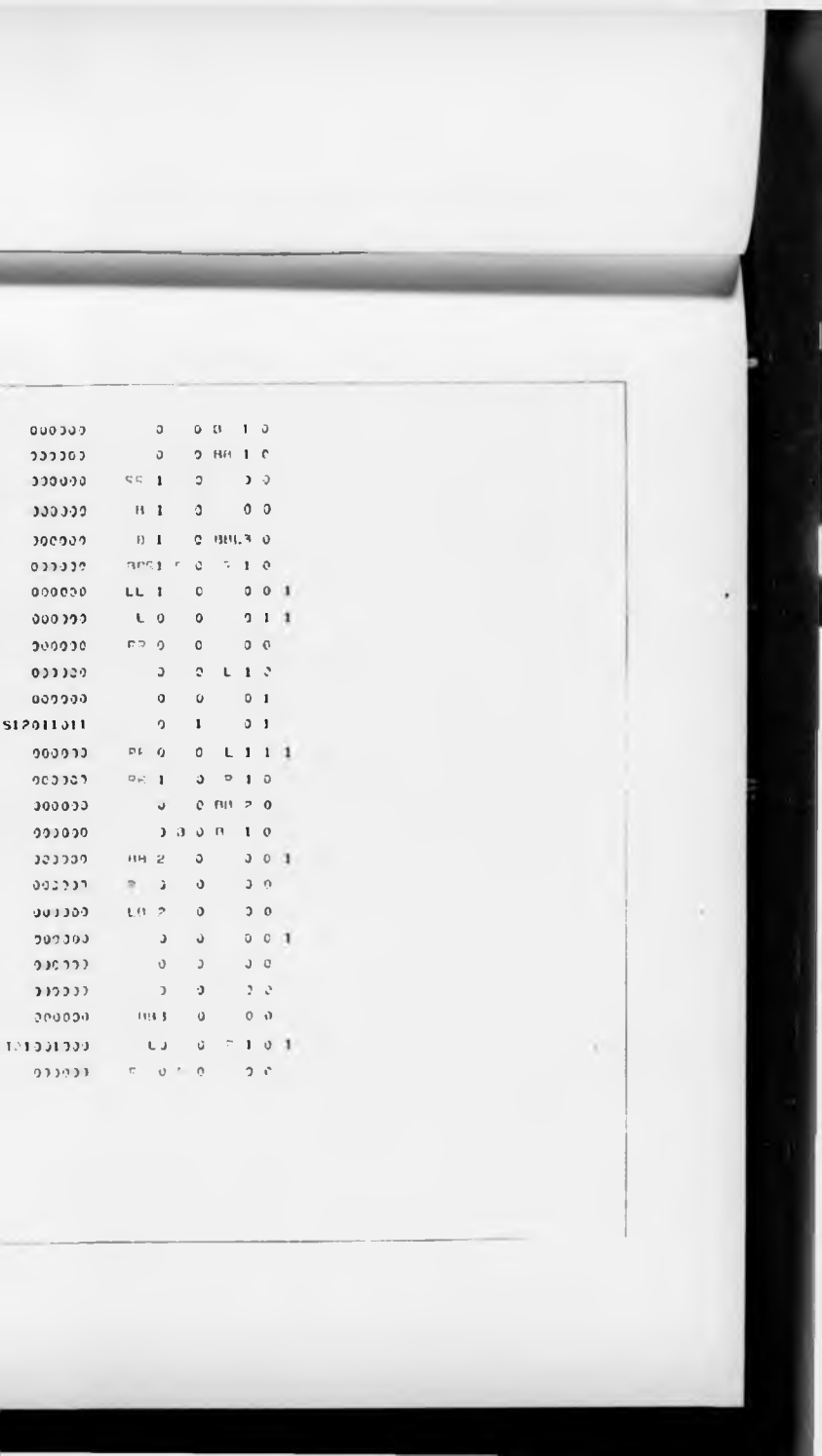
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000





150349	2	5	19	9956	A	0	4309	4811				A	2	2	6	1
150378	22	4	18	13322	A	0	4306	44	5		12	A	2	2	2	1
150122	4	10	9	12265	A	0	4610	50	4	3	9	A	2	2	6	1
152580	18	4	5	12903	A	0	3510	47	1	11	92	A	2	2	8	1
153090	13	4	18	12439	A	0	3507	45	1	9	278	A	2	2	4	1
154517	20	9	5	10098	A	0	2209	41	5	18	374	A	2	2	4	1
156777	21	9	20	10365	A	0	4801	43	8	1	47	A	2	2	2	1
156945	1	12	8	10155	A	0	4710	5312		6	54	A	2	2	2	1
157795	17	3	8	13248	A	0	2603	62	1	25	884	A	2	2	7	1
159245	4	1	1	13448	A	0	1404	66	1	51	136	A	2	2	6	1
159319	28	3	3	13398	A	0	2403	6110		37	96	A	2	2	4	1
200126	15	7	10	12137	A	0	2603	6611		20	246	A	2	2	7	2
250143	25	2	11	12149	A	0	2705	62	5	35	605	A	2	2	8	1
250909	8	11	9	12273	A	0	2706	4810		21	107	A	2	2	9	1
251659	12	1	13	12336	A	0	5211	58	4	5	3	A	2	2	4	1
300050	17	3	5	13131	A	0	1501	6611		45	1158	T	2	2	0	1
300130	19	8	10	10385	A	0	3405	6611		31	768	T	2	2	3	1
300209	23	6	18	11142	A	0	3512	6611		30	1169	T	2	2	8	1
300212	18	7	12	13202	A	0	5405	6611		12	43	T	2	2	8	1
300226	26	2	99	10037	A	0	3508	6611		30	116	T	2	2	2	1
300245	30	4	14	13437	A	0	3308	6611		31	1653	T	2	2	7	1
300340	18	5	8	13074	A	0	4204	6611		24	275	T	2	2	7	1
300382	8	9	14	12396	A	0	4208	6611		24	64	T	2	2	6	1
300530	10	1	2	12614	A	0	3712	6611		28	62	T	2	2	0	1
300522	18	4	8	13464	A	0	2808	6611		31	158	T	2	2	4	1

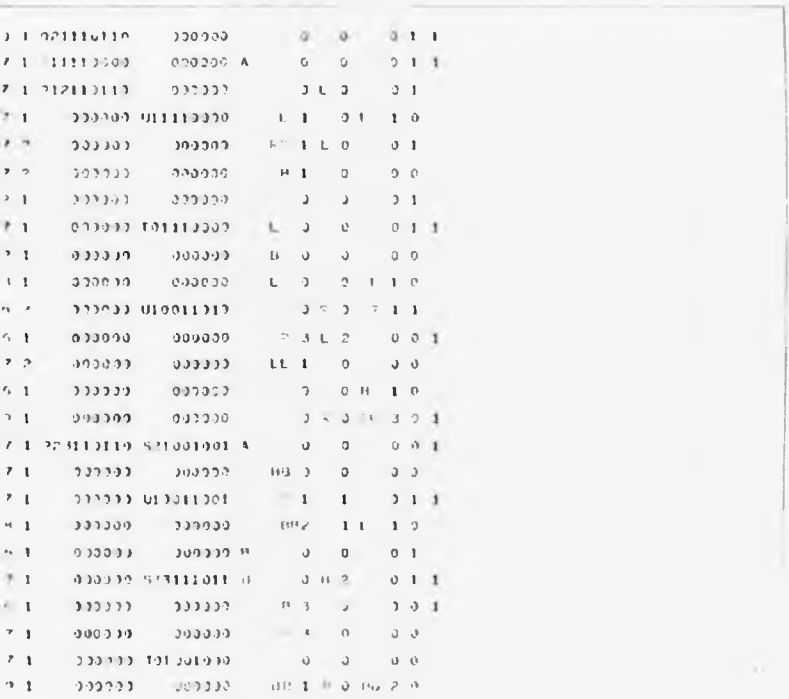
210

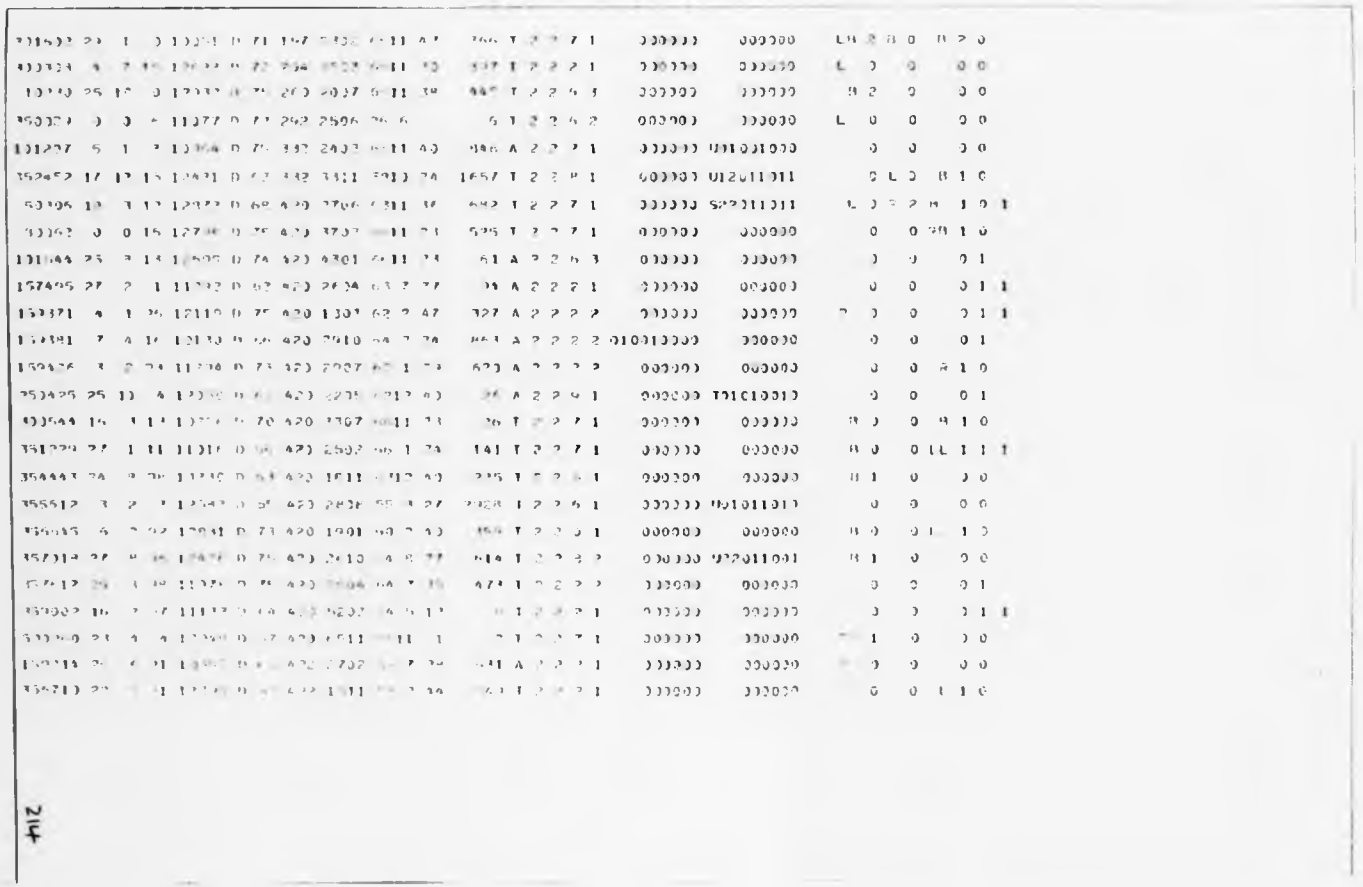


300555	23	11	13	12751	A	0	3606	6611	32	272	T	2	2	1	1	000000
300621	6	11	14	12363	A	0	3606	6611	30	591	T	2	2	5	1	000000
300704	2	4	7	12317	A	0	2702	6611	12	252	T	2	2	6	1	000000
300840	5	7	15	12244	A	0	3704	6611	24	245	T	2	2	7	1	000000
300842	31	10	4	10470	A	0	3201	6611	34	83	T	2	2	6	1	000000
300873	26	1	20	10232	A	0	2008	6611	4[illegible]	143	T	2	2	6	1	000000
301108	3	1	16	11193	A	0	3703	6611	26	463	T	2	2	6	1	000000
301163	22	1	18	12947	A	0	4411	6611	12	541	T	2	2	7	1	000000
301425	17	11	18	12210	A	0	3634	6611	26	309	T	2	2	8	1	000000
301497	6	1	14	10914	A	0	4501	6611	17	166	T	2	2	7	1	000000
301590	10	8	13	12476	A	0	3611	6611	24	1050	T	2	2	7	1	000000
301620	22	12	14	11309	A	0	4212	6611	23	136	T	2	2	8	1	000000
301737	18	4	13	11232	A	0	3416	6611	30	104	T	2	2	6	1	001000010
301748	5	11	13	11170	A	0	3404	6611	26	3[illegible]	T	2	2	[illegible]	1	000000
301796	12	2	18	13215	A	0	3607	6611	33	654	T	2	2	5	1	000000
301831	12	11	14	[illegible]	A	[illegible]	2004	6611	37	1165	T	2	2	5	1	000000
301863	20	12	10	10323	A	[illegible]	3703	6611	[illegible]	1327	T	2	2	5	3	000000
301912	10	7	14	12236	A	0	4206	6611	23	184	T	2	2	7	1	000000
301973	9	12	11	10277	A	0	2205	6611	30	957	T	2	2	7	1	000000
302015	21	5	15	11250	A	0	4204	6611	24	[illegible]	T	2	2	4	1	001010010
302116	21	12	10	10371	A	0	3701	6611	23	242	T	2	2	7	1	001010000
302113	29	7	10	12444	A	0	2205	6611	38	1590	T	2	2	7	1	001010010
302114	24	2	16	13234	A	0	4206	6611	24	[illegible]	T	2	2	3	2	001011000
302173	10	12	13	12140	A	[illegible]	3404	6611	24	1296	T	2	2	7	1	000000
350231	3	2	15	12661	A	[illegible]	4231	[illegible]	[illegible]	151	T	2	2	1	1	000000

```
2 2 3 1    000000    000000    R  0   0     0 0
2 2 8 1    000000    000000      R 1   0 BL 2 1
2 2 4 1    000000 T100110110       0   0     0 0
2 2 7 1    000000    000000        0   0     0 1 1
2 2 4 1 0010010000   000000        0   0 LL  1 0
2 2 2 1    000000    000000    LL 2 L 0       0 0
2 2 4 1 0010100100   000000        0   0     0 0
2 2 7 1    000000    000000    R 0   0       0 0 1
2 2 8 1    000000 0011001001       0   0     0 0
2 2 6 2    000000 0110001001   R LI      0   0 0 1
2 2 2 1    000000    000000    R 1   0       0 0
2 2 6 1    000000    000000    L   0   0     0 0
2 2 2 1    000000    000000        0 R 0     0 0
2 2 7 2    000000 0011001001       0   0     0 0
2 2 4 1    000000    000000        0   0     0 1
2 2 7 2    000000    000000    LR  1   0     0 0
2 2 2 1    000000    000000        0   0 BR  1 0
2 2 2 2    000000    000000        0   0 R   1 0
2 2 2 1    000000    000000    L   0   0     0 0
2 2 7 1    000000    000000      R 0   0     0 0
2 2 7 1 0010010000   000000        0   0     0 0 1
2 2 6 1    000000    000000        0   0     0 1
2 2 8 2    000000    000000    R   0   0     0 0
2 2 9 1    000000    000000      R 0   0     0 1 1
2 2 7 1    000000 T110110000       0   0     0 1 1
```

350497	14	1	3	13212	A	2		2704	41	8	8		67	T	
351183	23	1	47	17073	A	2		2034	64	6	24		264	T	
351241	12	11	17	12204	A	0		3608	64	9	24		135	T	
351681	3	0	17	12860	A	0		3606	4711	13			85	T	
353220	6	6	21	13110	A	2		2004	37	3	3		510	T	
353836	21	12	11	10353	A	3		2837	64	9	13		140	T	
354954	0	0	13	10815	A	0		3004	4310	1			44	T	
354962	3	0	23	13749	A	0		2006	47	5	9		228	T	
355351	13	2	13	17330	A	0		3703	65	1	13		455	T	
355448	19	4	24	11284	A	2		1106	63	4	52		537	T	
356269	9	10	26	13975	A	0		3511	64	7	24		520	T	
356726	18	4	7	12564	A	0		2808	64	7	22		365	T	
357588	24	11	36	12645	A	0		1710	64	7	34		277	T	
357627	6	5	18	12713	A	2		4705	64	6	15		311	T	
433379	13	9	23	10063	A	0		3802	4611	27			209	T	
433556	15	5	33	12281	A	0		2229	4611	44			29	T	
433396	13	0	16	13115	A	0		2805	4611	10			634	T	
450445	11	7	26	12447	A	0		2001	64	3	10		367	T	
452756	10	8	16	11730	A	0		3801	4711	13			208	T	
503171	5	1	19	13315	A	0		4511	4611	1			2	T	
653677	33	7	65	9226	A	2		4704	4812	1			13	T	
700543	16	3	7	12130	A	0		5408	4611	13			71	T	
751126	15	5	15	11132	A	0		5405	58	9	4		9	T	
	21	9	0	13	13218	D	44	002	2905	73	3	4		256	A
155337	16	8	21	11459	D	47	333	4206	65	8	13		57	A	





450311	31	12	91	13761	D	69	422	2307	63	1	39	1235	T	2	2	2	1
550293	28	6	82	13050	D	63	423	2105	62	0	41	193	T	2	2	2	1
352825	3	3	93	13148	D	64	433	2439	4011	5		441	T	2	2	2	1
355541	14	5	95	12151	D	56	433	1806	61	5	44	646	T	2	2	2	1
353546	27	1	98	11274	D	67	433	1406	6311	45		1479	T	2	2	6	1
43233	3	2	0	12266	D	53	434	2508	53	1	17	96	T	2	2	0	1
157923	13	7	5	13393	D	47	434	2706	47	1	19	393	A	2	2	9	1
158160	14	8	91	11269	D	65	434	1904	56	3	37	819	A	2	2	7	1
356189	1	4	0	11139	D	56	434	1510	5511	40		797	T	2	2	3	1
352533	23	2	3	13416	D	69	442	2002	61	7	43	692	T	2	2	7	1
355153	11	2	13	11183	D	74	442	4605	58	9	12	128	T	2	2	7	1
450136	4	4	97	12110	D	64	447	1805	55	6	27	187	T	2	2	0	1
50220	3	3	94	12052	D	67	450	2512	62	4	32	394	T	2	2	7	1
203356	4	7	13	13038	D	68	452	4207	6611	24		140	A	2	2	8	1
157443	11	5	10	12147	D	65	461	2911	46	3	16	310	A	2	2	6	1
154040	12	1	93	12011	D	71	517	4303	51	2	7	18	A	2	2	6	1
80243	12	5	20	12058	D	75	523	4408	6611	21		531	T	2	2	0	1
201476	33	5	4	13956	D	64	523	2306	6611	42		2336	T	2	2	7	1
153593	35	1	91	12093	D	62	525	1205	57	8	45	2493	A	2	2	2	1
203140	12	10	5	11334	D	68	525	2404	6611	42		239	T	2	2	6	1
253011	27	3	0	10154	D	71	527	4703	43	4	1		T	2	2	6	1
355368	33	11	95	12474	D	61	543	1703	6112	43		517	T	2	2	7	1
152068	26	5	94	10132	D	64	581	1205	62	5	50	1402	T	2	2	2	2
354014	1	12	95	10026	D	58	581	1206	56	5	36	5148	T	2	2	8	2
158025	24	8	96	12458	D	69	602	2208	61	0	41	113	A	2	2	4	2

```
000000     000000        0   0     0 1
000000 U720111011     B 1   0     0 0
000000     000000     =  0   0     0 0 1
```

355704	27	6	35	11437	D	73	723	2305	44	4	32		137	T	2	2	6	2					
353273	0	0	43	12431	D	68	812	1726	13	4				T	2	2	2	2					
331256	2	11	7	12745	D	74	929	2605	6611	38			42	T	2	2	2	1					

COHORT "B"

Reader 3

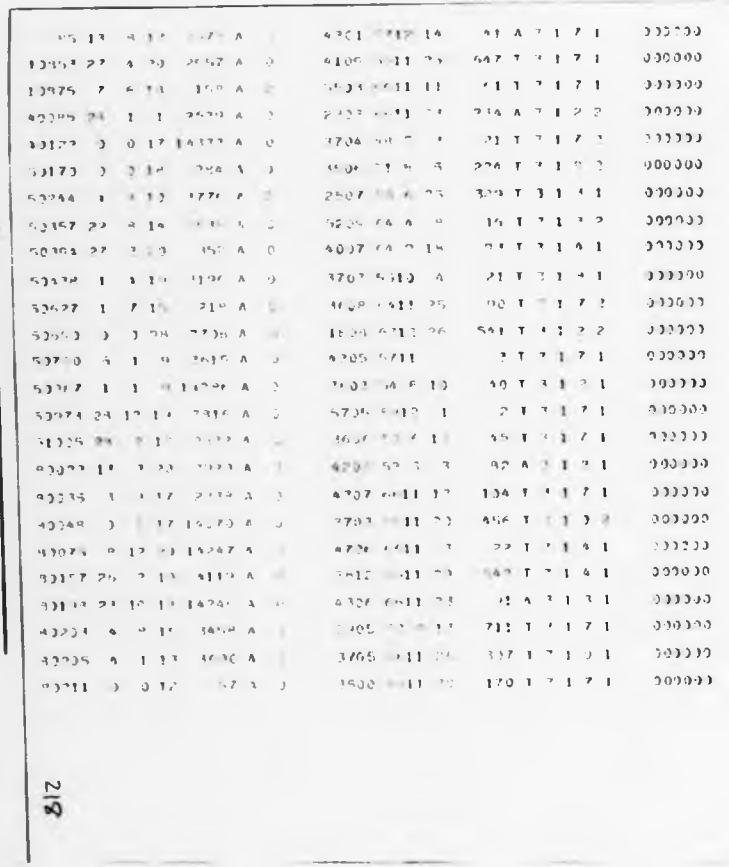
"Normals"

pp. 218 - 236

"Less-than-normals"

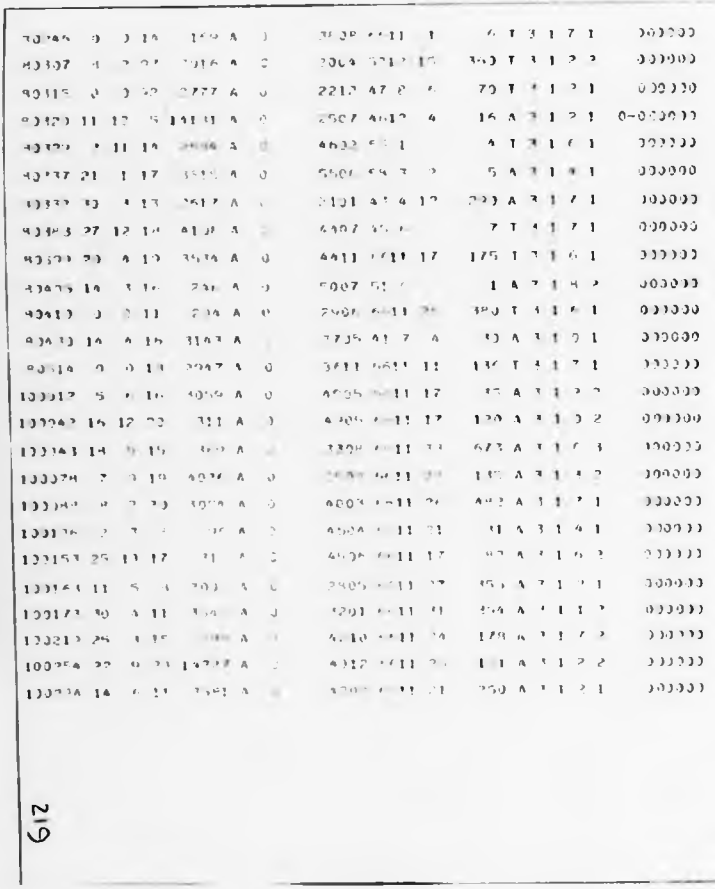
pp. 237 - 248

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0



818

0	0	0	0	000000
1	0	0	0	100000
0	0	0	0	010000
1	0	0	0	110000
0	0	0	0	001000
0	0	0	0	101000
0	0	0	0	011000
1	0	0	0	111000
0	0	0	0	000100
0	0	0	0	100100
0	0	0	0	010100
0	0	0	0	110100
0	0	0	0	001100
0	0	0	0	101100
0	0	0	0	011100
0	0	0	0	111100
0	0	0	0	000010
0	0	0	0	100010
0	0	0	0	010010
0	0	0	0	110010
0	0	0	0	001010
0	0	0	0	101010
0	0	0	0	011010
0	0	0	0	111010
0	0	0	0	000110
0	0	0	0	100110
0	0	0	0	010110
0	0	0	0	110110
0	0	0	0	001110
0	0	0	0	101110
0	0	0	0	011110
0	0	0	0	111110



153576	18	4	19	14471	A	0			3500	45	9	10		26	A	7	1	2	3
150602	9	12	11	14173	A	0			4208	4312		1		15	A	3	1	5	2
150819	11	9	11	3447	A	0			5304	54	4	5		4	A	7	1	7	2
150843	12	10	13	3335	A	0			4208	44	8	1		14	A	3	1	4	1
151145	26	4	17	3312	A	0			4236	4411		7		251	A	7	1	7	1
151193	2	10	13	206	A	0			2009	57	7	27		740	A	3	1	6	1
151221	1	6	10	517	A	0			4808	50	4	11		27	A	3	1	4	2
151288	29	9	13	3357	A	0			4708	4713					A	3	1	7	1
151315	28	5	13	41	A	0			3703	38	7	1		3	A	3	1	7	3
151615	17	9	16	14200	A	0			2611	44	5	7		42	A	3	1	7	2
151635	14	9	13	14232	A	0			4807	39	7	1		13	A	7	1	8	1
151642	30	6	4	3223	A	0			2009	44	9	27		543	A	3	1	2	1
151837	24	7	2	336	A	0			4305	42	8	9		595	A	7	1	3	1
151935	15	4	18	14553	A	0			4505	4611				2	A	7	1	0	1
151965	10	9	17	14560	A	0			3702	4611		9		336	A	3	1	0	1
152066	3	2	9	3319	A	0			2702	47	6	20		81	A	7	1	8	1
152165	12	8	14	2872	A	0			3707	38	2			43	A	3	1	4	1
152223	28	7	23	2661	A	0			3611	41	2	24		96	A	3	1	3	1
152264	21	7	14	3212	A	0			3404	50	5	15		282	A	3	1	6	1
152468	4	5	11	3504	A	0			3506	46	3	10		69	A	7	1	7	1
152535	30	11	9	2370	A	0			3604	38	8	2		38	A	3	1	2	2
152643	25	12	18	2628	A	0			4305	47	8				A	7	1	0	1
152704	1	2	13	3335	A	0			2032	41	2	4		244	A	7	1	7	1
152978	5	3	23	14408	A	0			3610	50	9	14		472	A	7	1	7	1
153387	19	1	19	3736	A	0			5101	5712		6		74	A	3	1	4	1

```
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
0 0    0    0        000000    000000
```

153133	13	4	11	3195	A	0	3702	39	1		54	A	3	1	7	1
153196	22	3	4	2647	A	0	4710	50	1	2	5	A	3	1	2	1
153375	23	8	16	214	A	0	3405	51	9	8	122	A	3	1	2	1
153436	11	7	20	3844	A	0	4610	51	6	4	77	A	3	1	7	1
153467	30	1	18	2964	A	0	4702	59	12	1	12	A	3	1	7	1
153477	25	3	14	3431	A	0	4711	59	11	3	6	A	3	1	9	1
153490	26	1	10	14272	A	0	3608	40	2	3	121	A	3	1	7	1
153688	27	5	12	3944	A	0	4009	46	9	6	14	A	3	1	0	1
153948	2	13	19	3468	A	0	3905	63	2	10	136	A	3	1	7	1
154060	23	2	16	3123	A	0	4208	46	2	1	10	A	3	1	7	1
154093	26	10	5	127	A	0	3301	52	11	22	453	A	3	1	7	1
154229	11	10	7	4127	A	0	2908	42	1	12	406	A	3	1	4	1
154338	4	1	14	2816	A	0	3510	36	7		45	A	3	1	7	1
154351	25	1	17	3102	A	0	4802	50	7	2	14	A	3	1	2	1
154379	14	5	13	482	A	0	4710	49	6	1	12	A	3	1	7	1
154421	15	5	13	3103	A	0	5007	51	5		1	A	3	1	0	1
154427	25	11	15	14305	A	0	4110	43	6	1	4	A	3	1	2	1
154429	9	12	18	14457	A	0	3611	47	2	10	154	A	3	1	8	1
154554	24	10	13	3642	A	0	3502	47	5	12	37	A	3	1	0	1
155060	12	7	10	2686	A	0	5105	51	7			A	3	1	6	1
155162	15	7	12	3012	A	0	4724	42	9	1	1	A	3	1	4	1
155236	2	3	16	2720	A	0	4610	47	5		1	A	3	1	7	1
155259	25	4	8	3453	A	0	4808	65	2	16	19	A	3	1	7	2
155277	17	9	12	25	A	0	4907	59	12	10	20	A	3	1	4	3
155351	21	3	15	2757	A	0	4011	46	11	6	18	A	3	1	2	1

153133	11	4	11	[illegible]	A	0	4702	30	1		54	A	3	1	7	1	000000
153196	23	3	4	2467	A	0	4712	53	1	2	5	A	7	1	2	1	000000
153275	21	8	16	214	A	0	3405	51	9	4	120	A	7	1	2	1	000000
153476	11	7	20	[illegible]	A	0	3613	41	6	4	77	A	7	1	7	1	000000
153467	10	1	14	2064	A	0	4727	1312		1	13	A	3	1	7	1	000000
153477	25	3	14	3411	A	0	4721	5311		[illegible]	6	A	3	1	9	1	100000
153490	26	1	10	14272	A	0	7604	40	7	3	121	A	3	1	7	1	000000
153683	27	5	12	3066	A	0	4000	[illegible]	[illegible]	[illegible]	14	A	3	1	[illegible]	1	000000
153789	2	10	10	3668	A	0	3692	53	2	10	136	A	3	1	7	1	000000
154060	21	7	16	3121	A	0	4204	46	2	1	10	A	7	1	7	1	000000
154091	26	10	5	127	A	0	3791	5211		22	451	A	3	1	7	1	000000
154222	11	10	7	4127	A	0	2008	42	1	17	406	A	7	1	4	1	000000
154308	4	1	14	2217	A	[illegible]	3510	34	7		46	A	3	1	7	1	000000
154351	25	1	17	3137	A	0	4702	[illegible]	7	2	14	A	3	1	2	1	000000
154379	14	5	13	[illegible]	A	0	4710	[illegible]	6	1	12	A	7	1	7	1	000000
154421	15	5	13	2103	A	0	5067	51	5		1	A	3	1	0	1	000000
154427	25	11	15	14105	A	0	4110	45	6	1	4	A	3	1	7	1	000000
154529	9	12	18	14437	A	0	3611	47	[illegible]	10	154	A	7	1	4	1	000000
154554	24	10	13	3602	A	0	3502	47	5	12	37	A	3	1	0	1	000000
155060	13	2	10	[illegible]	A	[illegible]	5122	51	7			A	3	1	6	1	000000
155162	15	7	13	3012	A	0	4776	[illegible]	9	1	1	A	3	1	6	1	000000
155186	2	3	16	2720	A	0	4410	37	5		1	A	1	1	7	1	000000
155263	25	4	[illegible]	[illegible]	A	0	[illegible]	[illegible]	2	14	10	A	4	1	7	1	000000
155277	17	2	12	[illegible]	A	0	[illegible]	[illegible]	22		20	A	7	1	4	1	000000
155351	21	3	13	2757	A	0	4311	[illegible]	[illegible]		15	A	7	1	2	1	000000

250321	10	4	20	7	A	0	4501	45	9		2	A	3	1
250359	19	7	20	3747	A	0	4310	47	7	3	31	A	3	1
250476	3	9	3	14261	A	0	3603	47	4	10	6	A	3	1
250489	20	6	20	14571	A	0	3609	46	9	10	242	A	3	1
250610	23	12	16	33	A	0	4301	43	3		1	A	3	1
250719	11	4	19	2692	A	0	4303	43	6		1	A	3	1
250795	17	4	17	14425	A	0	4106	42	5		7	A	3	1
250800	20	6	19	54	A	0	4601	50	5	4	20	A	3	1
250919	30	12	20	3494	A	0	2707	45	8	8	9	A	3	1
250966	25	1	20	4049	A	0	3705	45	9	8	135	A	3	1
251010	14	2	13	2924	A	0	4705	47	8			A	3	1
251029	10	8	19	4074	A	0	4208	44	4	1	13	A	3	1
251105	20	4	17	512	A	0	5501	6610		11	59	A	3	1
251195	4	9	14	14471	A	0	3611	45	4	8	140	A	3	1
251261	15	10	11	3940	A	0	4209	44	6	1	12	A	3	1
251364	16	12	2	66	A	0	3705	39	4		2	A	3	1
251633	11	2	15	3645	A	0	4309	46	3	2	29	A	3	1
251778	2	1	8	2993	A	0	3612	4411		10	50	A	3	1
251789	29	2	16	3967	A	0	4106	43	3	1	17	A	3	1
251830	27	2	6	4329	A	0	4409	4411			3	A	3	1
251937	28	4	17	134	A	0	3401	33	7	5	22	A	3	1
252036	18	5	14	3209	A	0	4405	51	9	7	4	A	3	1
252061	2	2	6	3011	A	0	2605	35	9	9	54	A	3	1
300177	8	7	16	359	A	0	3703	6511		25	357	T	3	1
300317	21	6	14	2697	A	0	3405	3611		25	774	T	3	1

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0		000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

300342	5	1	12	2786	A	0	3606	6611	23	443	T	3	1	4	1
300367	22	7	19	14370	A	0	3702	6611	23	366	T	3	1	3	1
300426	3	2	3	14246	A	0	1729	6611	43	32	T	3	1	7	1
300470	6	4	15	2845	A	0	3710	6611	26	64	T	3	1	7	1
300560	4	6	20	296	A	0	4307	6611	23	656	T	3	1	0	2
300723	9	3	14	3620	A	0	3703	6611	28	960	T	3	1	7	1
300760	12	11	15	3274	A	0	3907	6611	27	627	T	3	1	7	1
300733	16	3	19	3939	A	0	3703	6611	25	94	T	3	1	4	1
300883	13	5	13	389	A	0	3710	6611	29	202	T	3	1	6	1
300918	19	11	14	3218	A	0	4509	6611	29	155	T	3	1	8	1
300945	25	9	16	393	A	0	4505	6611	21	422	T	3	1	9	1
301107	20	11	20	3340	A	0	4212	6611	23	244	T	3	1	7	1
301136	13	5	3	14415	A	0	2612	6611	30	770	T	3	1	1	1
301227	6	5	17	3835	A	0	4704	6611	19	40	T	3	1	7	1
301261	19	11	9	3834	A	0	2907	6611	23	241	T	3	1	7	1
301273	27	9	19	3217	A	0	4306	6611	23	189	T	3	1	7	1
301272	29	10	19	2655	A	0	3807	6611	27	282	T	3	1	0	1
301343	12	1	15	442	A	0	3608	6611	33	600	T	3	1	7	1
301451	22	1	14	34	A	0	5312	6611	17	169	T	3	1	6	1
301473	9	12	3	3316	A	0	2707	6611	38	473	T	3	1	7	1
301576	15	2	14	2403	A	0	2812	6611	36	415	T	3	1	7	1
301579	11	9	15	3452	A	0	3703	6611	24	246	T	3	1	0	1
301638	21	5	20	3631	A	0	3710	6611	23	430	T	3	1	5	1
301671	10	9	10	14391	A	0	2905	6611	29	136	T	3	1	0	1
301697	13	7	19	2713	A	0	3512	6611	33	126	T	3	1	7	1

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

301721	18	10	19	14169	A	0	5506	6611	11	5	T	3	1	2	1
301723	23	5	10	2033	A	0	3606	6611	20	253	T	3	1	1	1
301864	10	9	7	3076	A	0	4311	6611	21	469	T	3	1	0	1
301880	6	3	16	14446	A	0	3703	6611	22	16	T	3	1	7	1
301997	16	12	7	3710	A	0	2509	6611	37	2341	T	3	1	4	1
302034	15	6	6	149	A	0	2504	6611	30	219	T	3	1	8	1
302131	23	9	8	3449	A	0	3904	6611	27	96	T	3	1	7	1
302132	5	8	20	3006	A	0	4001	6611	23	137	T	3	1	7	1
302178	2	3	17	14481	A	0	5501	6611	11	5	T	3	1	0	1
302202	10	11	4	3278	A	0	3609	6611	30	304	T	3	1	2	1
302240	16	2	20	14308	A	0	3611	6611	30	136	T	3	1	7	1
302296	9	8	15	14508	A	0	4207	6611	24	92	T	3	1	6	1
302299	13	9	1	2716	A	0	2804	6611	38	156	T	3	1	0	1
350195	13	9	7	3057	A	0	4311	64	6 23	74	T	3	1	0	1
350323	3	4	36	2901	A	0	2006	64	4 29	681	T	3	1	2	1
350677	0	0	16	3288	A	0	3607	39	9 3	8	T	3	1	7	1
350842	13	12	16	3937	A	0	3610	6411	28	254	T	3	1	7	1
351212	7	5	12	3987	A	0	4508	47	8 2	15	T	3	1	6	1
351437	2	1	12	4149	A	0	3804	59	9		T	3	1	2	1
351811	0	0	14	14578	A	0	3204	4411	11	104	T	3	1	8	1
351909	4	5	15	3239	A	0	3611	64	5 24	77	T	3	1	7	1
352318	23	8	23	14234	A	0	5402	64	5 13	23	T	3	1	8	1
353722	0	0	6	14438	A	0	3803	51	2 11	46	T	3	1	8	1
353772	12	5	14	14580	A	0	3510	64	6 23	453	T	3	1	7	1
354258	1	12	9	3374	A	0	2307	58	9	2	T	3	1	6	1

354772	3	0	20	3596	A	0		3809	4810	2		5	T	3	1	4	1
354946	13	12	36	14762	A	2		4404	66	2	21	1727	T	3	1	2	2
355033	7	5	41	241	A	2		2507	54	5	24	19	T	3	1	6	1
355129	1	2	06	3419	A	0		3706	61	2	24	704	T	3	1	7	1
355144	21	6	23	350	A	0		5802	58	6		10	T	3	1	7	2
355248	3	0	13	14451	A	0		2503	47	1	14	170	T	3	1	6	1
355421	4	6	13	2752	A	0		3710	57	8	13	279	T	3	1	2	1
356003	29	8	19	3370	A	0		4006	47	3	2	68	T	3	1	6	1
356125	3	0	1	4370	A	0		2007	36	5	2	42	T	3	1	7	1
356429	11	10	15	4076	A	0		3707	49	9	6	275	T	3	1	7	1
356873	3	7	9	14442	A	0		2509	4611	11		485	T	3	1	6	1
357312	25	2	14	3124	A	0		3611	4613	8		276	T	3	1	2	1
357367	13	3	16	3035	A	0		3606	48	4	11	103	T	3	1	6	1
357375	19	9	19	3487	A	2		4813	5413	6		7	T	3	1	4	1
357469	4	7	45	45	A	0		4404	4710	2		20	T	3	1	2	2
358508	11	3	01	14537	A	0		3609	59	8	32	743	T	3	1	2	1
358709	8	3	04	3822	A	0		2004	62	3	35	1335	T	3	1	2	1
400311	30	5	11	353	A	2		3912	4611	26		824	T	3	1	7	2
400706	22	3	16	3120	A	0		2908	4611	33		917	T	3	1	7	1
400722	5	5	15	4156	A	0		4901	4611	17		48	T	3	1	4	1
401447	27	5	20	14295	A	2		3710	4611	20		140	T	3	1	0	1
453367	20	5	01	310	A	2		2008	4113	41		331	T	3	1	6	2
453353	2	3	16	3368	A	0		5103	52	8			T	3	1	6	1
500335	23	2	15	3145	A	0		5511	4611	1		6	T	3	1	4	1
500314	8	4	20	2417	A	3		4611	4611	1		2	T	3	1	7	1

629

0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
1 0 0	0	0	000000	000000
0 0	0	0	000000	000000
1 0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000

600020	28	6	19	744	A	0		5406	6611	12		86	T	3	1	6	2
600048	14	1	13	2457	A	0		4609	6611	20		217	T	3	1	0	1
600117	17	6	20	4760	A	2		4610	6611	21		314	T	3	1	7	1
650202	6	5	19	3835	A	0		4603	47	5		2	T	3	1	7	1
650220	10	4	10	3444	A	0		4701	47	3		1	T	3	1	0	1
650333	31	5	20	14127	A	0		4609	4610				T	3	1	2	1
650464	5	6	19	14231	A	0		4610	4611			4	T	3	1	3	1
650534	27	11	20	4143	A	0		4607	4610				T	3	1	7	1
650671	28	2	14	14512	A	0		4605	47	5		35	T	3	1	0	1
700160	31	8	15	133	A	0		5704	6611	3		19	T	3	1	0	1
750090	15	6	18	3635	A	0		5602	62	6	6	3	T	3	1	5	2
750280	26	7	20	14518	A	0		5411	5412				T	3	1	4	1
752234	31	5	17	3534	A	0		5404	56	1			T	3	1	7	1
900055	21	7	19	1741	A	2		4704	6611	13		157	T	3	1	7	1
900065	9	11	19	14575	A	0		4303	5611	3		49	T	3	1	7	1
900097	29	10	1	14371	A	0		4002	6611	26		533	T	3	1	2	2
900119	25	12	15	3736	A	0		4005	6611	21		537	T	3	1	6	1
154097	29	5	13	3858	D	72		4604	4611			3	A	3	1	0	1
153705	6	3	1	4103	D	67		2508	52	3	18	75	A	3	1	7	1
251597	3	4	1	14436	D	56		3611	77	9			A	3	1	3	1
155390	24	3	13	4332	D	52	302	2905	53	7	20	496	A	3	1	3	1
453397	24	3	5	14123	D	67	302	2905	47	3	20	997	T	3	1	4	2
354521	18	1	19	14129	D	62	314	4503	6111	16		141	T	3	1	7	1
53331	22	11	4	14329	D	71	151	2507	52	3	7	73	T	3	1	6	1
80146	3	3	12	14136	D	69	151	2805	53	7	15	573	T	3	1	6	1

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

150057	31	3	13	14478	D	65	151	5608	57	12	1	2	A	3	1	6	1
155730	6	3	12	275	D	60	151	2907	57	9	23	1348	A	3	1	7	2
40131	0	0	6	2854	D	66	153	2909	43	9	4	80	T	3	1	6	1
157483	9	5	99	76	D	60	153	2805	43	11	15	92	A	3	1	5	1
358216	6	4	9	3125	D	71	157	4410	54	11	9	19	T	3	1	0	1
154321	7	6	2	14253	D	65	154	2508	46	10	19	40	A	3	1	0	2
154326	2	1	14	2935	D	69	154	4905	49	11		13	A	3	1	4	1
153733	3	4	2	3119	D	67	157	2910	42	3	12	37	A	3	1	7	1
251508	26	1	20	2946	D	72	157	3602	44	12	9	194	A	3	1	8	1
152047	12	3	12	2622	D	71	158	4302	48	9	5	16	A	3	1	7	1
45	24	5	99	2642	D	66	162	2403	60	11	36	658	A	3	1	8	1
10158	24	9	8	4161	D	71	162	2306	66	11	40	469	T	3	1	7	3
50727	0	0	7	2707	D	70	162	2903	47	6	10	343	T	3	1	6	1
150922	29	11	13	4306	D	65	162	5207	59	7	6	29	A	3	1	4	1
151922	22	3	9	3841	D	56	162	3509	46	8	10	424	A	3	1	4	2
250292	4	11	36	14303	D	60	162	4703	52	8	5	90	A	3	1	6	1
356728	25	10	7	3309	D	72	162	2409	47	1	14	104	T	3	1	2	1
850011	21	4	18	3044	D	64	162	5803	64	12	6	27	T	3	1	7	1
157862	9	11	4	3100	D	67	163	2704	47	7	22	671	A	3	1	7	1
352439	14	2	41	2083	D	72	177	3612	50	2	21	102	T	3	1	6	1
356146	0	0	35	228	D	51	177	1812	23	7	1	10	T	3	1	7	2
80289	16	6	0	2734	D	66	181	1509	48	4	11	136	T	3	1	7	1
351681	0	0	31	2226	D	47	190	1905	47	7	20	2256	T	3	1	9	1
250041	30	5	2	14244	D	60	196	4206	43	5		7	A	3	1	2	1
153072	3	12	13	14274	D	55	197	5206	55	4	2	1	A	3	1	7	1

	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000

101670	30	10	9	2746	D	74	200	3003	6611		20	42	A	3	1	7	2
158475	30	12	12	26	D	68	200	3603	38	6	2	7	A	3	1	7	1
159460	3	11	99	4044	D	67	204	2402	6012		36	369	A	3	1	0	1
450310	11	12	13	353	D	66	204	3710	55	9	23	564	T	3	1	7	1
158454	6	6	7	14174	D	64	260	4905	4912			8	A	3	1	0	1
353429	0	0	95	3650	D	49	322	2803	4611		18	321	T	3	1	9	1
155083	19	12	15	295	D	60	320	3302	60	7	27	732	A	3	1	8	2
10190	22	4	18	14198	D	72	331	3906	6611		26	699	T	3	1	6	2
250540	24	5	19	4052	D	63	371	5005	5512		5	11	A	3	1	6	1
352704	1	8	91	374	D	74	321	2206	59	9	36	616	T	3	1	2	2
352807	23	5	7	3649	D	66	321	3607	6510		22	1701	T	3	1	2	2
353456	19	10	97	14348	D	65	231	2509	6311		36	370	T	3	1	0	2
102	23	4	12	50	D	66	332	3703	48	2	10	222	A	3	1	7	1
155708	2	10	10	14486	D	70	332	3705	66	4	28	506	A	3	1	4	2
155790	20	9	8	341	D	42	332	3411	42	4	7	5	A	3	1	9	1
156659	23	4	34	2820	D	70	332	2511	41	2	12	778	A	3	1	7	1
158032	9	5	95	3022	D	55	332	1904	4210		23	197	A	3	1	2	1
159328	7	1	98	3742	D	72	332	1903	67	2	43	149	A	3	1	2	1
159341	16	7	2	3180	D	61	334	2511	63	5	35	196	A	3	1	4	1
950136	10	11	19	4019	D	71	334	5009	62	1	11	26	T	3	1	7	1
101017	4	12	17	14564	D	73	414	3408	6611		24	414	A	3	1	9	2
251635	5	6	15	3635	D	64	416	3705	3511		3	34	A	3	1	7	1
103	3	11	19	170	D	65	420	3909	47	4	7	215	A	3	1	6	1
206	21	5	17	14357	D	68	420	3411	64	6	31	656	A	3	1	7	1
10534	22	2	19	2799	D	67	420	3608	6611		19	449	T	3	1	7	1

232

```
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
1 0 0   0   0     000000   000000
  0 0   0   0     000000   000000
1 0 0   0   0     000000   000000
  0 0   0   0     000000   000000
1 0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
1 0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000   000000
  0 0   0   0     000000-0 000000-
  0 0   0   0     000000   000000
1 0 0   0   0     000000   000000
  0 0   0   0     000000   000000
```

40063	24	0	92	14448	D	67	420	2111	47	8	6	42	A	3	1	7	1
50144	14	3	8	14509	D	65	420	2611	56	12	11	577	T	3	1	8	1
50523	0	0	96	2637	D	64	420	2001	63	12	16	197	T	[illegible]	1	7	1
50630	20	10	11	14212	D	57	420	3501	46	10	3	116	T	[illegible]	1	7	1
50965	0	0	1	14093	D	57	420	2012	56	4	2	29	T	3	1	7	1
51079	0	0	0	14140	D	63	420	1904	63	11	9	47	T	3	1	2	1
80275	0	0	3	3663	D	59	420	2907	52	8	11	27	T	3	1	4	1
80277	1	1	4	[illegible]	D	66	420	[illegible]	[illegible]	11	42	319	A	3	1	[illegible]	1
80292	1	7	95	[illegible]	D	[illegible]	420	2309	59	3	11	335	A	3	1	6	[illegible]
100025	15	1	4	[illegible]	D	76	420	2904	[illegible]	11	37	1335	A	3	1	2	[illegible]
100596	15	6	9	[illegible]	D	67	420	3020	[illegible]	11	27	194	A	3	1	3	[illegible]
100617	1	1	20	[illegible]	D	73	420	4704	56	11	12	49	A	3	1	7	[illegible]
101254	17	3	15	[illegible]	D	77	420	4804	[illegible]	11	18	98	A	3	1	7	
101549	3	6	15	2912	D	[illegible]	420	3704	66	11	21	322	A	3	1	7	
101695	11	5	18	14160	D	67	420	4126	56	11	24	112	A	3	1	7	
150014	22	6	10	[illegible]	D	66	420	3710	43	2	2	5	A	3	1	[illegible]	
150579	1	9	6	[illegible]	D	76	420	2910	43	7	1	511	A	3	1	2	
151667	4	6	11	4771	D	72	420	3710	[illegible]	3	3	135	A	3	1	6	
152387	6	11	17	[illegible]	D	[illegible]	420	4509	[illegible]	5	1	2	A	3	1	4	
152577	21	6	4	14127	D	[illegible]	420	2011	[illegible]	1			A	3	1	3	
154061	20	2	14	[illegible]	D	[illegible]	420	3707	[illegible]	[illegible]	11	517	A	3	1	2	
154754	30	1	3	2741	D	[illegible]	420	3612	63	10	7	62	A	3	1	6	
155029	2	7	23	2614	D	[illegible]	420	4704	[illegible]	8	11	76	A	3	1	7	
155374	1	12	11	137	D	71	420	4407	59	12	3	7	A	3	1	0	
155917	18	7	20	[illegible]	D	[illegible]	420	3710	[illegible]	4		[illegible]	A	3	1	[illegible]	

156944	13	7	2	3614	D	75	420	3511	4512	10	138	A	3	1	6	1
157195	2	7	5	754	D	68	420	4301	40	6	6	28	A	3	1	8	1
157493	16	3	8	14325	D	62	420	2902	45	5	16	867	A	3	1	7	1
158076	19	4	17	2798	D	69	420	2203	62	8	42	136	A	3	1	2	2
158272	5	8	0	2947	D	61	420	3701	37	4			A	3	1	2	1
158413	23	9	35	2938	D	73	420	4412	45	1	4	9	A	3	1	2	1
159435	19	4	10	513	D	66	420	4503	6812	19		91	A	3	1	8	2
159468	12	11	7	4037	D	63	420	4711	61	3	12	26	A	3	1	7	2
250026	31	10	19	2647	D	64	420	4708	48	8	1	8	A	3	1	9	1
250124	23	3	8	3903	D	52	420	4106	5212	11		71	A	3	1	0	1
250253	14	5	12	4177	D	63	420	4304	5211	3		44	A	3	1	6	1
251166	31	9	17	14524	D	64	420	4703	4711			1	A	3	1	9	1
300423	9	8	13	116	D	69	420	4505	6611	20		179	T	3	1	7	1
300557	7	10	13	7235	D	70	420	3302	6611	27		885	T	3	1	8	1
301574	15	4	12	3710	D	74	420	2904	6611	25		317	T	3	1	7	1
352584	0	3	27	2300	D	65	420	2004	4211	22		148	T	3	1	2	1
356433	24	1	26	3947	D	55	420	1527	5211	43		118	T	3	1	5	1
358376	13	4	3	2634	D	69	420	4205	64	4	21	130	T	3	1	2	1
133227	8	12	15	116	D	74	422	4502	6611	21		55	A	3	1	4	2
156521	21	10	6	3733	D	50	434	2303	3610	3		218	A	3	1	7	1
100944	2	3	10	136	D	60	444	4610	6611	20		57	A	3	1	7	2
155743	10	10	12	7387	D	46	444	2509	46	4	10	335	A	3	1	2	1
155208	2	6	25	14768	D	55	446	1309	5612	42		254	A	3	1	7	1
152103	3	5	6	453	D	65	465	2904	4712	27		134	A	3	1	6	1
150471	14	1	4	4157	D	43	493	4103	4712	2		6	A	3	1	2	1

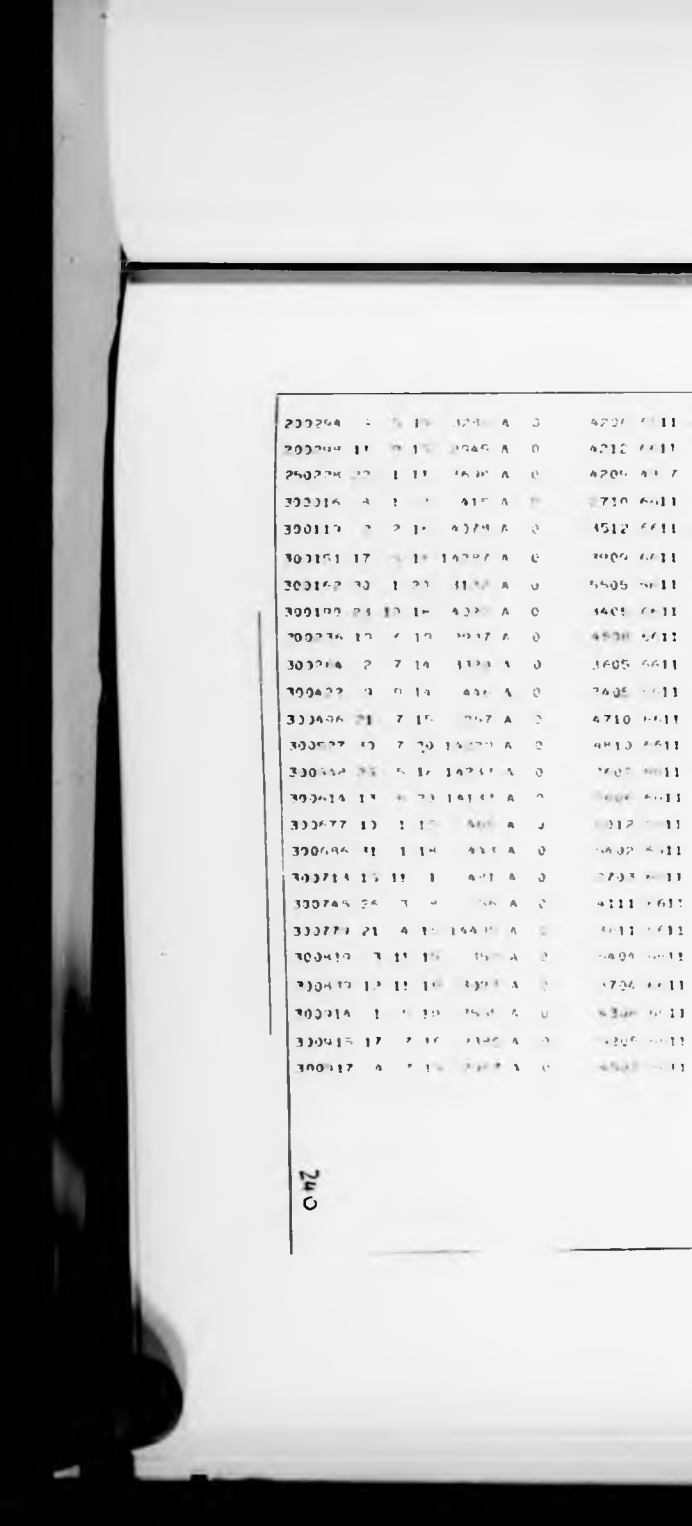
50920	16	11	10	3955	D	56	491	5406	56	3	1	3	T	3	1	7	1
950924	5	9	96	17	D	73	501	5401	60	8	6	13	T	3	1	7	2
101715	11	11	16	3856	D	67	502	3410	6611		32	546	A	3	1	6	1
152312	17	6	13	3282	D	63	502	4905	61	3	11	42	A	3	1	6	1
100569	14	9	13	2729	D	65	527	4712	6611		18	75	A	3	1	0	2
156260	24	9	18	3606	D	44	527	3503	4210		7	264	A	3	1	9	1
351852	22	3	1	2811	D	74	527	2506	64	7	39	2001	T	3	1	7	1
154623	18	2	62	14417	D	43	544	2510	4311		18	1368	A	3	1	9	1
156387	28	9	14	3962	D	40	550	4209	45	7	2	18	A	3	1	2	1
159259	13	1	12	2976	D	67	570	4301	57	2	12	28	A	3	1	8	1
40186	0	0	05	3349	D	68	581	2101	43	6	27	114	T	3	1	2	1
153653	3	6	13	274	D	61	581	4801	50	3	1	1	A	3	1	7	2
50507	0	0	3	14308	D	60	590	1704	48	3	22	297	T	3	1	7	2
157514	22	2	94	2918	D	53	590	1808	49	1	30	90	A	3	1	2	1
155318	8	3	12	3646	D	75	591	5001	5911		8	51	A	3	1	7	1
300239	10	4	13	326	D	64	592	3510	6611		30	83	T	3	1	6	2
159309	4	3	93	14153	D	72	603	4309	46	4	2	34	A	3	1	6	1
159098	14	12	16	3869	D	69	757	4209	45	9	3	8	A	3	1	7	1
358308	0	0	17	14359	D	61	757	4008	46	3	5	64	T	3	1	7	1
50782	25	1	17	247	D	48	812	4605	48	6	2	17	T	3	1	9	2
100135	14	7	9	3340	D	71	812	4106	6611		25	424	A	3	1	2	1
154430	23	5	0	3167	D	58	812	2803	31	2	2	7	A	3	1	2	1
155656	13	2	11	2636	D	63	812	4723	47	5		1	A	3	1	7	1
80230	1	1	13	2911	D	67	816	4301	6611		16	35	T	3	1	6	1
153083	26	11	2	14163	D	54	816	2206	43	8	4	174	A	3	1	7	1

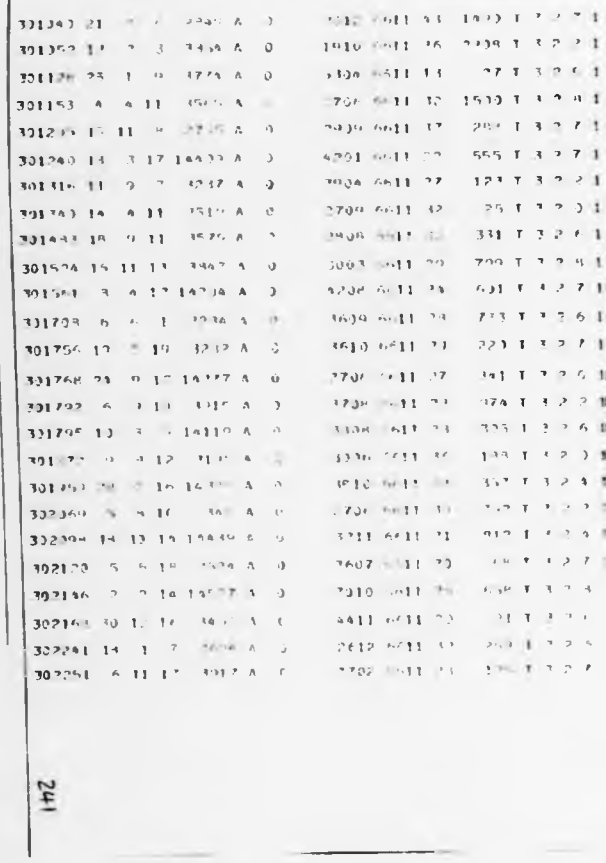
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

155281	13	8	14	2745	D	45	921	4011	45	5	4	37	A	3	1	9	1
250263	20	6	14	3036	D	63	929	5504	56	4	1	2	A	3	1	6	1
300719	18	4	14	2712	D	75	936	3611	66	11	25	623	T	3	1	3	1
357490	29	12	9	4105	D	62	974	4308	58	9	7	482	T	3	1	0	1
50766	11	4	16	156	D	60	976	4510	60	6	3	26	T	3	1	7	1
153666	2	4	20	3976	D	57	983	4805	52	7	4	37	A	3	1	7	1
158343	16	4	12	14180	D	41	997	3601	41	8	5	8	A	3	1	9	2
77	14	11	12	14538	D	41	998	3705	40	4	2	10	A	3	1	9	1
156308	9	8	15	4067	D	41	998	3607	41	7	5	72	A	3	1	9	1
50328	24	4	17	3733	L	55		5407	55	3		1	T	3	1	9	1
150210	25	1	12	3598	L	64		4912	52	4	2	4	A	3	1	9	1
152585	7	8	9	4034	L	58		4910	58	5	8	17	A	3	1	9	2
154264	5	5	17	3062	L	51		4802	51	4	1	7	A	3	1	9	1
154364	25	1	34	492	L	41		4007	41	4		1	A	3	1	9	3
155056	13	2	06	3805	L	25		2502	25	4			A	3	1	9	2
156397	27	2	13	3817	L	64		5102	51	5			A	3	1	9	1
156668	12	9	19	14714	L	70		3511	47	6	11	57	A	3	1	9	1
158154	3	9	14	3978	L	48		4709	48	3		2	A	3	1	9	1
250017	10	8	18	4025	L	49		4208	49	6	5	14	A	3	1	9	1
250322	19	10	8	2381	L	64		3501	37	1	2	4	A	3	1	9	2
250565	16	10	14	136	L	66		4206	44	8	1	2	A	3	1	9	1
250711	9	12	9	495	L	70		4105	43	8	2	18	A	3	1	9	2

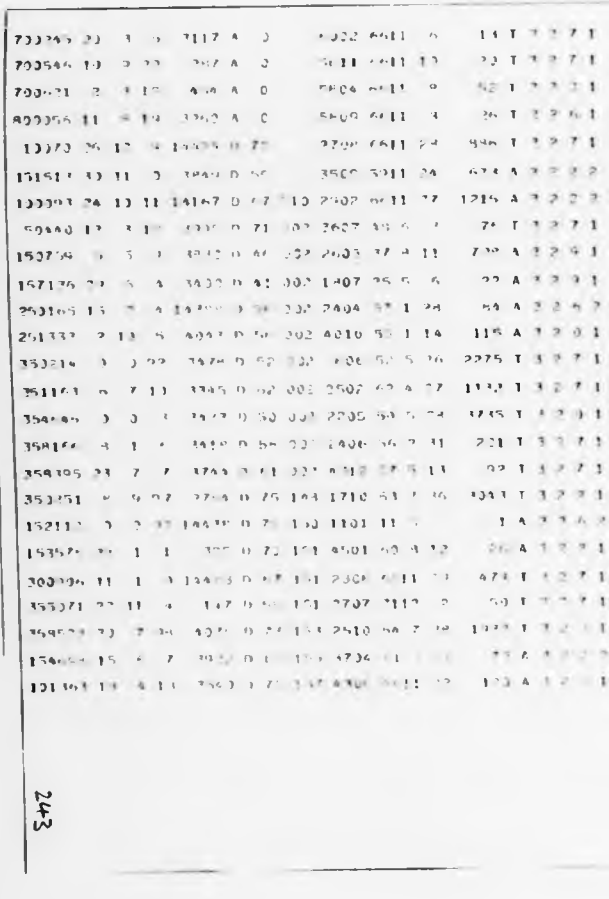
106	71	1	3	3507	A	0	2305	6310	40	340	A	3	2	2	2				
237	0	0	28	132	A	0	2004	6611	37	94	T	3	2	6	1				
10019	5	8	22	2856	A	0	4508	6611	16	56	T	3	2	7	1				
10336	24	13	16	4324	A	3	3710	6611	25	117	T	3	2	7	1				
10122	6	4	17	3731	A	0	3709	6611	21	93	T	3	2	4	1				
10145	18	7	18	3932	A	3	3906	6611	27	261	T	3	2	7	1				
10460	10	5	19	3139	A	0	4509	6611	19	130	T	3	2	7	1				
10655	30	6	23	4354	A	0	5503	6611	11	37	T	3	2	4	1				
50169	13	10	26	351	A	0	2005	64	9	20	332	T	3	2	2	2			
53429	0	0	29	8145	A	0	2804	5111	7	293	T	3	2	7	1				
53730	4	0	14	14135	A	0	3101	64	6	21	290	T	3	2	7	1			
80302	3	6	3	3845	A	0	1005	6611	23	241	A	3	2	8	2				
80326	0	2	13	112	A	0	2503	6611	21	663	T	3	2	2	1				
80354	0	0	4	8472	A	2	2207	6611	39	129	T	3	2	7	1				
80356	0	2	19	255	A	0	2809	6611	34	1139	T	3	2	4	1				
80387	0	0	18	2956	A	0	3704	6611	23	245	T	3	2	7	1				
80131	19	10	11	14523	A	0	3308	6611	26	171	A	3	2	8	2				
80139	0	0	10	14379	A	2	2809	6611	9	174	T	3	2	7	1				
80162	0	2	18	3254	A	0	3511	6611	17	768	T	3	2	6	1				
80168	28	7	16	14557	A	0	3310	6611	28	113	T	3	2	4	1				
80209	20	3	23	14135	A	0	4404	6611	13	514	T	3	2	6	1				
80314	0	0	24	3972	A	2	3404	6811	4	43	T	3	2	7	1				
80521	3	0	4	14356	A	2	2604	6611	3	8	T	3	2	2	1				
80526	0	0	6	2899	A	0	3610	6611	24	620	T	3	2	7	1				
100260	29	6	12	476	A	0	4008	6611	16	14	A	3	2	4	2				

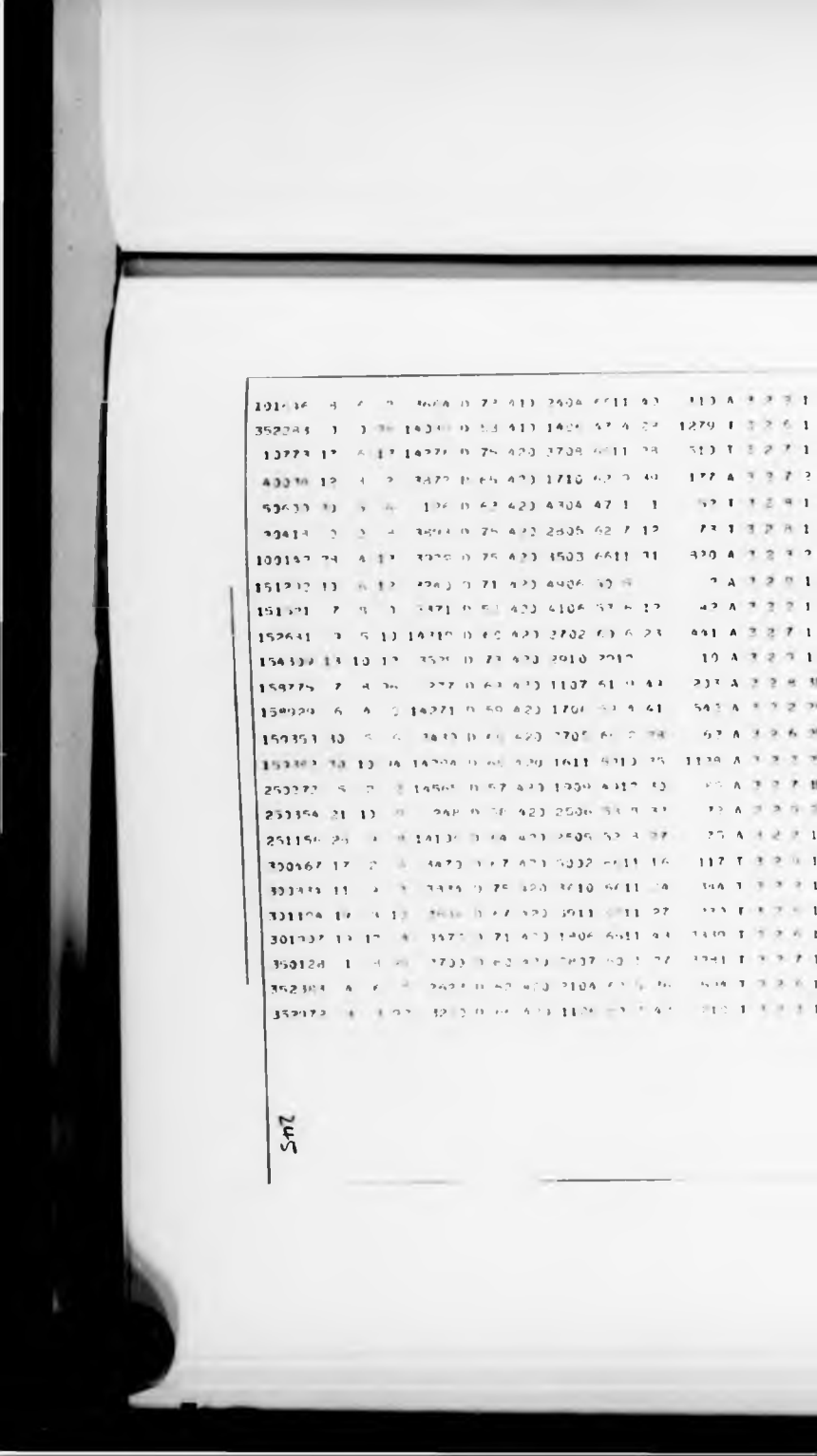
101460	6	10	18	14194	A	0				5135	6611	14		68	A	3	2	6	2				
101472	8	17	14	3488	A	0				4305	6611	22		138	A	3	2	7	2				
101511	18	7	9	3914	A	0				4210	6611	24		207	A	3	2	6	2				
151159	13	7	33	4934	A	0				2806	46	7	18	81	A	3	2	6	1				
153312	22	11	14	3851	A	0				4106	46	7	6	30	A	3	2	0	1				
153981	1	1	16	4087	A	0				3406	37	2	2	150	A	3	2	4	1				
154841	31	3	38	270	A	0				1204	53	4	44	135	A	3	2	7	2				
155321	19	9	18	191	A	0				3610	4411	10		138	A	3	2	7	1				
155272	1	1	15	208	A	0				3704	47	7	10	346	A	3	2	6	2				
157591	3	7	33	4392	A	0				1604	21	3	4	45	A	3	2	7	2				
157699	23	3	14	3618	A	0				4310	44	3		1	A	3	2	6	1				
157951	13	9	13	4162	A	0				4510	49	8	12	32	A	3	2	2	1				
158121	6	4	7	14747	A	0				2401	42	2	18	52	A	3	2	6	2				
158743	21	10	20	3947	A	0				4804	6211	13		79	A	3	2	7	2				
159246	23	6	0	333	A	0				2604	65	6	30	583	A	3	2	2	2				
159285	6	10	1	3844	A	0				2605	6511	23		97	A	3	2	6	2				
159329	10	13	22	455	A	0				2306	53	6	31	201	A	3	2	2	2				
159413	5	4	21	14223	A	0				4301	56	6	13	62	A	3	2	0	1				
159437	15	3	24	14443	A	0				2201	57	8	34	530	A	3	2	7	1				
200075	14	5	8	1	A	0				2808	6611	34		131	A	3	2	3	2				
200112	17	10	14	3931	A	0				3307	6611	33		669	A	3	2	7	2				
200162	9	3	13	3271	A	0				4107	6611	25		44	A	3	2	7	2				
200203	21	11	19	3574	A	0				4702	6611	13		76	A	3	2	7	2				
200226	10	2	13	4047	A	0				4209	6611	24		142	A	3	2	6	1				
200251	2	1	15	14443	A	0				4801	6611	13		25	A	3	2	6	2				

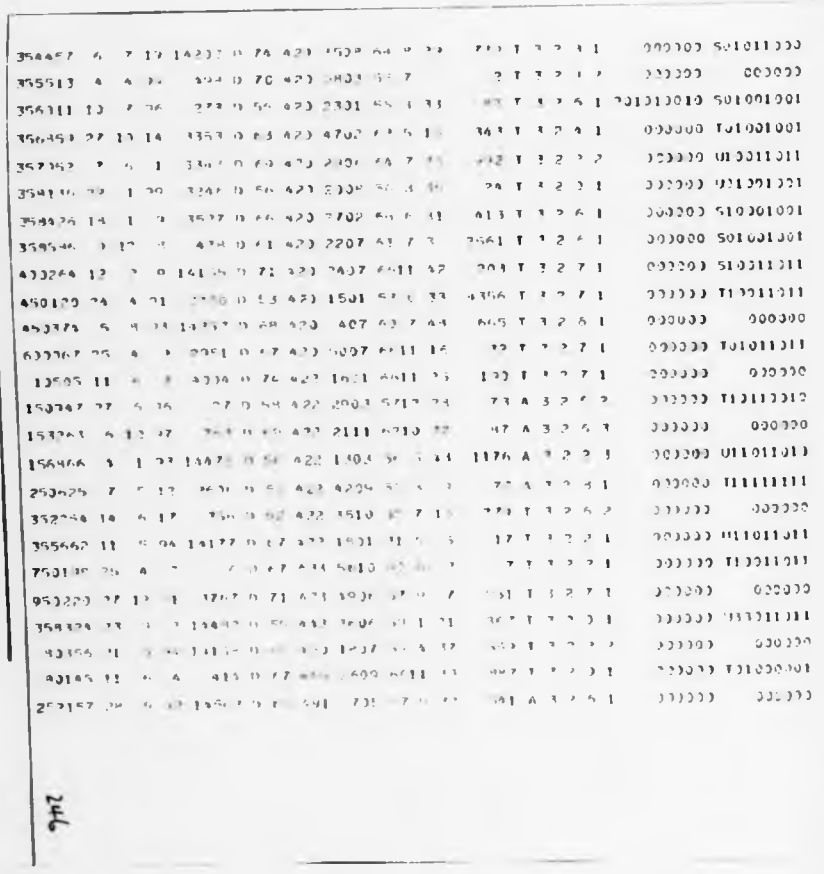




302273	7	4	12	3335	A	0	2812	6611		32	339	T	3	2	7	1
302333	4	8	20	14746	A	0	3512	6611		30	446	T	3	2	7	1
353128	1	5	11	3038	A	0	4709	54	3	16	71	T	3	2	7	1
353138	0	0	16	2827	A	0	3209	42	9	5	65	T	3	2	7	1
353663	13	5	1	3277	A	0	4003	53	3	22	121	T	3	2	2	1
353666	0	0	18	3562	A	0	3811	39	8		23	T	3	2	7	1
354497	24	11	0	225	A	0	3001	64	4	34	171	T	3	2	7	1
356058	5	5	18	312	A	0	5108	59	7	7	4	T	3	2	0	2
356938	21	10	25	427	A	0	1606	6310		37	264	T	3	2	2	1
357204	0	0	3	3953	A	0	1909	3011		2	46	T	3	2	0	1
357360	18	2	34	3831	A	0	4208	55	3	13	46	T	3	2	4	1
357723	0	0	15	14435	A	0	3609	51	1	14	220	T	3	2	4	1
358140	19	9	18	3572	A	0	4709	64	6	16	153	T	3	2	7	1
400160	21	10	15	229	A	0	4412	6611		22	174	T	3	2	7	1
400196	20	7	7	3533	A	0	2207	6611		34	375	T	3	2	7	1
400215	22	6	18	14445	A	0	3906	6611		24	47	T	3	2	6	1
400235	19	4	12	3361	A	0	2802	6611		38	797	T	3	2	1	1
400266	23	6	13	376	A	0	2805	6611		33	494	T	3	2	7	2
400358	14	4	10	431	A	0	5010	6611		16	66	T	3	2	0	1
450231	16	6	34	2753	A	0	1106	63	1	51	112	T	3	2	7	2
500135	6	11	13	457	A	0	6511	6511		1	2	T	3	2	2	1
500141	2	9	13	14448	A	0	6511	6611		1	2	T	3	2	7	1
500194	21	7	2	3327	A	0	6511	6611		1	1	T	3	2	2	1
550123	24	11	23	14469	A	0	1811	62	3	43	6592	T	3	2	3	2
700026	3	2	18	14435	A	0	5405	6611		12	25	T	3	2	7	2

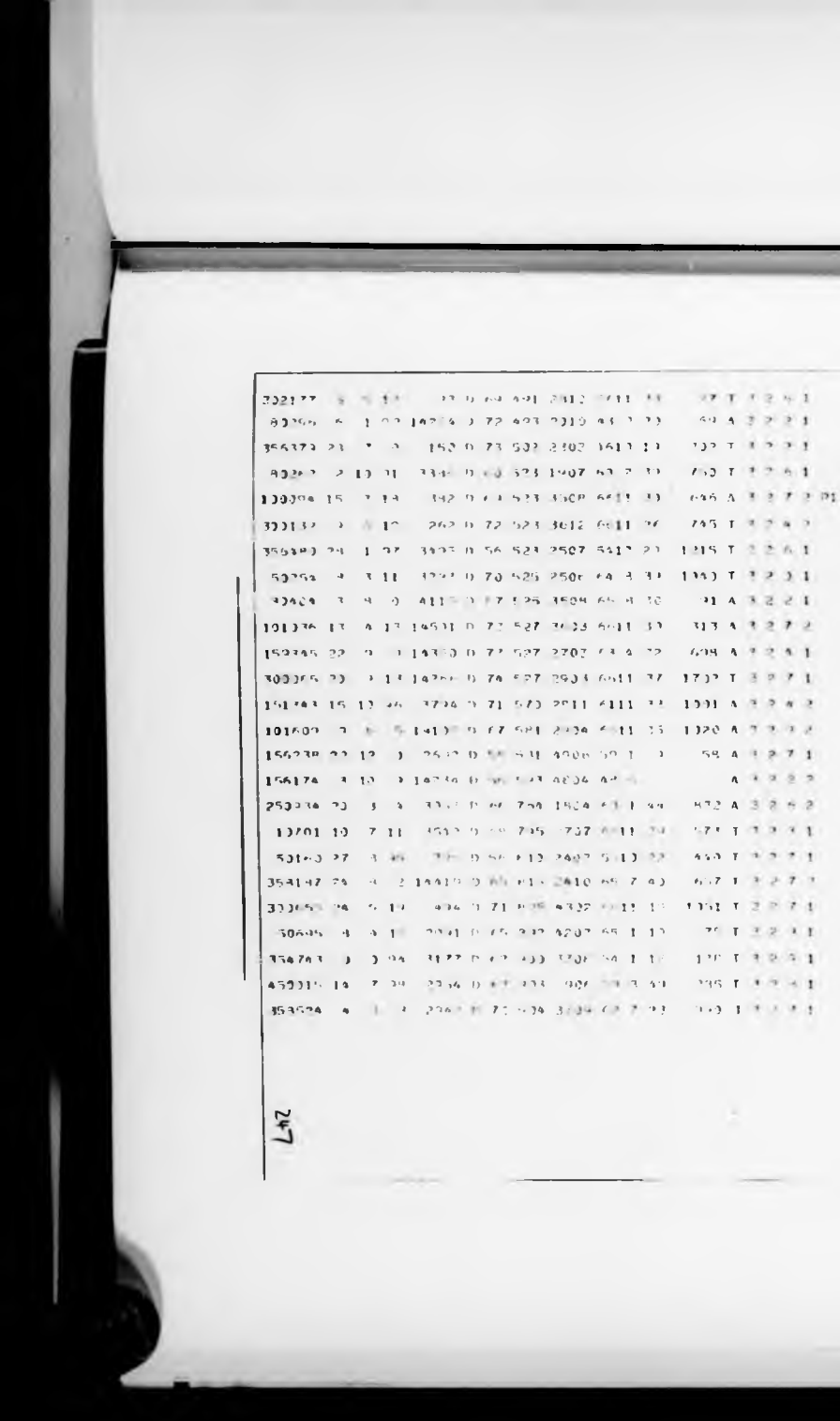






354457	6	7	19	14203	D	74	420	3508	64	8	29	779	T	3	2	3	1
355513	4	4	99	498	D	70	420	5803	58	7		2	T	3	2	9	2
356311	10	7	96	273	D	56	420	2301	58	8	33	83	T	3	2	6	1
356859	27	10	14	3353	D	63	420	4702	63	5	16	343	T	3	2	4	1
357352	7	6	1	3343	D	69	420	2906	64	7	35	992	T	3	2	2	2
358136	22	1	99	3246	D	56	420	2008	56	8	36	24	T	3	2	0	1
358426	18	1	9	3597	D	66	420	2702	66	6	31	413	T	3	2	6	1
358586	9	12	8	438	D	61	420	2207	61	7	34	2561	T	3	2	6	1
400264	12	2	8	14155	D	71	420	2407	66	11	42	203	T	3	2	7	1
450120	24	4	91	2780	D	53	420	1501	53	6	38	4356	T	3	2	7	1
450374	5	8	93	14353	D	68	420	407	60	7	48	665	T	3	2	6	1
600067	25	4	9	2951	D	67	420	5007	66	11	16	32	T	3	2	7	1
10505	11	6	2	4004	D	74	422	1601	66	11	25	190	T	3	2	7	1
150947	27	6	96	27	D	58	422	2903	57	12	28	73	A	3	2	6	2
153263	6	10	97	763	D	69	422	2111	62	10	32	87	A	3	2	6	3
156866	4	1	93	14472	D	56	422	1303	56	5	43	1176	A	3	2	2	3
250625	7	5	12	2606	D	59	422	4209	52	8	9	72	A	3	2	8	1
352254	14	6	17	356	D	52	422	3510	59	7	16	779	T	3	2	6	2
355662	11	5	94	14177	D	67	422	1801	71	6	5	17	T	3	2	2	1
750198	25	4	2	6	D	67	433	5610	60	6	3	7	T	3	2	2	1
950220	27	12	91	3767	D	71	433	4906	57	9	7	951	T	3	2	7	1
358324	23	9	3	14492	D	59	443	3606	59	1	21	867	T	3	2	0	1
80356	21	5	94	14158	D	65	450	1807	39	4	37	569	T	3	2	2	2
80145	11	6	4	413	D	67	466	2609	66	11	33	887	T	3	2	0	1
252157	28	9	32	14567	D	65	491	705	57	9	32	541	A	3	2	6	1

246



247

```
 92746 11 10 18  3725 0 48 932 3506 46 7 13   222 A 3 2 9 1    000000    000000    TP 1   0    0 0
152388 12 11  4  3471 0 51 974 3601 51 2 15   557 A 3 2 7 1    000000    000000    L  0   0    0 0
156003 22 10 16  7110 L 74      4607 46 9        1 A 3 2 7 1    000000    000000       0 P 3    0 0
```

COHORT "B"

Reader 4

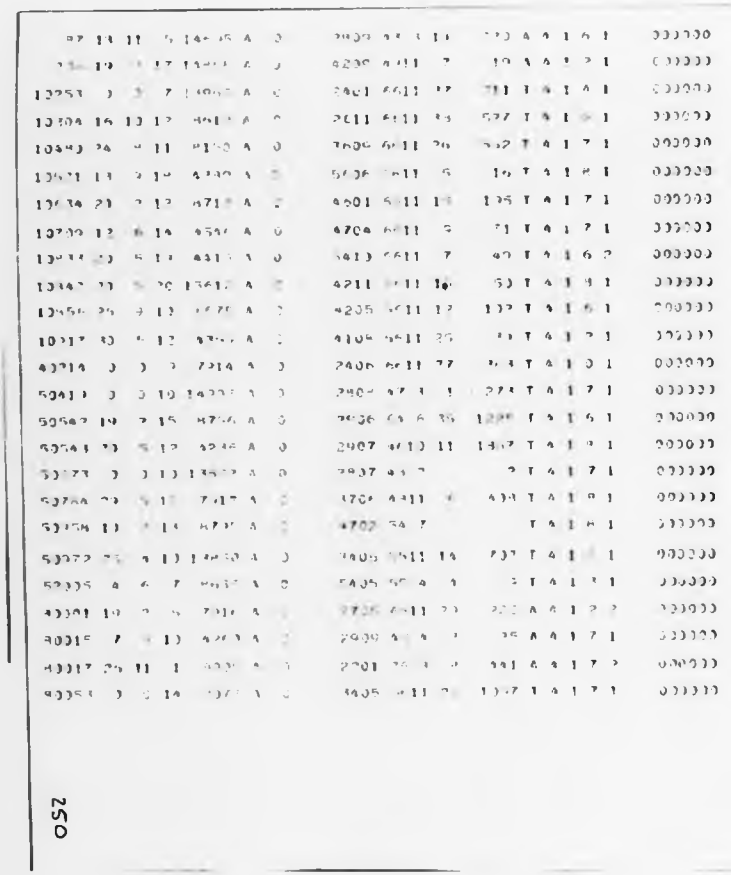
"Normals"

pp. 250 - 268

"Less-than-normals"

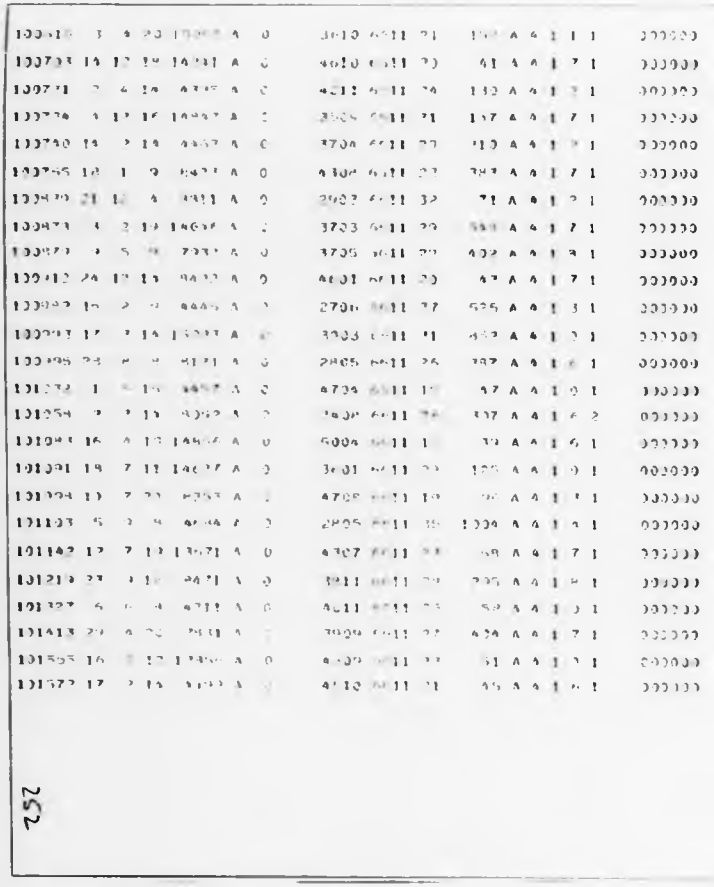
pp. 269 - 281

0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000



250

0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000



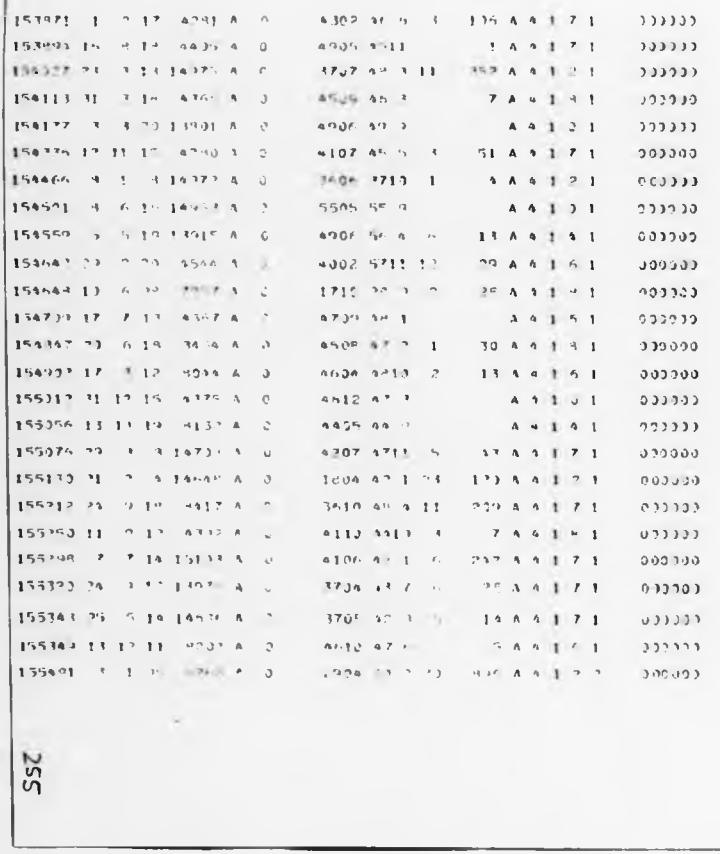
252

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

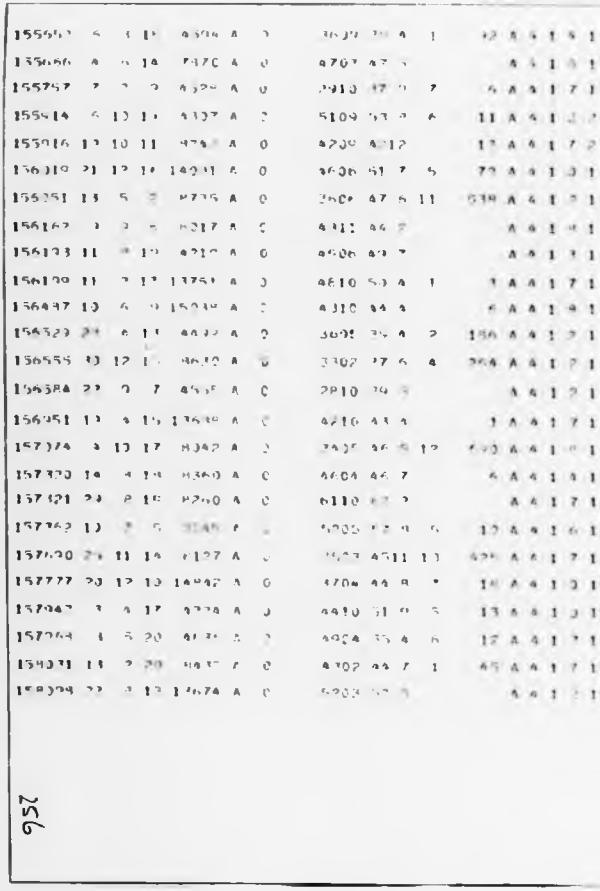
101581	17	1	11	4611	A	0	3011	5611		[illegible]	71	A	4	1	4	1
101780	27	4	22	4734	A	0	4707	6611		14	107	A	4	1	6	1
101744	23	7	17	14067	A	0	3008	6611		12	47	A	4	1	6	1
101765	1	4	8	8325	A	0	4302	6611		23	42	A	4	1	7	1
150122	4	11	2	4071	A	0	4303	4611		7	52	A	4	1	6	1
150160	22	13	24	4656	A	0	1811	2011		7	10	A	4	1	2	1
150364	1	9	12	7971	A	0	4302	47	3		14	A	4	1	7	1
150388	13	17	14	15445	A	0	3911	4211		7	7	A	4	1	4	1
150410	2	3	11	7201	A	0	5607	58	5	2	4	A	4	1	0	1
150707	22	13	5	4722	A	0	2505	4511		14	322	A	4	1	6	1
150811	7	2	12	4612	A	0	4204	47	2		1	A	4	1	6	1
150923	20	11	14	4204	A	0	4602	4211			9	A	4	1	6	1
150950	16	13	12	8217	A	0	7407	47	5	12	407	A	4	1	4	1
151224	25	4	10	14925	A	0	3606	45	5	6	17	A	4	1	3	1
151261	24	7	16	4527	A	0	4720	55	1	7	15	A	4	1	6	1
151620	3	2	19	4122	A	0	5310	51	3		1	A	4	1	5	1
151657	28	7	12	17842	A	0	4304	53	5	13	236	A	4	1	7	1
151777	16	11	7	15354	A	0	2005	3110		22	760	A	4	1	7	1
151942	22	11	23	6015	A	0	4604	4710		1	14	A	4	1	6	1
151946	5	7	16	4630	A	0	4209	[illegible]	[illegible]		2	A	4	1	7	1
151948	22	5	12	11701	A	0	3610	44	4	1	43	A	4	1	3	1
152251	4	1	1	13422	A	0	3201	44	2	12	127	A	4	1	6	1
152121	27	12	15	4412	A	0	5112	[illegible]	6	13	34	A	4	1	7	1
152126	25	4	17	14715	A	0	4601	56	5		1	A	4	1	7	1
152181	6	13	17	4661	A	0	4612	47	9		12	A	4	1	7	1

0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000
0 0 0 0 0000000

0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000

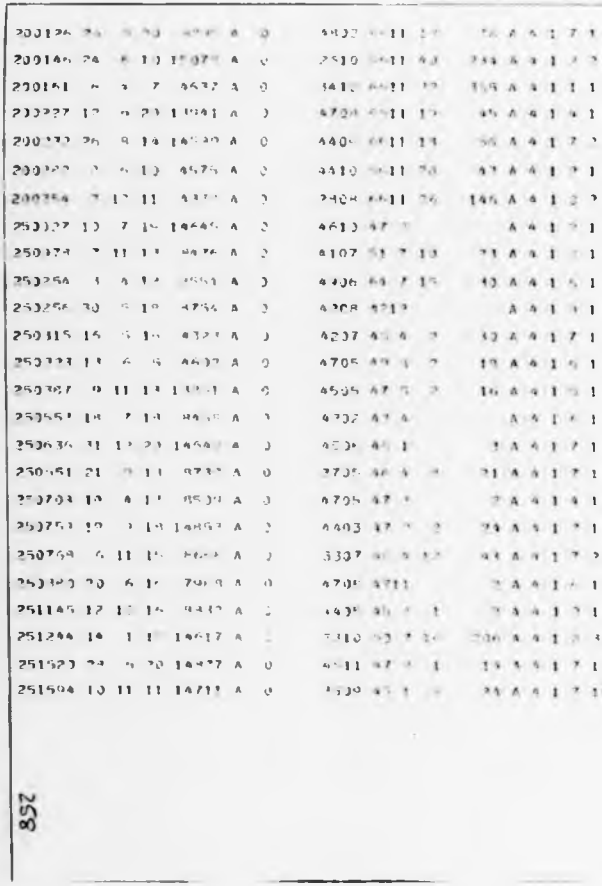


SS2



0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

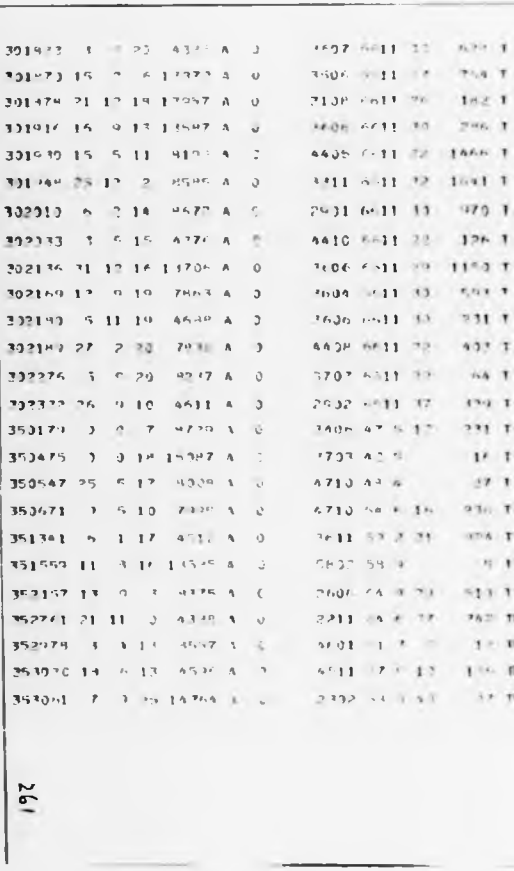


852

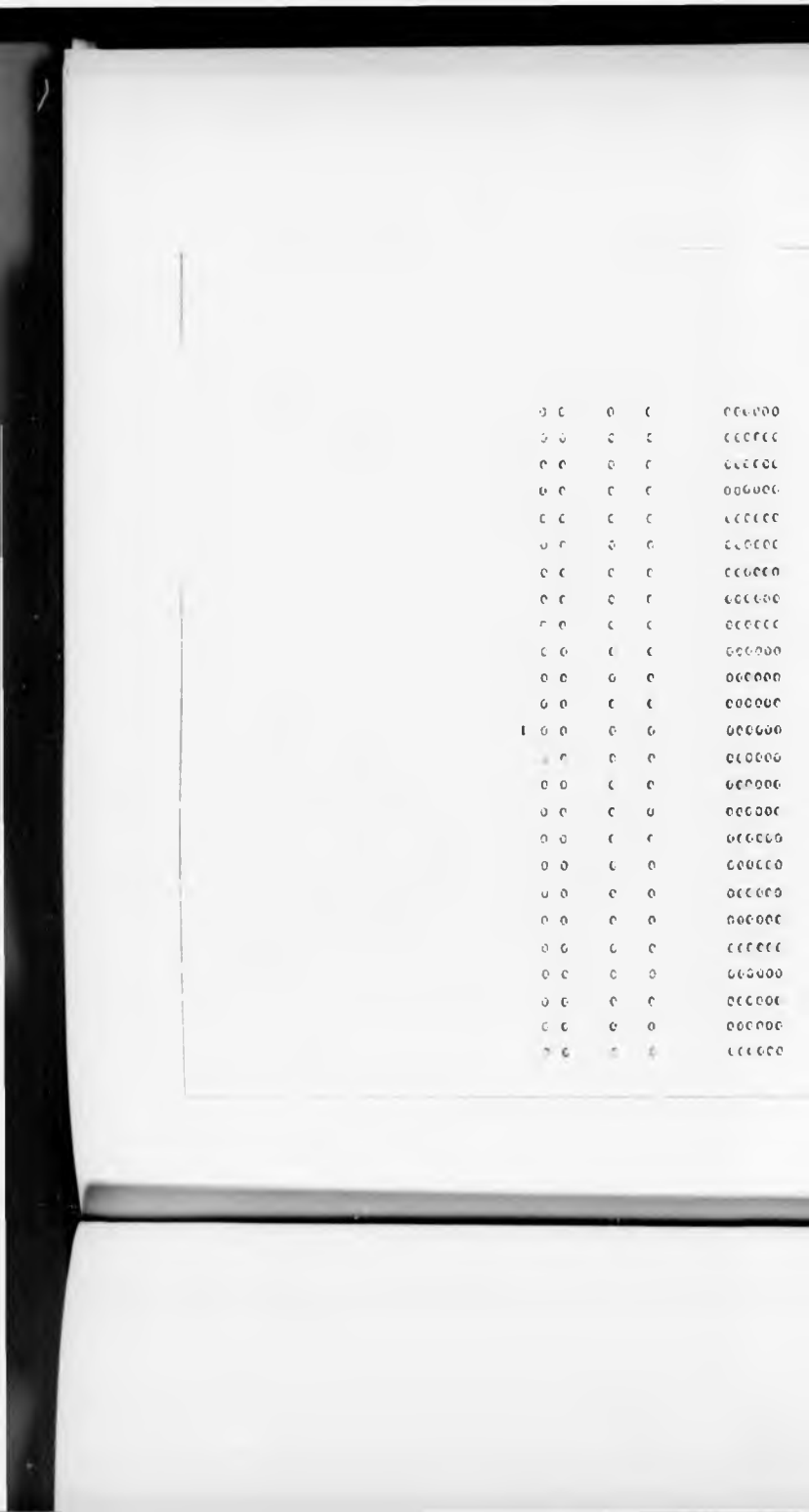
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
1	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
0	0	0	0	000000	000000	
1	0	0	0	000000	000000	

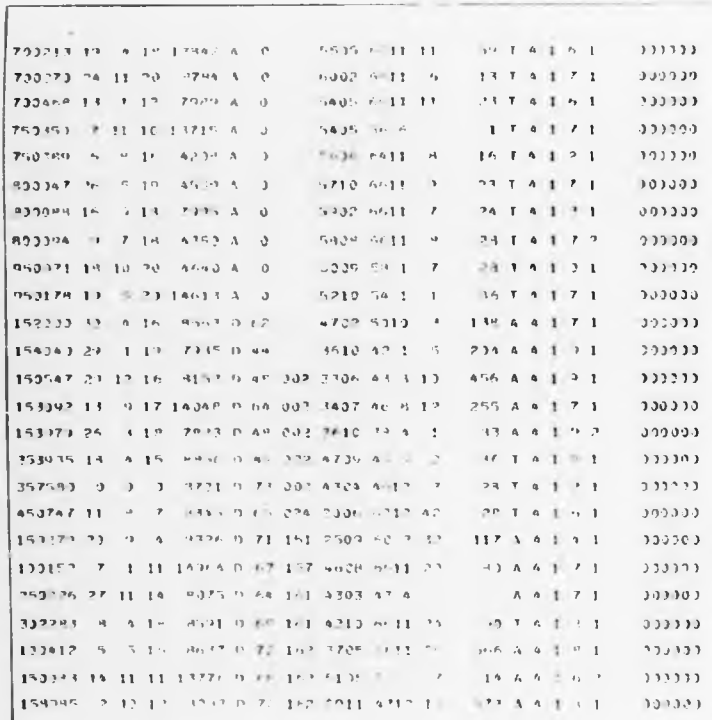
251653	3	5	11	4456	A	0	4907	58	1	8	4	A	4	1	6	1
251673	29	9	16	4667	A	0	4003	45	7	5	44	A	4	1	0	1
251939	8	7	11	15037	A	0	3705	47	6	10	213	A	4	1	2	1
252298	21	3	17	4536	A	0	4506	45	9			A	4	1	0	1
300002	23	2	13	8738	A	0	4306	6611	23		483	T	4	1	7	1
300006	31	1	20	13883	A	0	5311	6611	13		58	T	4	1	1	1
300032	29	12	19	13782	A	0	5309	6611	13		97	T	4	1	8	1
300058	5	12	16	4540	A	0	3906	6611	26		406	T	4	1	7	1
300159	22	11	15	4662	A	0	3702	6611	23		455	T	4	1	4	1
300184	21	4	20	8828	A	0	5208	6611	14		24	T	4	1	7	1
300199	21	3	13	13944	A	0	5205	6611	14		40	T	4	1	7	1
300246	23	6	17	13764	A	0	3904	6611	26		237	T	4	1	5	2
300247	13	12	16	4623	A	0	2904	6611	27		839	T	4	1	2	1
300298	29	9	19	13597	A	0	3309	6611	22		394	T	4	1	7	1
300329	15	5	8	14651	A	0	2801	6611	38		774	T	4	1	5	1
300377	2	1	10	15022	A	0	4208	6611	24		103	T	4	1	1	1
300414	29	4	16	4647	A	0	3610	6611	30		933	T	4	1	4	1
300490	21	6	18	14702	A	0	4305	6611	23		434	T	4	1	6	1
300511	4	9	16	4614	A	0	4101	6611	21		135	T	4	1	0	1
300530	17	12	13	14864	A	0	4208	6611	24		731	T	4	1	5	1
300539	6	3	14	3014	A	0	7512	6611	30		1970	T	4	1	5	1
300552	31	12	18	7903	A	0	4510	6611	21		362	T	4	1	6	1
300585	12	1	8	4531	A	0	2006	6611	39		128	T	4	1	8	1
300605	6	12	20	13316	A	0	3909	6611	26		122	T	4	1	7	2
300659	14	7	15	15108	A	0	4105	6611	25		1075	T	4	1	7	1

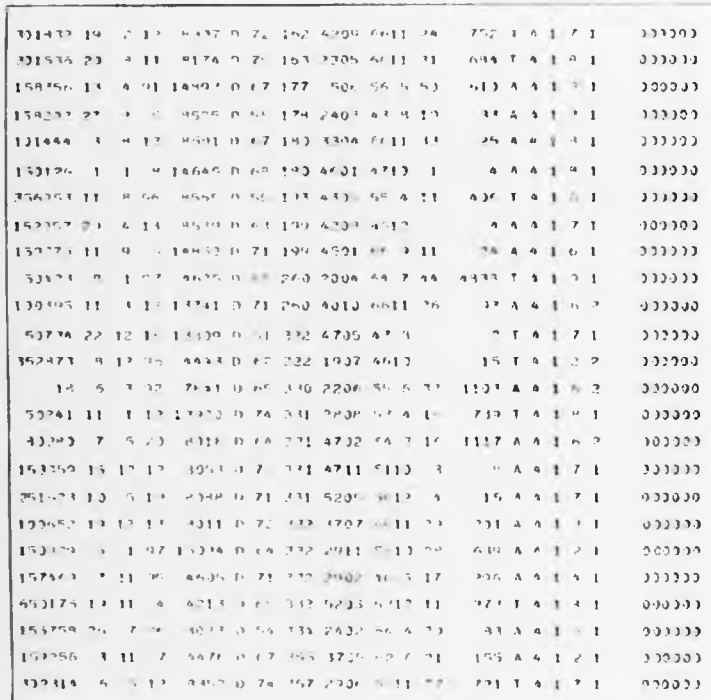
251653	3	5	11	4456	A	0		4937	59	1	8		4	A	4	1	6	1
251674	23	9	19	4667	A	0		4003	45	7	5		44	A	4	1	0	1
251939	8	7	11	15037	A	0		3705	47	6	13		213	A	4	1	2	1
252298	21	3	17	4536	A	0		4506	45	9				A	4	1	0	1
300002	23	2	13	3748	A	0		4306	6611	23			483	T	4	1	7	1
300006	11	1	20	13883	A	0		5311	6611	13			58	T	4	1	1	1
300032	29	12	19	13732	A	0		5309	6611	13			97	T	4	1	8	1
300058	5	13	16	4540	A	0		3936	6611	26			306	T	4	1	7	1
300159	22	11	15	4662	A	0		3702	6611	23			455	T	4	1	4	1
300184	21	4	20	8828	A	0		5208	6611	14			24	T	4	1	7	1
300193	21	3	13	13944	A	0		5205	6611	14			49	T	4	1	7	1
300246	23	6	17	13744	A	0		3904	6611	26			237	T	4	1	5	2
300247	13	12	16	4623	A	0		3906	6611	27			349	T	4	1	2	1
300298	28	9	19	13507	A	0		3309	6611	22			394	T	4	1	7	1
300329	15	5	8	14651	A	0		3801	6611	28			774	T	4	1	5	1
300377	2	1	13	15022	A	0		4238	6611	24			103	T	4	1	1	1
300414	29	4	16	4647	A	0		3610	6611	30			934	T	4	1	4	1
300490	21	6	18	14702	A	0		4305	6611	23			434	T	4	1	6	1
300511	4	9	16	4614	A	0		4101	6611	21			135	T	4	1	0	1
300530	17	12	13	14864	A	0		4238	6611	24			731	T	4	1	5	1
300533	6	3	14	4014	A	0		3512	6611	29			1370	T	4	1	5	1
300552	21	12	18	7933	A	0		4510	6611	21			462	T	4	1	6	1
300545	12	1	8	4531	A	0		2804	6611	39			124	T	4	1	8	1
300605	6	12	20	14316	A	0		3909	6611	26			122	T	4	1	7	2
300659	14	7	15	15109	A	0		4105	6611	25			1075	T	4	1	7	1



353186	21	10	20	13554	A	0					4705	64	9	17		25	T	4	1	4	1
354318	2	7	20	13692	A	0					4109	64	9	16		423	T	4	1	2	1
354750	0	0	12	14000	A	0					1909	4111		1		10	T	4	1	4	1
355087	7	5	20	13559	A	0					4409	46	8	2		17	T	4	1	7	1
356592	0	0	18	4431	A	0					3811	42	7	7		173	T	4	1	2	1
357457	0	0	17	13551	A	0					4603	50	6	4		25	T	4	1	7	1
357520	14	5	3	4407	A	0					5804	5812				1	T	4	1	2	1
358409	24	11	08	13605	A	0					2106	64	7	32		427	T	4	1	2	1
358584	31	3	20	8175	A	0					4835	6113				7	T	4	1	7	1
400008	17	10	20	4589	A	0					4703	6611	19			450	T	4	1	7	1
400149	14	4	14	8354	A	0					4712	6611	17			71	T	4	1	4	1
400177	24	2	2	4208	A	0					2901	6611	23			89	T	4	1	3	1
400247	22	1	19	14899	A	0					3710	6611	23			251	T	4	1	7	1
400439	10	6	17	14078	A	0					4703	6611	19			89	T	4	1	7	1
400456	29	8	17	4680	A	0					3710	6611	23			423	T	4	1	6	1
450716	29	5	19	8265	A	0					1808	47	7	4		134	T	4	1	2	1
500324	17	4	19	4245	A	0					6511	6611		1		6	T	4	1	2	1
600391	25	10	20	8835	A	0					5606	6611		5		85	T	4	1	8	1
650050	2	8	19	13675	A	0					4706	6011		1		12	T	4	1	7	1
650063	23	3	19	13934	A	0					5507	57	9	2		34	T	4	1	7	2
650140	31	7	13	7913	A	0					4703	6011		3		55	T	4	1	2	2
650587	3	12	14	8487	A	0					4608	6613					T	4	1	6	1
650691	22	6	17	15021	A	0					4608	47	1			13	T	4	1	7	2
700001	4	4	13	8187	A	2					5308	6611		7		14	T	4	1	4	1
700021	2	7	14	8158	A	0					5405	6611	13			15	T	4	1	7	1







0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

155407	13	7	19	8274	D	67	420	4302	67	8	20	169	A	4	1	9	2
155404	10	10	9	8656	D	61	420	3505	43	3	7	150	A	4	1	7	1
156173	22	7	2	7985	D	55	420	2001	49	8	29	756	A	4	1	5	1
156596	6	9	16	8620	D	66	420	4107	43	4	1	4	A	4	1	5	1
156718	3	5	2	14971	D	58	420	4806	48	11		1	A	4	1	7	1
157131	4	7	19	8271	D	74	420	4906	49	7			A	4	1	7	1
159180	20	3	5	4570	D	65	420	3005	46	6	16	930	A	4	1	8	1
159255	19	12	91	13357	D	74	420	911	56	1	33	424	A	4	1	2	2
159465	13	9	8	4187	D	74	420	4704	62	5	14	65	A	4	1	2	2
251734	19	12	1	8710	D	72	420	2212	66	10	25	45	A	4	1	0	1
252135	27	10	4	4322	D	47	420	4305	47	2	7	9	A	4	1	9	1
301568	26	5	12	4468	D	67	420	2809	66	11	38	262	T	4	1	6	1
351164	21	8	93	4522	D	73	420	1508	64	4	43	431	T	4	1	7	1
351210	30	3	96	8057	D	63	420	2610	53	3	24	289	T	4	1	7	2
352192	6	5	12	14748	D	57	420	2905	37	4	27	340	T	4	1	7	2
353532	0	0	99	9900	D	67	420	2707	23	9			T	4	1	7	1
353683	18	10	91	13731	D	72	420	2908	59	12	24	1227	T	4	1	2	1
354762	8	6	9	13774	D	62	420	2808	62	12	27	243	T	4	1	7	1
355574	5	8	2	4204	D	74	420	2606	66	6	32	219	T	4	1	8	1
356495	7	11	12	7954	D	74	420	4206	66	7	22	297	T	4	1	7	1
450671	13	10	95	13570	D	63	420	2201	63	5	41	2976	T	4	1	9	1
650018	26	9	10	4620	D	72	420	4601	59	6	6	16	T	4	1	7	1
950181	16	7	94	14557	D	52	420	4007	53	12	13	434	T	4	1	7	1
50237	9	12	94	8641	D	76	422	2205	51	1	22	933	T	4	1	0	1
100118	29	9	15	4194	D	63	422	4904	66	11	17	104	A	4	1	7	2

	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000

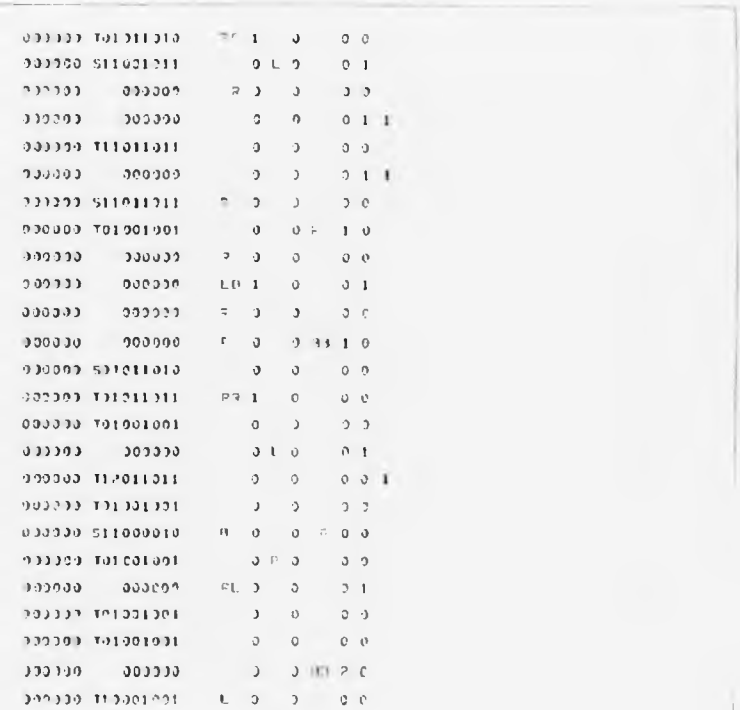
155407	13	7	14	9074	D	60	420	4302	62	8	20	169	A	4	1	8	2
155404	10	10	9	8656	D	61	420	3505	43	3	7	150	A	4	1	7	1
156173	22	7	2	7985	D	55	420	2301	40	8	20	756	A	4	1	5	1
156506	6	8	16	8620	D	66	420	4107	43	4	1	4	A	4	1	5	1
156718	3	5	2	14071	D	58	420	4806	4811			1	A	4	1	7	1
157131	4	7	18	9271	D	74	420	4906	40	7			A	4	1	7	1
159180	20	3	5	4570	D	65	420	3305	46	8	16	930	A	4	1	8	1
159255	19	12	91	13357	D	74	420	911	66	1	31	424	A	4	1	2	2
159465	13	9	5	4187	D	74	420	4704	62	5	14	65	A	4	1	2	2
251774	13	12	1	9710	D	72	420	2212	6610	25		45	A	4	1	0	1
252135	27	10	4	4322	D	47	420	4305	47	2	7	9	A	4	1	9	1
301568	26	5	12	4468	D	67	420	2009	6611	38		262	T	4	1	6	1
351164	21	8	97	4522	D	73	420	1508	64	4	43	431	T	4	1	7	1
351710	30	3	96	4057	D	62	420	2610	53	3	24	389	T	4	1	7	2
352102	6	5	13	13748	D	57	420	2905	37	4	27	343	T	4	1	7	2
353572	3	3	99	9835	D	67	420	2707	23	8			T	4	1	7	1
357583	14	10	91	14791	D	72	420	2908	5910	24		1227	T	4	1	2	1
358762	8	6	9	13774	D	62	420	2808	6212	27		243	T	4	1	7	1
355574	5	8	2	4204	D	74	420	2606	66	6	32	219	T	4	1	8	1
356405	7	11	12	7854	D	74	420	4206	66	7	23	297	T	4	1	7	1
450671	13	10	05	13570	D	63	420	2201	63	5	41	2476	T	4	1	2	1
650018	26	9	10	4420	D	72	420	4601	52	6	6	16	T	4	1	7	1
950181	16	7	94	14657	D	52	420	4007	5310	14		454	T	4	1	7	1
50237	9	13	94	8641	D	74	420	2209	63	1	32	933	T	4	1	0	1
100113	20	3	15	4134	D	61	420	4904	6611	17		104	A	4	1	7	2

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

251349	17	4	2	15085	D	74	422	2906	44	3	14	43	A	4	1	2	1
351739	28	10	98	8704	D	74	422	3508	59	5	23	216	T	4	1	6	1
355404	22	4	2	15074	D	63	422	4208	49	2	3	32	T	4	1	7	1
159440	26	7	98	4624	D	72	434	1010	60	7	44	694	A	4	1	8	2
353603	0	0	96	8062	D	64	446	1811	19	1			T	4	1	2	2
153094	3	9	6	4504	D	75	450	4608	4612			4	A	4	1	5	1
151775	21	5	19	8775	D	65	491	3705	65	1	27	68	A	4	1	3	1
80265	18	2	12	4264	D	74	523	2603	6611		19	269	T	4	1	2	1
101600	6	9	8	8609	D	70	523	3706	6611		29	265	A	4	1	6	1
155025	18	6	94	14829	D	57	527	2201	5710		31	1031	A	4	1	2	2
150499	10	9	19	8709	D	68	572	4405	46	8	2	22	A	4	1	8	1
150345	25	5	2	4368	D	57	581	1612	5612		34	975	A	4	1	7	1
153130	13	1	14	8777	D	66	581	4306	48	4	4	15	A	4	1	4	1
200201	13	3	4	4657	D	75	591	4310	6611		21	47	A	4	1	7	2
353948	13	1	14	4659	D	68	581	3306	53	7	20	1754	T	4	1	7	1
157434	25	4	2	8530	D	63	585	4107	4611		5	130	A	4	1	6	1
159051	27	7	93	13913	D	74	585	2305	32	5	9	160	A	4	1	0	1
151956	26	2	12	13689	D	70	587	3611	4711		11	28	A	4	1	8	1
151787	12	1	4	4391	D	62	612	4112	48	7	6	18	A	4	1	2	1
80275	3	1	95	8078	D	65	785	1704	46	3	4	40	A	4	1	0	1
650715	2	4	92	13662	D	71	792	4507	49	1	3	36	T	4	1	7	1
154247	8	8	9	13638	D	52	810	4702	5012		7	8	A	4	1	6	1
352540	27	9	17	8475	D	74	810	4708	5811		8	25	T	4	1	7	1
150824	20	9	16	13750	D	38	812	3610	38	9	1	96	A	4	1	9	1
154096	31	3	6	14203	D	64	812	4906	43	7			A	4	1	7	1

0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000
0 0 0 0 000000

158015	29	11	19	15024	D	53	836	4907	47	6	7		15	A	4	1	6	1	000000
355624	0	0	0	4917	D	52	810	3638	53	7	11		72	T	4	1	6	1	000000
157393	5	6	17	14961	D	45	825	2610	45	8	12		619	A	4	1	9	1	000000
351253	20	4	4	14026	D	48	835	1812	4413	12			703	T	4	1	9	1	000000
5031	28	7	13	13955	D	51	503	4711	51	7	7		38	A	4	1	8	1	000000
357365	21	4	21	4365	D	60	916	2801	53	8	25		254	T	4	1	7	1	000000
80154	3	0	15	8356	D	71	922	3308	57	7	0		247	T	4	1	7	1	000000
159724	29	6	17	4693	D	39	923	3704	51	6	1		58	A	4	1	3	1	000000
153837	7	4	14	8368	D	62	372	4335	4711	13			333	A	4	1	7	1	000000
152157	17	3	11	4653	L	70		4804	48	5				A	4	1	9	1	000000
156386	21	8	8	15076	L	69		4906	44	7				A	4	1	9	1	000000
250977	17	1	0	9170	L	48		4609	48	4	1		19	A	4	1	8	1	000000
351373	27	8	20	4643	L	71		3909	4717	1			75	T	4	1	9	1	000000
650723	5	7	13	15026	L	54		5310	5411	1			24	T	4	1	9	2	000000



93	16	4	12	7974	A	0	2935	44	4	13	379	A	4	2	5	2
221	0	0	11	13845	A	0	2731	6611	20		391	T	4	2	7	1
13034	1	7	9	4529	A	0	4709	6611	14		126	T	4	2	6	1
13035	30	1	5	8237	A	0	2312	6611	45		513	T	4	2	7	1
13329	0	0	17	4143	A	0	3410	6611	21		174	T	4	2	7	1
13715	25	4	9	4336	A	0	2623	6611	42		178	T	4	2	7	1
13417	21	3	13	14844	A	0	3403	6611	19		249	T	4	2	6	1
13444	6	7	5	7263	A	0	4510	6611	14		63	T	4	2	0	2
93157	0	0	14	14654	A	0	3701	33	7	7	113	T	4	2	6	1
93165	0	0	2	4238	A	0	1806	66	4	21	274	T	4	2	2	1
93133	12	7	37	13935	A	0	1305	55	6	14	2725	T	4	2	2	1
93274	0	0	16	8479	A	0	3702	6611	12		164	T	4	2	7	1
93437	24	4	15	13796	A	0	3703	6611	1		10	T	4	2	8	2
93571	21	4	5	4238	A	0	2232	6611	23		333	T	4	2	7	1
93563	28	5	20	9431	A	0	4601	53	1	2	4	T	4	2	0	1
93956	27	5	13	14753	A	0	3631	65	4	19	191	T	4	2	3	1
93373	30	11	4	7867	A	0	2308	50	5	25	154	A	4	2	2	2
93343	14	0	14	7451	A	0	4239	6611	12		231	T	4	2	7	1
93364	0	0	11	14726	A	0	3707	6611	24		174	T	4	2	7	1
93365	0	0	15	13762	A	0	3734	66	2	27	412	T	4	2	6	1
93353	7	3	43	9546	A	0	1506	64	4	21	144	T	4	2	2	1
93035	0	0	29	4456	A	0	4710	6611	17		142	T	4	2	7	1
93132	7	7	29	13948	A	0	4510	6611	12		28	T	4	2	4	1
93164	0	0	9	8902	A	0	2511	6611	35		416	T	4	2	7	1
93181	0	4	15	14256	A	0	3612	6611	17		274	T	4	2	6	1

90190	3	0	14	18782	A	0	16OP	4611	27
90215	3	3	23	4277	A	2	1710	4411	25
90219	1	7	15	13961	A	0	4090	4411	17
100322	17	6	17	12540	A	0	3711	4611	03
100373	11	8	17	14567	A	0	2407	4411	12
100424	24	7	8	4274	A	0	4890	4411	1P
100510	4	4	16	4225	A	0	3707	4511	29
100114	1	7	15	7940	A	0	4710	4411	19
100240	26	10	12	13639	A	0	3211	4411	13
100277	5	8	19	4424	A	3	4408	4411	23
100322	23	3	10	4243	A	0	3411	4611	26
100341	15	5	19	4478	A	0	4010	4411	1P
100424	21	8	12	4227	A	0	1508	4511	21
100515	12	13	14	13514	A	3	4304	4511	24
100542	20	6	12	14771	A	0	1704	4411	20
100547	3	5	13	14041	A	0	4304	4511	22
100557	22	1	14	14342	A	2	4605	4611	20
100618	24	3	13	7464	A	3	2913	4511	13
100647	4	1	13	7904	A	0	5211	4411	1P
100648	20	10	14	11642	A	3	1707	4611	20
100702	22	10	12	7971	A	0	1604	4411	22
100746	1	7	15	8540	A	2	4113	4711	25
100747	14	7	20	8546	A	0	1011	4611	22
100915	9	11	13	7373	A	0	5305	4611	1P
100956	19	13	1P	4228	A	2	4401	5411	22

```
222 A A 2 4 1     000000 S11011011  D T   0   0     0 1
 40 A A 2 4 1     000000 T01001001          0   0     0 0
132 A A 2 4 2     000000 T11011011          0   0     0 0
511 A A 2 7 2     000000 S11001011          0   0     0 0
 10 A A 2 5 2     000000 T11011011          0   0     0 0
 65 A A 2 4 1     000000 T01011011          0   0     0 0
 17 A A 2 5 1     000000 S11011011        F 1 S 0     0 0
935 A A 2 3 2     000000 S22011011          0   0     0 0
 58 A A 2 6 2 P12001010     000000  D  L 1   0   0     0 0
 47 A A 2 7 1     000000 112011011          0   0     0 0
486 A A 2 4 1     000000     000000         0   0     0 1
  2 A A 2 4 2     000000 S11011011          0   0     0 0
497 A A 2 2 1     000000 T01001001          0   0     0 0
 10 A A 2 7 2     000000 T01001001          0   0     0 0
256 A A 2 7 1     000000     000000         0   0     0 1
711 A A 2 7 1 P10010010     000000  D      0   0     0 0
595 A A 2 2 1     000000     000000         0   0     0 1 1
553 A A 2 7 2     000000 T02111111       BB 1   0     0 0 1
 11 A A 2 7 1 P01011011     000000         0   0     0 0
    A A 2 2 2     000000     000000         0   0     0 1
    A A 2 4 1     000000     000000         0   0     0 1 1
  2 A A 2 7 1     000000     000000         0   0   1 1 0
 11 A A 2 7 1     000000     000000         0   0     0 1 1
 17 A A 2 2 1     000000 T01001001          0   0     0 0
 15 A A 2 4 1     000000     000000         0   0     0 1
```

130950	10	0	17	14620	A	0		4301	6611	23
131271	23	6	13	8263	A	0		4705	6611	13
131352	25	4	2	8267	A	0		1739	6611	45
131106	1	4	14	14315	A	0		4204	6611	24
131420	14	5	4	8170	A	0		2407	6611	12
131348	19	3	23	8296	A	0		4704	6611	13
131520	4	12	18	14329	A	0		4813	6611	18
131522	28	2	3	8274	A	0		2537	6611	42
131588	25	5	2	15339	A	0		4303	6611	23
131625	15	5	19	14327	A	0		4607	6611	11
150736	21	7	13	8173	A	0		3631	45 7	9
151016	24	4	13	17914	A	0		4805	52 3	3
152668	7	1	7	14604	A	0		2305	33 7	26
152813	13	4	17	13558	A	0		5305	55 8	5
153413	15	2	12	4414	A	0		2912	44 7	14
155143	23	2	13	14327	A	0		3436	38 5	13
155253	21	9	1	17156	A	0		3304	44 3	37
155662	12	12	7	8351	A	0		2604	6513	39
156111	3	4	19	8516	A	0		5209	38 7	5
156246	24	5	3	8287	A	0		5303	55 6	
156681	17	4	9	14663	A	0		5002	33 7	
157026	7	6	14	4432	A	0		4113	42 0	
157933	31	7	13	4444	A	0		4601	52 5	6
157873	21	11	7	13763	A	0		4803	56 6	3
158255	11	12	19	8535	A	0		4402	31 3	1

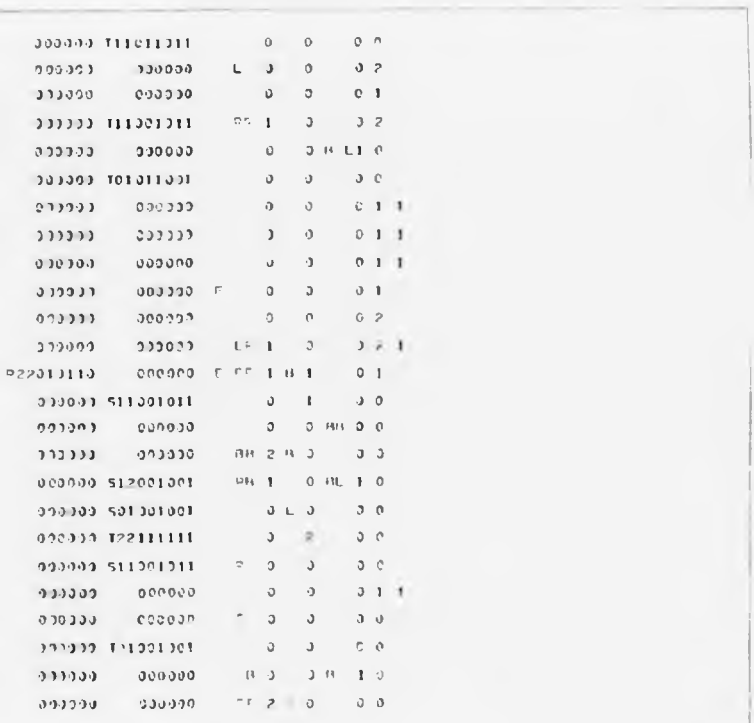
159201	12	11	22	9410	A	0	2309	64	5	31	78	A	4	2	7	1
159404	5	10	18	4511	A	0	2311	62	6	41	109	A	4	2	2	1
200215	22	9	12	14862	A	0	3306	6611	30		36	A	4	2	9	2
200260	1	5	16	14672	A	0	3910	6611	26		57	A	4	2	3	2
200212	19	6	6	14925	A	0	2511	6611	41		102	A	4	2	6	1
200272	7	12	20	4388	A	0	4009	6611	23		126	A	4	2	8	2
200274	5	2	15	8515	A	0	3704	6611	26		64	A	4	2	8	1
200316	3	5	16	7877	A	0	3610	6611	20		355	A	4	2	8	1
250317	25	5	6	8039	A	0	2008	40	2	10	478	A	4	2	7	1
250345	28	9	20	4210	A	0	4706	43	2		5	A	4	2	7	1
250409	6	1	18	4462	A	0	4710	53	7	5	12	A	4	2	7	1
250436	22	1	6	4503	A	0	3510	57	5	21	52	A	4	2	4	1
300106	7	8	14	7835	A	0	2711	6611	32		107	T	4	2	7	1
300213	1	6	17	8626	A	0	5201	6611	14		43	T	4	2	0	1
300243	29	5	17	14775	A	0	4009	6611	17		152	T	4	2	9	1
300261	24	4	14	13664	A	0	3309	6611	19		720	T	4	2	6	1
300443	23	5	16	14939	A	0	3706	6611	28		147	T	4	2	7	1
300469	28	10	19	13343	A	0	4603	6611	22		165	T	4	2	9	1
300524	20	2	12	8491	A	0	3009	6611	16		58	T	4	2	0	1
300590	30	1	10	8538	A	0	2503	6611	41		2074	T	4	2	1	1
300682	13	11	9	8967	A	0	4209	6611	23		76	T	4	2	6	1
300717	29	5	11	14899	A	0	3611	6611	20		99	T	4	2	7	1
300796	19	1	4	15102	A	0	2403	6611	32		875	T	4	2	7	1
300809	25	7	13	13993	A	0	4210	6611	22		57	T	4	2	2	1
300837	1	8	7	14682	A	0	2312	6611	35		170	T	4	2	7	1

300855	1	4	15	13989	A	0	3608	6611	30	1250	T	4	2	4	1	021113110	S11001031	D	7	0	L	0		0	0	
300922	29	8	1	14522	A	0	3506	6611	31	353	T	4	2	2	1	000000	S12111111			0		0		0	0	
300972	19	9	20	8583	A	0	3309	6611	27	123	T	4	2	7	1	000000	T01001001			0		0		0	0	
300995	2	5	14	4259	A	0	3606	6611	22	527	T	4	2	8	2	000000	T01011011			0		0		0	0	
301011	13	6	16	14010	A	0	4710	6611	10	101	T	4	2	8	1	000000	T01001001			0		0		0	0	
301041	23	3	13	4360	A	0	2006	6611	21	147	T	4	2	7	1	000000	000000		PS	3	P	0	P	1	0	
301071	27	11	15	13826	A	0	4704	6611	18	304	T	4	2	7	1	000000	T10001011		L	0	L	1		0	0	
301097	13	11	9	7032	A	0	3611	6611	29	675	T	4	2	5	1	000000	000000		B2	1		0		0	0	
301099	21	7	18	14715	A	0	4235	6611	24	552	T	4	2	7	1	000000	T11011010			0		0		0	0	
301112	26	5	18	9696	A	0	3707	6611	28	560	T	4	2	6	1	000000	000000		L	0	L	0		0	0	
301375	7	3	15	13977	A	0	4412	6611	31	500	T	4	2	4	1	000000	S01001001		L	1	L	0		0	0	
301404	2	3	17	15061	A	0	3404	6611	32	12	T	4	2	7	1	000000	000000		PS	1		0	P	2	0	
301457	24	12	16	8025	A	0	3707	6611	20	285	T	4	2	7	1	000000	000000		7	0		0		0	0	
301534	14	11	11	4547	A	0	2812	6611	27	637	T	4	2	7	1	000000	000000		PS	1		0		0	0	
301605	1	2	9	8500	A	0	4502	6611	20	22	T	4	2	6	1	000000	T01001001			0		0		0	0	
301614	13	6	20	4043	A	0	4109	6611	25	98	T	4	2	6	2	000001	000000			0		0		0	1	1
301622	17	7	22	13756	A	0	4203	6611	23	12	T	4	2	7	2	000000	000000			0		0		0	2	
301648	12	4	21	15327	A	0	4712	6611	19	321	T	4	2	1	1	011010010	000000	D		0		1		0	1	
301690	23	12	17	14710	A	0	3703	6611	28	301	T	4	2	7	1	000000	T01001001		9	0		0		0	0	
301745	5	7	18	8517	A	0	2707	6611	27	712	T	4	2	7	4	000000	T22011010			0	L	2		0	1	
301774	17	9	1	8804	A	0	2624	6611	43	267	T	4	2	7	1	000000	000000		B8	0		0		0	1	1
301784	27	12	21	13761	A	0	4611	6611	18	443	T	4	2	7	1	000000	000000		P	0		0		0	0	
301857	11	1	20	14743	A	0	4307	6611	24	122	T	4	2	8	1	000000	S01001001			0		0		0	0	
301874	4	6	10	14205	A	0	4007	6611	26	212	T	4	2	2	1	000000	000000	D		0		1		0	0	
301917	25	5	16	8475	A	0	4407	6611	[illegible]	732	T	4	2	7	1	000000	000000		5	1		0		0	0	1

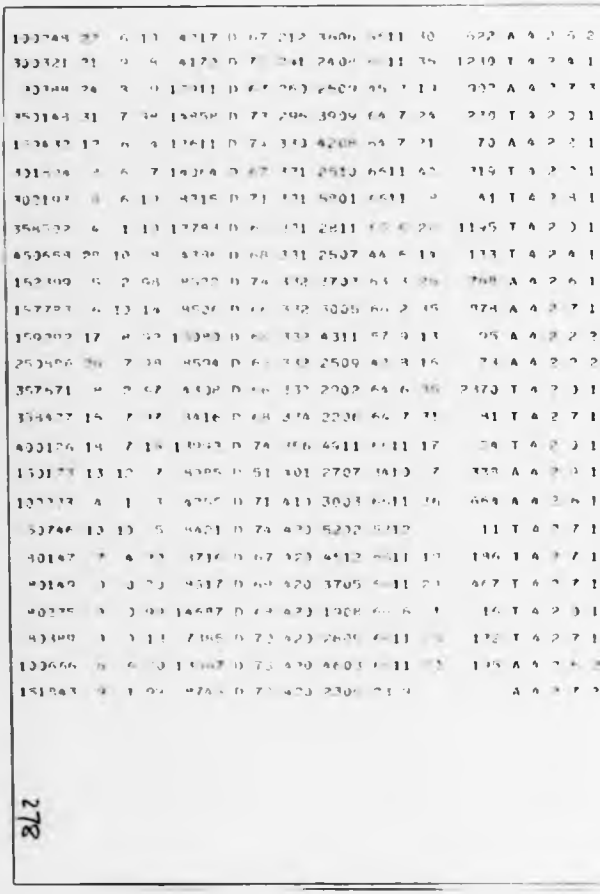
3D1D1Y	26	5	12	4572	A	0	4407	6611
3D1H7A	4	6	10	14795	A	0	4307	6611
3D1H4E	11	1	10	14767	A	0	4337	6611
3D12MA	27	12	23	12761	A	C	4M11	6611
3D1Z7A	17		1	M4QA	A	0	2M2A	6611
3D17A5	5	7	14	M5I3	A	0	1707	6611
3D15QQ	22	12	17	10710	A	0	1703	6611
3D1MH4	12	4	23	15033	A	C	4710	6611
3D15Y2	17	7	22	11755	A	0	4203	6611
3D151A	11	4	22	H043	A	0	4109	6611
3D1A05	1	2	0	H303	A	C	4502	6611
3D1Y2A	14	11	11	4547	A	0	2M12	6611
3D14A7	24	12	14	M025	A	0	3707	6611
3D1004	2	3	17	15041	A	0	2404	6611
3D1376	7	3	15	14722	A	0	4412	6611
3D1172	26	5	14	4446	A	0	4702	6611
3D1D41	21	2	14	10715	A	0	4205	6611
3D10W7	17	11	0	7002	A	0	3M11	6611
3D17Z7	27	11	15	13M26	A	C	4704	6611
3D1D41	22	3	12	4540	A	0	2006	6611
3D1D11	11	4	16	10010	A	0	4710	6611
3D1D76	2	5	14	4050	A	0	3706	6611
3D2272	14	3	23	M547	A	3	1705	6611
3D0222	20	4	1	14502	A	0	1506	66 7
3D0M45	1	4	15	13M9	A	0	3402	6611

301920	14	12	10	13678	A	0		2912	6611	36	1325	T	4	2	7	1			
302032	13	2	7	8119	A	0		3901	6611	27	68	T	4	2	2	2			
302061	29	4	18	14358	A	0		3406	6611	31	2179	T	4	2	6	1			
302062	9	8	17	13867	A	0		3809	6611	27	754	T	4	2	6	1			
302083	13	3	12	8432	A	0		3609	6611	30	303	T	4	2	1	1			
302093	3	4	16	9647	A	0		4303	6611	21	453	T	4	2	7	1			
302107	1	10	14	14626	A	0		3711	6611	28	817	T	4	2	7	1			
302110	1	5	11	9627	A	0		3904	6611	27	148	T	4	2	7	1			
302186	12	9	20	4435	A	0		3911	66	9	26	431	T	4	2	7	1		
302236	22	4	19	13566	A	0		3901	6611	24	687	T	4	2	7	1			
302303	26	4	19	8105	A	0		3638	6611	28	655	T	4	2	7	1			
302319	21	5	13	9643	A	0		3704	6611	23	144	T	4	2	7	1			
302329	26	7	18	13835	A	0		3611	6611	23	452	T	4	2	7	1			
350492	25	7	22	9536	A	0		1811	60	3	36	3056	T	4	2	2	1		
351315	0	0	0	3465	A	0		2906	37	4		2	T	4	2	2	1		
351545	25	2	28	13740	A	0		2804	64	7	36	259	T	4	2	6	1		
351810	0	0	11	15319	A	0		3309	42	5	14	1864	T	4	2	7	1		
352057	9	2	26	14702	A	0		2101	64	4	38	1720	T	4	2	3	1		
353406	31	8	13	4630	A	0		3402	64	9	26	248	T	4	2	7	1		
353409	7	8	2	13785	A	0		3006	64	7	34	711	T	4	2	7	2		
353477	1	5	20	9359	A	0		3907	6010	2		111	T	4	2	7	1		
354006	15	1	15	14893	A	0		3506	47	5	6	36	T	4	2	4	1		
354173	0	0	06	7276	A	0		2602	25	7		2	T	4	2	6	2		
354339	9	6	23	13547	A	0		1906	61	6	23	304	T	4	2	2	1		
355715	14	11	27	8169	A	0		1905	64	7	28	536	T	4	2	2	1		

355369	15	6	9	4352	A	0		1908	64	7	21		436	T	4	2	7	1
356015	8	12	93	4603	A	0		2008	6112	35			134	T	4	2	4	1
356543	27	7	16	4381	A	0		4305	64	9	21		98	T	4	2	2	1
357285	5	6	91	13739	A	0		4305	53	6	16		41	T	4	2	3	1
357787	19	5	95	13744	A	0		1913	63	5	34		383	T	4	2	6	1
357801	25	2	13	15067	A	0		4513	6611	13			252	T	4	2	3	2
358326	5	5	97	13628	A	0		1536	64	7	43		202	T	4	2	0	1
358146	3	9	3	8000	A	0		2911	53	4	23		924	T	4	2	7	1
358471	18	9	20	14680	A	0		5836	58	9				T	4	2	7	1
400043	14	3	19	4613	A	0		3902	6611	24			402	T	4	2	3	1
400210	13	3	23	8857	A	0		3710	6611	29			423	T	4	2	7	1
400240	9	11	10	13088	A	0		2530	6611	34			19	T	4	2	0	1
450652	23	7	98	4417	A	0		1007	56	7	56		816	T	4	2	6	1
450653	11	12	94	13820	A	0		607	54	7	43		739	T	4	2	5	1
500052	23	9	15	14832	A	0		6511	6611		1		6	T	4	2	0	1
500075	12	1	11	14676	A	0		6511	6611		1		2	T	4	2	3	1
500178	26	9	14	8831	A	0		6511	6611		1		2	T	4	2	7	1
500202	25	1	12	13987	A	0		6511	6611		1			T	4	2	2	1
500284	22	11	14	14781	A	0		6511	6611		1		2	T	4	2	7	1
500330	12	12	97	8236	A	0		6511	6611		1		2	T	4	2	0	1
650302	13	3	20	13821	A	0		4907	56	8	7		14	T	4	2	7	1
650498	25	5	23	9252	A	0		4701	63	1	16		523	T	4	2	7	2
650502	25	12	11	14039	A	0		4611	63	8			1	T	4	2	7	1
700016	31	5	17	14675	A	0		5802	6611		8		27	T	4	2	7	1
700211	21	6	16	14758	A	0		5604	6611		8		17	T	4	2	3	1

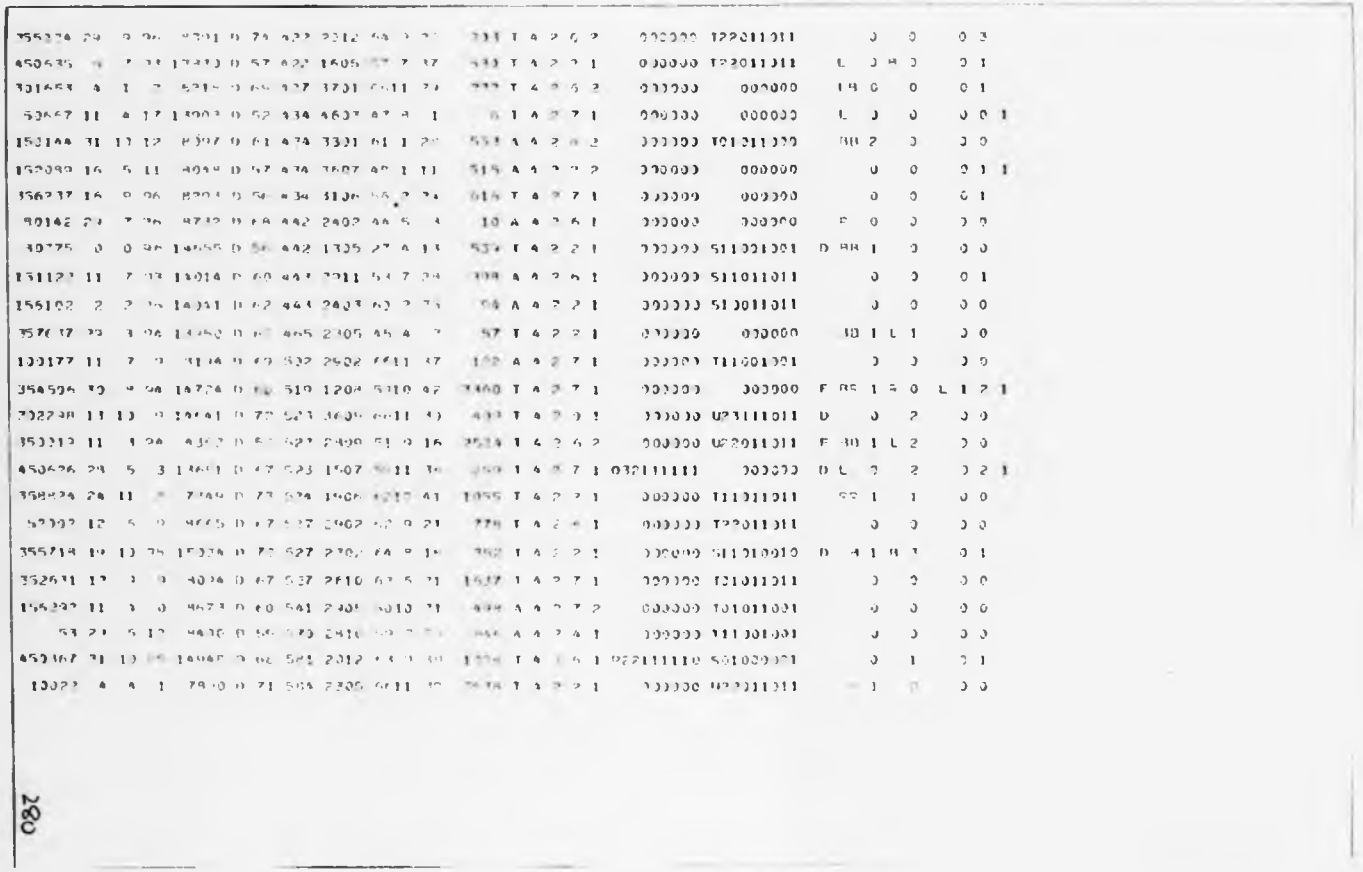


352730	14	3	06	8304	D	71	154	1007	66	2	48	462	T	A	2	6	1
250345	1	7	8	13627	D	60	157	4411	47	4	2	6	A	A	2	6	1
10181	15	6	9	8683	D	67	162	2306	66	6	39	1570	T	A	2	3	1
10602	17	2	12	7812	D	71	162	3512	6611	33		137	T	A	2	6	1
52009	0	0	2	4771	D	66	162	1809	66	8	45	2892	T	A	2	0	1
130938	16	7	2	7918	D	72	162	2904	6611	37		31	A	A	2	7	1
101535	4	5	20	8728	D	69	162	4602	6611	20		196	A	A	2	7	1
157767	18	2	3	14737	D	71	162	2506	5112	26		67	A	A	2	2	1
158094	15	10	24	14603	D	64	162	3602	5911	23		54	A	A	2	6	1
350772	28	5	06	8148	D	67	162	2605	6310	25		542	T	A	2	0	2
354093	26	5	16	14320	D	56	162	3507	55	4	15	71	T	A	2	7	1
355424	4	5	17	8830	D	54	162	3606	53	8	17	170	T	A	2	6	1
355747	11	11	17	4473	D	66	162	3606	58	7	21	946	T	A	2	7	1
357491	2	10	10	14650	D	60	162	4409	60	9	16	398	T	A	2	7	1
158827	2	7	4	7373	D	66	177	2506	66	7	38	30	A	A	2	0	1
159429	21	2	23	13388	D	68	177	2511	58	4	32	73	A	A	2	5	1
101639	6	11	7	8707	D	57	181	4503	6611	21		44	A	A	2	2	1
101101	25	2	12	13931	D	70	193	4704	6611	13		43	A	A	2	6	2
358033	15	5	21	7947	D	53	193	2310	5212	29		91	T	A	2	6	1
450533	26	2	3	8688	D	65	193	2307	65	1	37	1738	T	A	2	7	1
151233	2	1	6	17978	D	61	196	3502	44	7	4	25	A	A	2	7	2
230137	13	9	11	14010	D	66	197	4404	6611	22		43	A	A	2	6	1
450381	0	0	0	8745	D	56	199	2210	35	7	2	31	T	A	2	8	2
250626	14	10	23	3637	D	66	200	2308	5311	43		99	A	A	2	7	2
100103	4	8	8	13622	D	72	204	3705	6611	24		116	A	A	2	0	1



272

```
0 2 2 2    000000    000000        0   0    0 1
0 2 6 1    000000 T01001011        0   0    0 0
0 2 8 1    000000 T11011001    B   0   0    0 0
0 2 7 1    000000 S12011011        0   0    0 0
0 2 6 2    000000 T21011011  D  B 1 B 2    0 1
0 2 2 1    000000 T01001001    BB 1 B 0    0 0
0 2 6 1 B01010000 S11001011    BB 0   0    0 0
0 2 6 1    000000 S22011011        0   0    0 0
0 2 7 1    000000    000000        0   0    0 1
0 2 8 2    000000    000000    B   0   0    0 0
0 2 6 1    000000    000000    B   0   0    0 1
0 2 7 1    000000 T01011011        0   0    0 0
0 2 7 1    000000    000000    L   0   0 B  1 0
0 2 2 1    000000    000000        0   0    0 1
0 2 7 1    000000 T22111111        0   0    0 0
0 2 2 2    000000    000000    LL  1   0    0 0
0 2 6 2    000000 S01001001        0   0    0 1
0 2 2 2    000000 T11011011  D LL  1   0    0 1
0 2 6 2 B21011010 T12001010        0   0    0 1
0 2 7 1    000000 T10011000        0   0    0 0
0 2 2 1    000000 T01011011        0   0    0 0
0 2 2 1    000000 S10001001  D     0   B 1  0 1
0 2 6 1    000000    000000    LB  0   1    0 0
0 2 7 1    000000    000000        0   0    0 1
0 2 7 1    000000 T22111110    BB  1   -  1  0 0
```



1	000000	T01011011		0	0	0	0		
1	000000	T11011011	T	0	0	0	0		
2	000000	T01001001	T	1	1	0	0		
1	000000	000000	T	0	0	0	0	0	1
1	000000	000000		0	0	0	1		
1	000000	T01001001		0	0	0	0		
1	000000	S01001001		0	1	0	0	0	1
1	000000	000000		0	0	0	1	1	

COHORT "B"

Reader 5

"Normals"

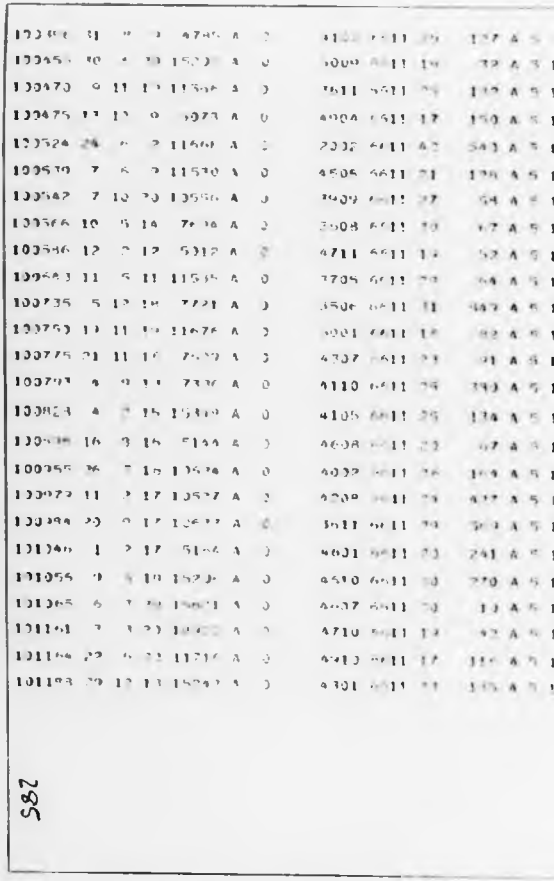
pp. 283 - 303

"Less-than-normals"

pp. 304 - 314

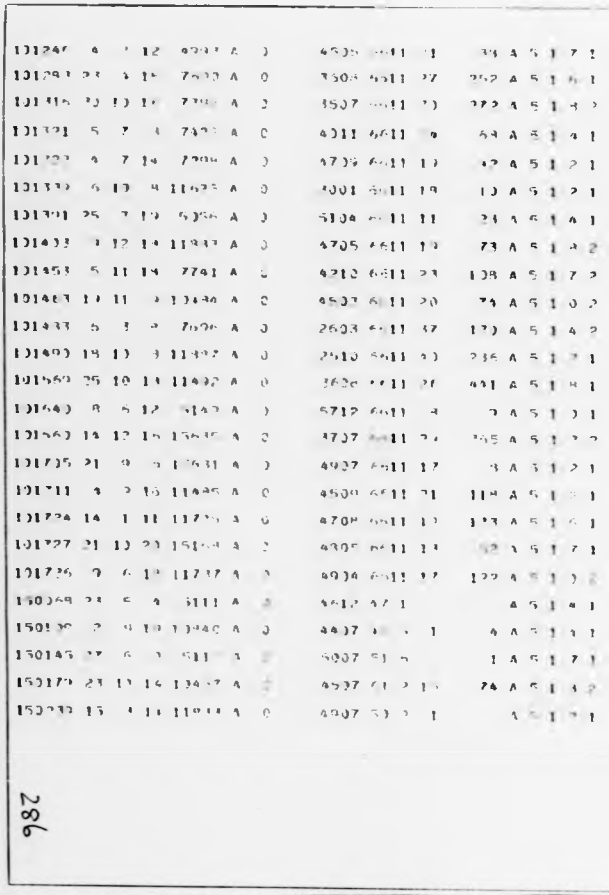
15	16	11	23	10917	A	0	4808	54	6	14		53	A	5	1	7	1
31	3	6	13	10676	A	0	3411	4613	11			382	A	5	1	7	1
33	12	7	8	15453	A	0	2604	60	2	32		639	A	5	1	6	1
63	9	5	12	7615	A	0	4209	6611	21			190	T	5	1	2	1
10462	5	4	17	10501	A	0	4510	6611	23			152	T	5	1	7	1
10513	12	4	19	11931	A	0	4507	6611	20			57	T	5	1	6	1
10737	11	2	19	15283	A	0	4509	6611	23			172	T	5	1	7	2
40161	0	0	3	10576	A	0	1705	63	6	43		146	T	5	1	2	1
50039	14	11	20	7608	A	0	4801	49	1			2	T	5	1	8	1
50477	6	11	18	5205	A	0	4703	50	1	2		30	T	5	1	7	1
50565	0	0	13	5027	A	0	3311	59	2	5		984	T	5	1	6	1
50615	11	4	19	10862	A	0	4801	56	4	8		65	T	5	1	2	1
50643	1	11	7	7786	A	0	4308	47	4			52	T	5	1	7	1
50666	14	4	18	16383	A	0	4510	47	8	1		10	T	5	1	8	1
50715	0	0	1	7643	A	0	2006	46	8	2		38	T	5	1	8	2
52757	29	9	20	11634	A	0	3732	46	7	3		240	T	5	1	7	1
80006	27	6	14	4939	A	0	4005	6611	25			178	T	5	1	0	2
80074	0	0	20	11661	A	0	3702	6611	16			59	T	5	1	7	1
80141	0	0	4	15229	A	0	2602	6611	13			147	T	5	1	0	2
80272	0	0	8	13422	A	0	2306	6611	10			203	T	5	1	6	1
80104	0	0	11	10406	A	0	2808	6611	9			16	T	5	1	0	2
80114	21	0	18	10597	A	0	5804	6611	2			42	T	5	1	2	1
80177	0	0	0	15559	A	0	1811	53	6	36		213	T	5	1	2	1
80140	6	5	2	7444	A	0	2403	44	2	19		61	A	5	1	7	3
80170	0	0	18	11913	A	0	3702	6611	28			246	T	5	1	7	1

80177	23	7	18	12685	A	0		3708	6611	25		333	T	5	1
80196	0	0	2	4773	A	0		1902	6611	28		248	T	5	1
80217	0	0	94	7196	A	0		1811	66	5	20	183	T	5	1
80218	2	4	13	10930	A	0		2704	91	0	1	8	A	5	1
80227	22	8	11	15233	A	0		2901	6611	22		47	T	5	1
80247	0	0	11	10409	A	0		2910	6611	13		462	T	5	1
80248	0	0	97	15151	A	0		1901	6611	2		437	T	5	1
80306	29	11	9	7534	A	0		4510	65	5		10	A	5	1
80513	4	2	10	15413	A	0		4707	6611	13		122	T	5	1
100022	6	6	13	11636	A	0		3607	6611	20		682	A	5	1
100035	13	8	16	5141	A	0		3606	6611	20		102	A	5	1
100053	17	7	16	7343	A	0		3302	6611	31		443	A	5	1
100063	11	12	14	11576	A	0		4110	6611	25		113	A	5	1
100077	28	7	16	11608	A	0		3403	6611	32		443	A	5	1
100096	30	12	15	15397	A	0		3309	6611	23		534	A	5	1
100104	11	3	12	15323	A	0		3704	6611	28		171	A	5	1
100147	17	9	12	7766	A	0		2803	6611	38		764	A	5	1
100159	13	4	15	10812	A	0		3302	6611	33		569	A	5	1
100170	23	5	16	10671	A	0		3612	6611	22		155	A	5	1
100213	1	13	15	11956	A	0		5105	6611	15		13	A	5	1
100211	9	13	8	5071	A	0		2505	6611	13		74	A	5	1
100239	8	5	20	4708	A	0		4505	6611	19		93	A	5	1
100268	13	2	16	10827	A	0		3509	6611	21		147	A	5	1
100271	15	1	11	15342	A	0		4008	6611	24		53	A	5	1
100304	29	6	17	15243	A	0		5105	6611	11		23	A	5	1



582

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000



0	0	0	0	000000	000000	1
0	0	0	0	000000	000000	2
0	0	0	0	000000	000000	3
0	0	0	0	000000-0	000000-0	4
0	0	0	0	000000	000000	5
1	0	0	0	000000	000000	6
0	0	0	0	000000	000000	7
0	0	0	0	000000	000000	8
1	0	0	0	000000	000000	9
0	0	0	0	000000	000000	10
0	0	0	0	000000	000000	11
0	0	0	0	000000-0	000000-0	12
0	0	0	0	000000-0	000000-0	13
0	0	0	0	000000	000000	14
0	0	0	0	000000	000000	15
0	0	0	0	000000	000000	16
0	0	0	0	000000	000000	17
0	0	0	0	000000	000000	18
0	0	0	0	000000	000000	19
0	0	0	0	000000	000000	20

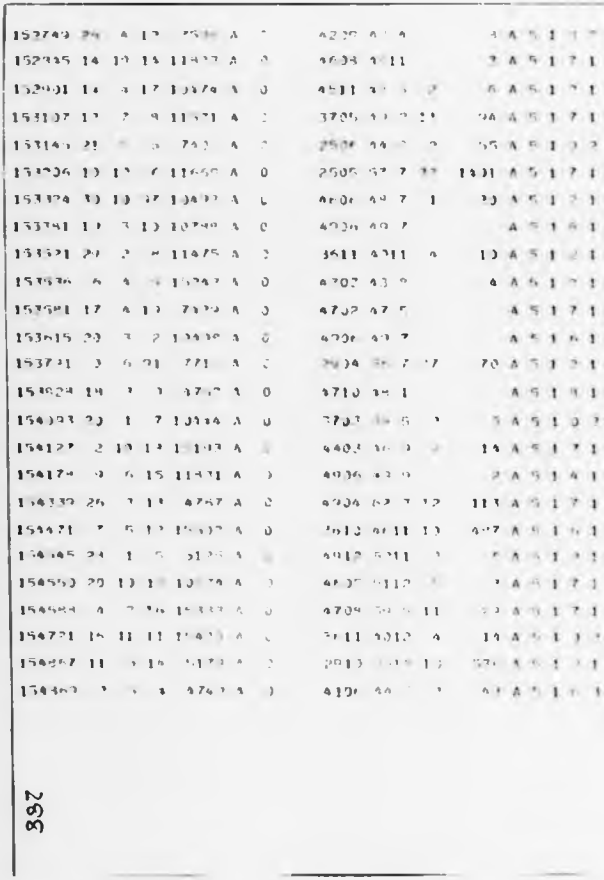
101246	4	3	12	4993	A	0	4505	6611		21	88	A	5	1
101283	23	4	18	7690	A	0	3508	6611		27	252	A	5	1
101316	30	10	16	7398	A	0	3507	6611		30	272	A	5	1
101321	5	7	3	7423	A	0	4011	6611		24	68	A	5	1
101322	4	7	14	7298	A	0	4709	6611		19	42	A	5	1
101339	6	10	8	11625	A	0	3001	6611		19	10	A	5	1
101391	25	3	19	5056	A	0	5104	6611		11	23	A	5	1
101403	9	12	14	11983	A	0	4705	6611		19	73	A	5	1
101453	5	11	14	7741	A	0	4210	6611		23	108	A	5	1
101463	19	11	9	10494	A	0	4503	6611		20	74	A	5	1
101483	6	3	9	7696	A	0	2603	6611		37	130	A	5	1
101490	18	10	8	11897	A	0	2510	6611		40	236	A	5	1
101569	25	10	14	11492	A	0	3608	6611		26	441	A	5	1
101640	8	6	12	5149	A	0	5712	6611		8	9	A	5	1
101660	14	12	16	15635	A	0	3707	6611		29	365	A	5	1
101705	21	9	6	15631	A	0	4907	6611		17	9	A	5	1
101711	4	2	16	11495	A	0	4509	6611		21	118	A	5	1
101724	14	1	11	11725	A	0	4708	6611		19	173	A	5	1
101727	21	10	20	15169	A	0	4805	6611		19	52	A	5	1
101736	9	6	18	11787	A	0	4904	6611		17	122	A	5	1
150069	23	5	4	5111	A	0	4612	47	1			A	5	1
150109	2	9	19	10940	A	0	4407	46	5	1	4	A	5	1
150145	27	6	0	5113	A	0	5007	51	6		1	A	5	1
150179	23	13	14	10457	A	0	4507	61	2	15	74	A	5	1
150239	15	3	14	11833	A	0	4907	50	2	1		A	5	1

286

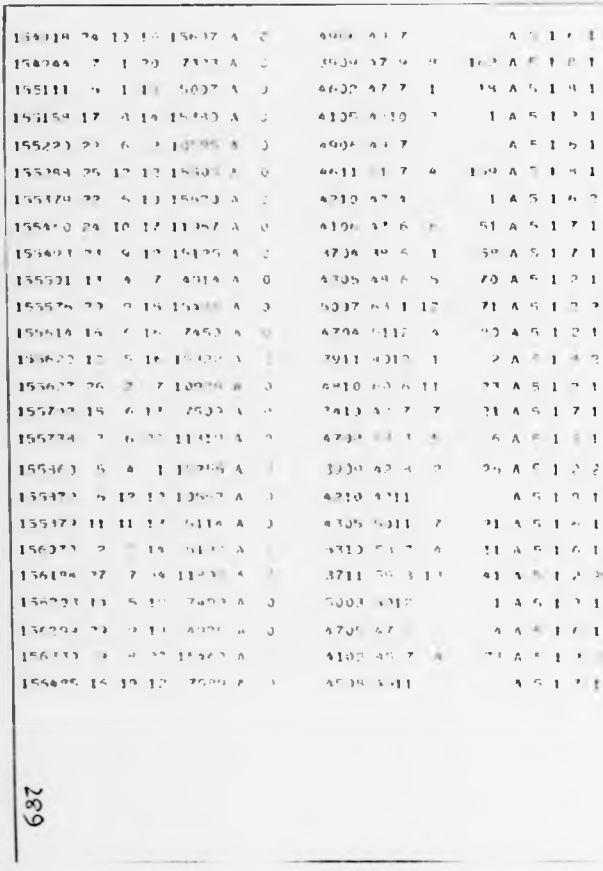
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000-0	000000-0	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000-0	000000-0	1 0
0	0	0	0	000000-0	000000-0	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000-0	000000-0	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000-0	000000-0	1 0
0	0	0	0	000000	000000	1 0
0	0	0	0	000000	000000	1 0

153324	12	5	[illegible]	15211	A	0	3513	47	9	11	35	A	5	1
153414	6	8	23	15436	A	0	3203	58	5	6	12	A	5	1
153614	21	8	20	7653	A	0	3704	47	7	5	44	A	5	1
153677	0	3	30	13553	A	0	2209	2210			2	A	5	1
153474	5	9	3	12533	A	0	4709	4711				A	5	1
153995	1	1	14	7509	A	0	3404	58	7	26	482	A	5	1
153943	6	9	10	5315	A	0	3705	44	2	6	17	A	5	1
153969	26	5	17	13899	A	0	4106	46	3	4	13	A	5	1
153985	8	9	15	5174	A	0	3708	55	3	14	41	A	5	1
151222	13	7	16	11936	A	0	2310	52	8	12	77	A	5	1
151232	6	6	23	10837	A	0	4704	47	9		13	A	5	1
151233	20	3	16	11529	A	0	3534	3712	12		126	A	5	1
151324	7	11	8	7430	A	0	2508	40	5	3	153	A	5	1
151334	13	13	10	13346	A	0	3209	46	8	4	2	A	5	1
151405	13	3	11	5132	A	0	4507	46	7	1	6	A	5	1
151728	1	5	16	11425	A	0	4703	47	5			A	5	1
151736	13	12	15	15382	A	0	4510	4613		2	7	A	5	1
151874	13	6	15	10610	A	0	4107	53	8	3	21	A	5	1
151890	9	7	14	15235	A	0	3607	36	9	4	3	A	5	1
151959	14	1	3	7301	A	0	4531	47	2	2	5	A	5	1
152009	24	12	16	4777	A	0	5310	59	3	4	8	A	5	1
152013	27	4	7	5132	A	0	2603	47	2	14	634	A	5	1
152275	17	4	12	4757	A	0	2802	47	5	16	300	A	5	1
152633	22	11	19	15434	A	0	4834	58	8	5	12	A	5	1
152639	3	10	17	10445	A	0	4904	57	[illegible]	[illegible]	117	A	5	1

0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000-0	000000-0
0 0	0	0	000000-0	000000-0
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000-0	000000-0
0 0	0	0	000000	000000
0 0	0	0	000000-0	000000-0
0 0	0	0	000000-0	000000-0
0 0	0	0	000000	000000
0 0	0	0	000000-0	000000-0
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000-0	000000-0
0 0	0	0	000000	000000
0 0	0	0	000000	000000
0 0	0	0	000000	000000



	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000-0	000000-0
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000

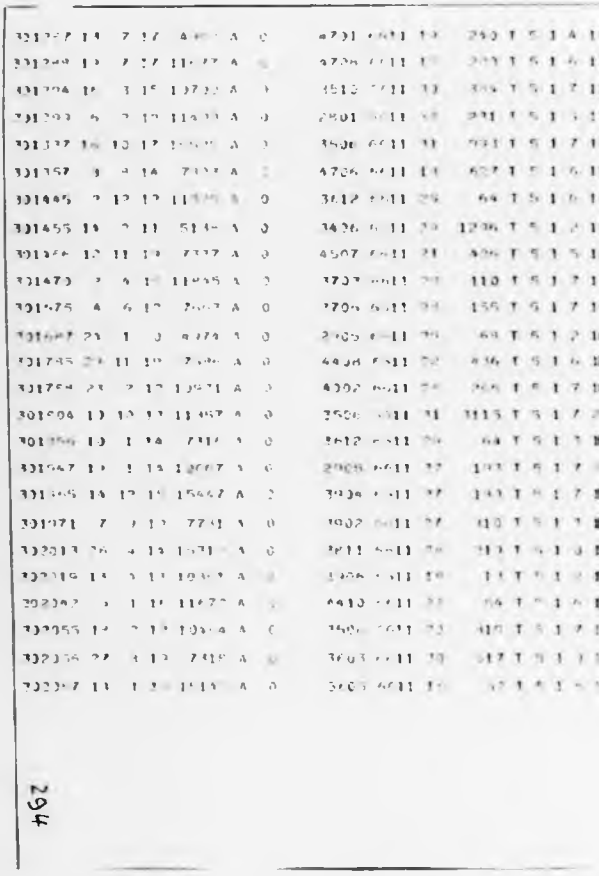


156594	5	5	9	11810	A	0	4407	49	1	11		81	A	5	1	7	1
156859	12	1	9	9742	A	0	3511	4	11	11		563	A	5	1	6	1
156953	1	7	17	11611	A	0	4409	42	7	10		143	A	5	1	6	1
157006	14	10	15	7642	A	0	4806	52	1			16	A	5	1	4	1
157023	1	7	15	15519	A	0	7318	42	9	9		442	A	5	1	4	2
157181	17	7	19	10770	A	0	4706	47	4				A	5	1	9	1
157310	14	9	10	7777	A	0	4205	4410		1		15	A	5	1	7	1
157447	26	10	17	5228	A	0	4610	51	5	2		8	A	5	1	9	1
157586	17	11	11	7648	A	0	5101	51	8			1	A	5	1	7	1
157718	21	7	16	10865	A	0	4712	53	2	2		9	A	5	1	4	1
157726	23	4	8	7401	A	0	4707	4410		1		63	A	5	1	0	1
157735	3	7	17	7617	A	0	3503	47	6	12		443	A	5	1	7	2
157792	12	11	11	11837	A	0	2909	4312		11		393	A	5	1	9	2
157839	6	1	15	11523	A	0	4410	38	8	13		29	A	5	1	2	1
157935	8	2	11	13911	A	0	3609	43	6	4		10	A	5	1	2	1
158035	25	12	9	10672	A	0	4107	46	8	5		71	A	5	1	7	1
158159	15	7	14	13769	A	0	3411	45	9	13		509	A	5	1	6	1
158289	29	8	20	10456	A	0	3810	41	5	4		185	A	5	1	7	2
158458	23	2	20	5139	A	0	4904	51	7	2		23	A	5	1	7	1
158527	11	9	13	10847	A	0	3112	41	3	4		148	A	5	1	4	1
158649	7	3	16	13704	A	0	4808	4411					A	5	1	7	1
158714	11	11	18	7456	A	0	4711	43	7	1		4	A	5	1	9	2
158734	23	12	6	7672	A	0	4706	51	3	3		8	A	5	1	7	1
158804	17	4	12	7585	A	0	5101	45	4	14		29	A	5	1	2	1
158815	10	12	20	15440	A	0	4802	50	9	8		38	A	5	1	6	1

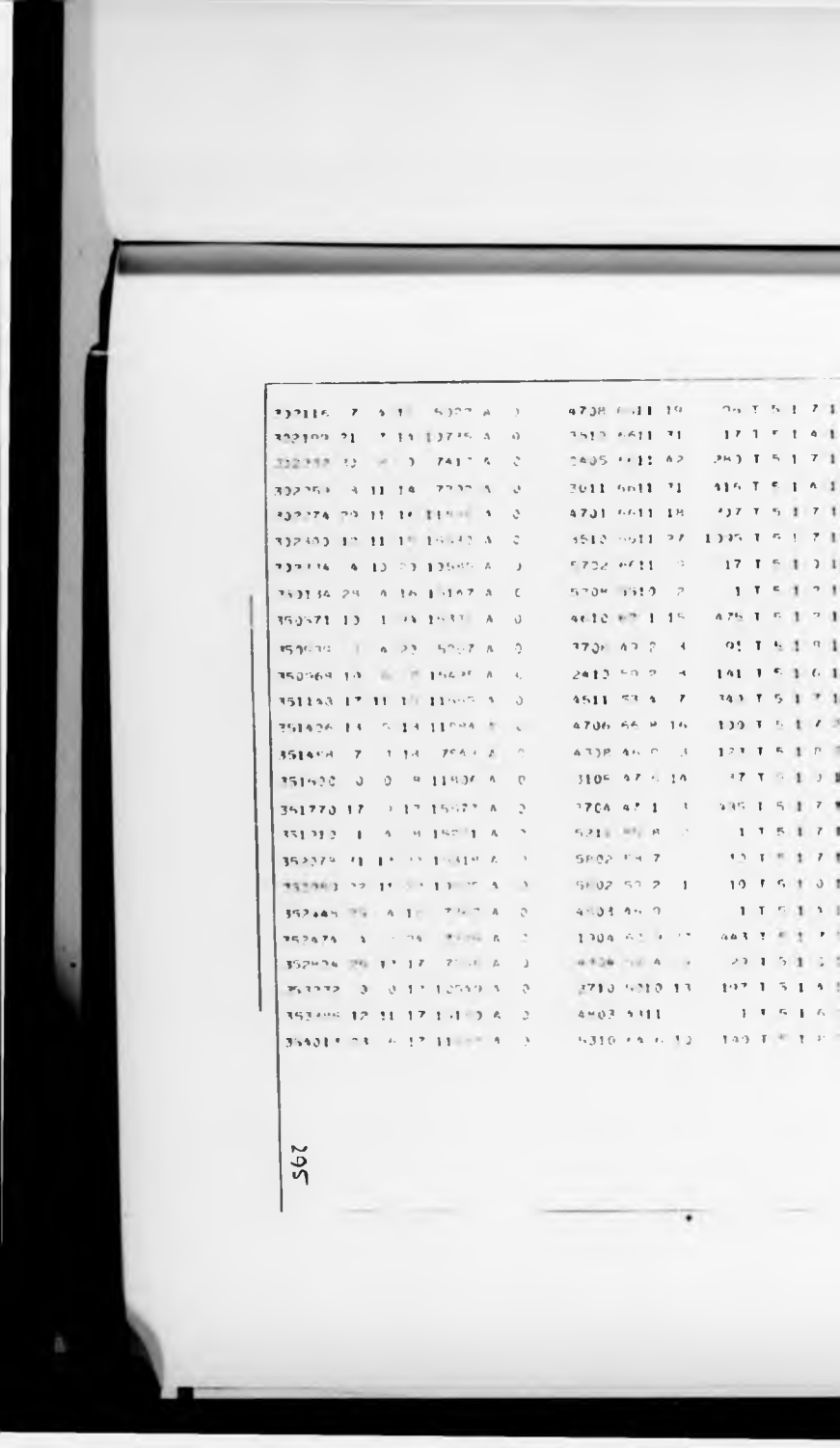
	0	0	0	0	000000	000000	1	2
	0	0	0	0	000000-0	000000-0	1	2
	0	0	0	0	000000-0	000000-0	1	[illegible]
1	0	0	0	0	000000	000000	[illegible]	2
1	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000-0	000000-0	1	[illegible]
	0	0	0	0	000000-0	000000-0	1	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000	000000	1	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000-0	000000-0	1	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000	000000	2	[illegible]
	0	0	0	0	000000	000000	2	2
	0	0	0	0	000000-0	000000-0	1	2
	0	0	0	0	000000	000000	1	2
	0	0	0	0	000000	000000	[illegible]	[illegible]
	0	0	0	0	000000	000000	1	[illegible]
	0	0	0	0	000000	000000	2	2
	0	0	0	0	000000-0	000000-0	1	2
	0	0	0	0	000000	000000	1	[illegible]
1	0	0	0	0	000000	000000	2	0
	0	0	0	0	000000	000000	1	[illegible]

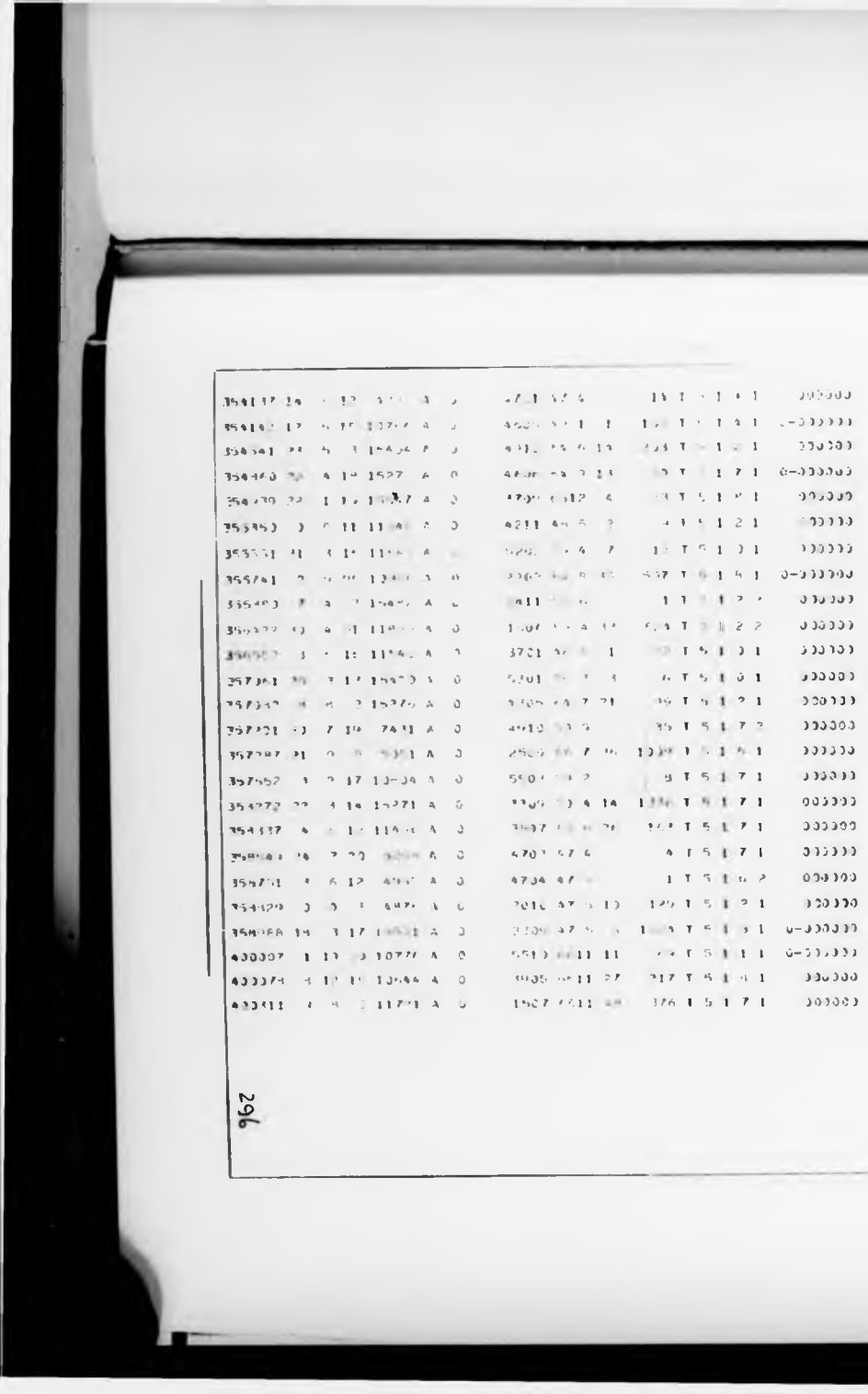
158340	20	3	11	11650	A	0	4909	65	6	15	26	A	5	1
158344	14	3	20	10724	A	0	4802	51	3	3	6	A	5	1
159233	14	2	29	11542	A	0	2011	64	3	21	41	A	5	1
159247	8	6	10	10779	A	0	2906	41	6	12	9	A	5	1
159322	27	5	0	11771	A	0	4208	54	6	21	182	A	5	1
159326	6	4	6	10523	A	0	2607	43	3	17	58	A	5	1
159400	9	10	26	5100	A	0	1512	6110		27	77	A	5	1
159406	14	11	0	15356	A	0	2003	5210		24	381	A	5	1
159423	25	7	15	15315	A	0	3208	38	6	4	7	A	5	1
159435	27	10	0	5204	A	0	4608	6611		16	93	A	5	1
200080	2	8	17	11577	A	0	3511	6611		31	283	A	5	1
200087	23	12	4	15157	A	0	3704	6611		29	20	A	5	1
200127	20	12	14	10738	A	0	3405	6611		26	206	A	5	1
200163	16	11	20	11930	A	0	4603	6611		20	55	A	5	1
200194	30	4	2	10671	A	0	2509	6611		41	105	A	5	1
200239	16	3	15	5149	A	0	4301	6611		20	42	A	5	1
200403	24	11	19	10766	A	0	4608	6611		17	47	A	5	1
250036	22	3	18	15623	A	0	4208	41	3		1	A	5	1
250071	1	10	5	10813	A	0	3502	42	7	7	14	A	5	1
250216	16	6	18	7540	A	0	3703	47	6	10	73	A	5	1
250347	1	5	16	4849	A	0	3512	43	6	7	19	A	5	1
250396	9	3	13	15152	A	0	4509	46	5		5	A	5	1
250446	13	5	12	15574	A	0	4603	46	6		2	A	5	1
250473	23	6	19	15201	A	0	4504	45	6		1	A	5	1
250472	4	7	15	5136	A	0	4601	49	6	3	2	A	5	1

0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000-0	000000-0
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000

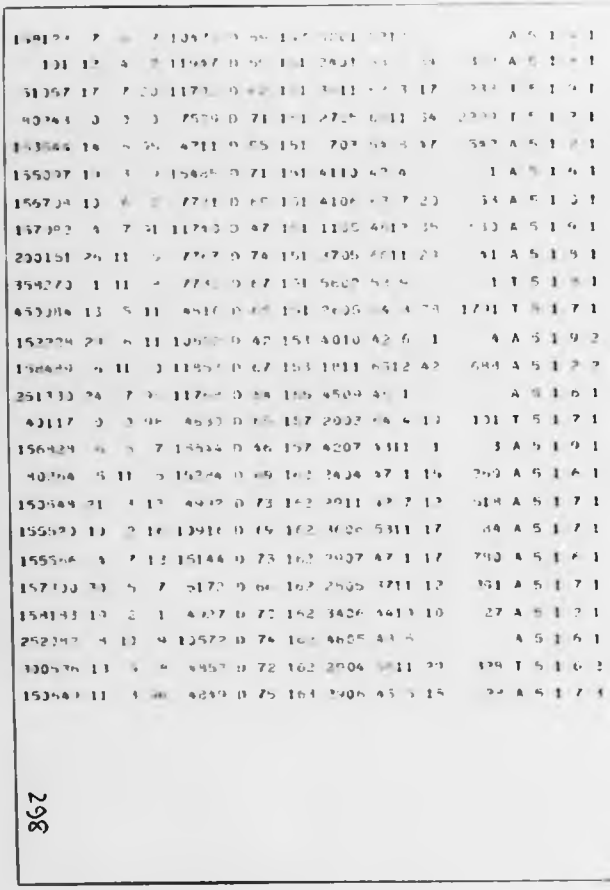


```
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000-0   000000-0
0 0    0   0      000000-0   000000-0
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
0 0    0   0      000000     000000
```



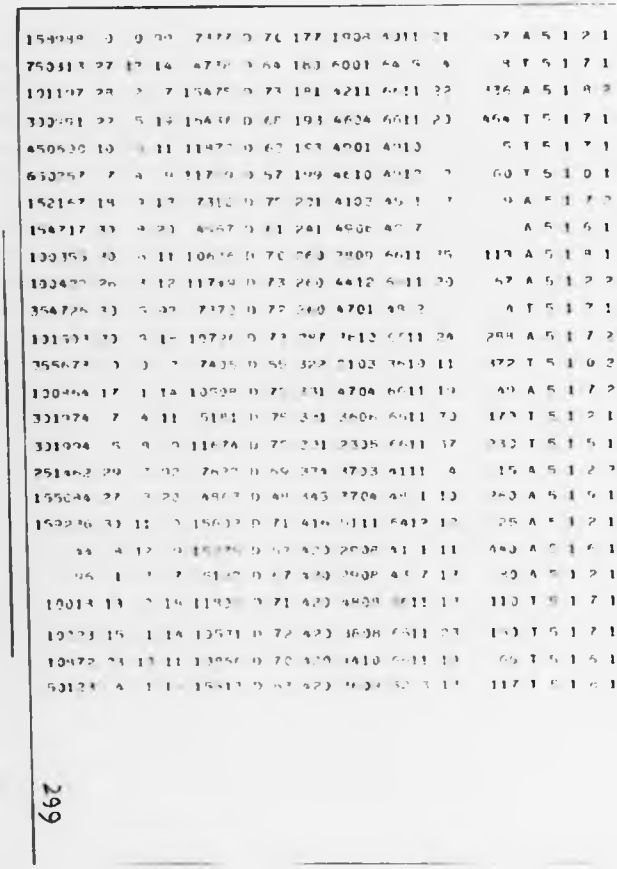


0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000



862

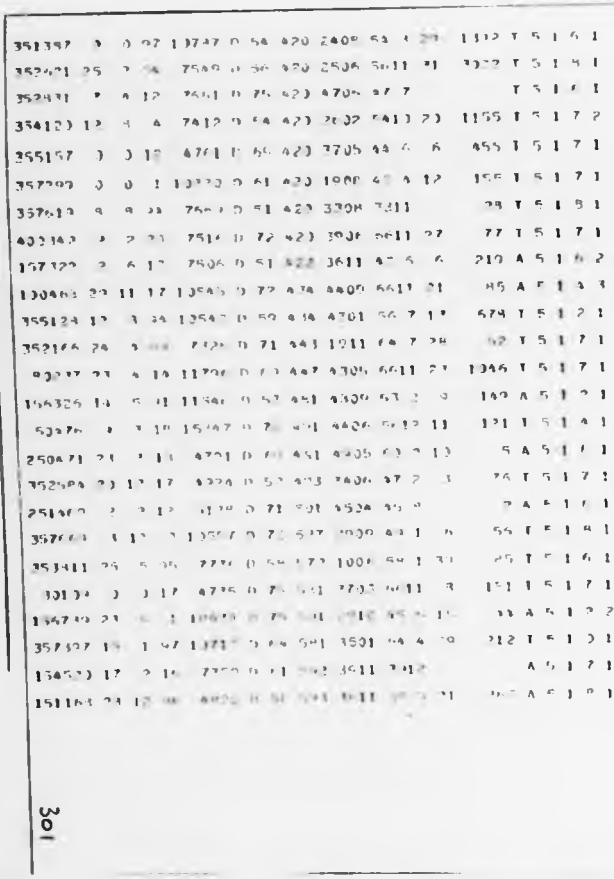
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

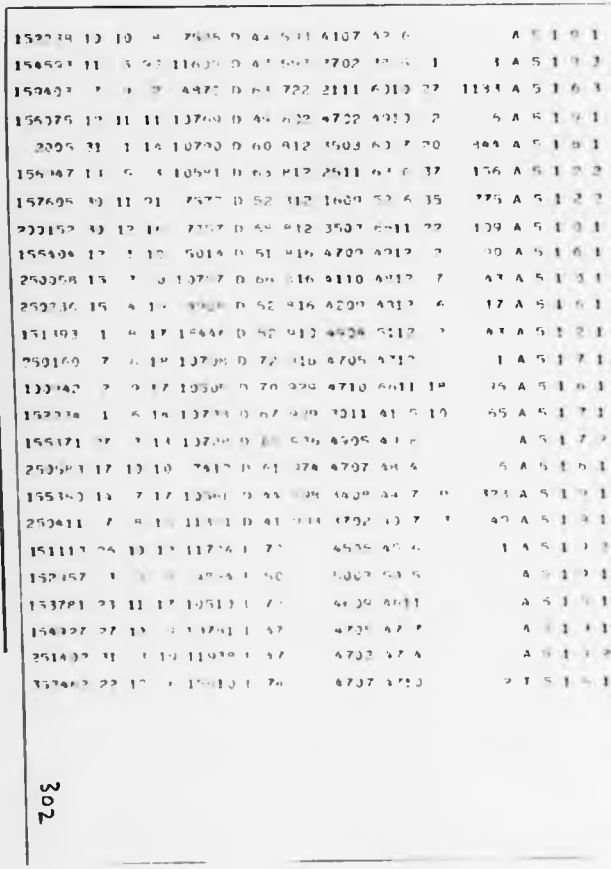


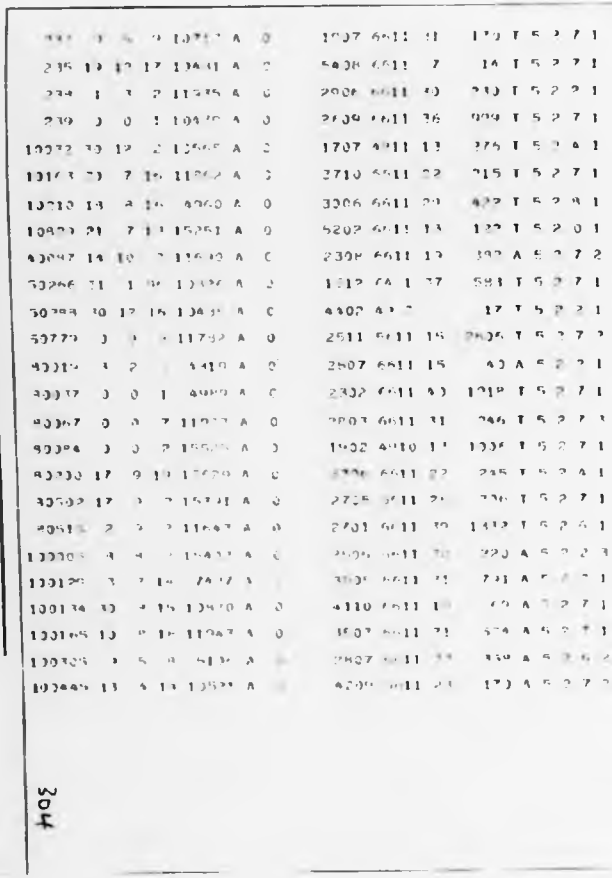
[illegible]	T	5	1	7	1	000000	000000	0	0	0	0	
111	A	[illegible]	1	7	[illegible]	000000	000000	0	0	0	0	
[illegible]	A	[illegible]	1	2	1	000000	000000	0	0	0	0	
[illegible]	A	5	1	6	2	000000	000000	0	0	0	0	
41	A	5	1	4	1	000000	000000	0	0	0	0	
[illegible]	A	5	1	4	1	000000	000000	0	0	0	0	1
66	A	5	1	2	1	000000	000000	0	0	0	0	
443	A	5	1	3	1	000000	000000	0	0	0	0	
177	A	5	1	6	1	000000	000000	0	0	0	0	
1	A	5	1	7	1	000000	000000	0	0	0	0	
1	A	5	1	7	1	0-000000	0-000000	0	0	0	0	
[illegible]	A	5	1	7	1	000000	000000	0	0	0	0	
	A	5	1	7	1	000000	000000	0	0	0	0	
45	A	5	1	9	2	000000	000000	0	0	0	0	
7	A	5	1	9	1	000000	000000	0	0	0	0	
[illegible]	A	5	1	0	2	000000	000000	0	0	0	0	
43	A	5	1	3	2	000000	000000	0	0	0	0	
[illegible]	A	5	1	2	1	000000	000000	0	0	0	0	
1	A	5	1	2	1	0-000000	0-000000	0	0	0	0	
[illegible]	A	5	1	2	2	000000	000000	0	0	0	0	
[illegible]	A	5	1	7	1	000000	000000	0	0	0	0	
51	A	5	1	7	1	000000	000000	0	0	0	0	
[illegible]	A	5	1	6	1	000000	000000	0	0	0	0	1
[illegible]	T	5	1	7	1	000000	000000	0	0	0	0	
[illegible]	T	5	1	7	1	000000	000000	0	0	0	0	

300

0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000

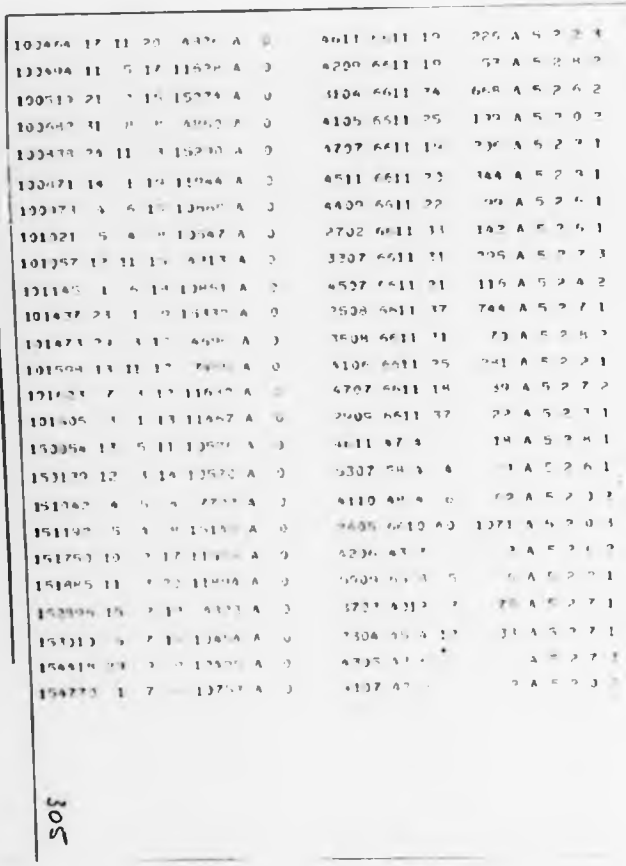


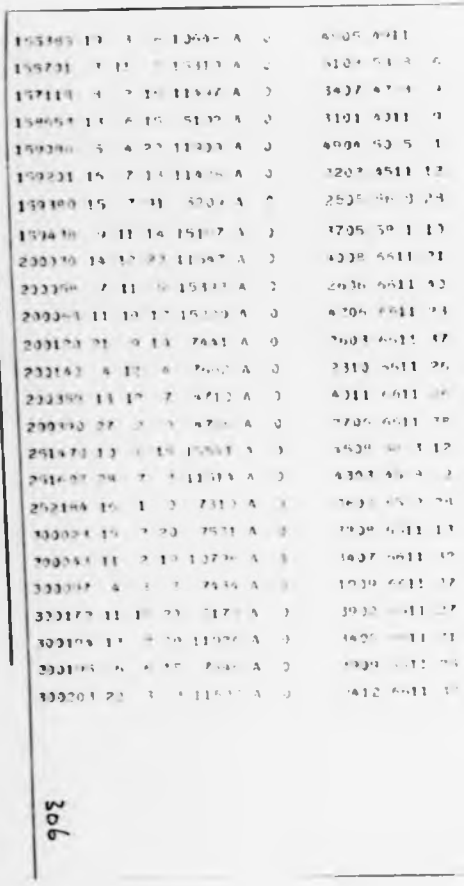


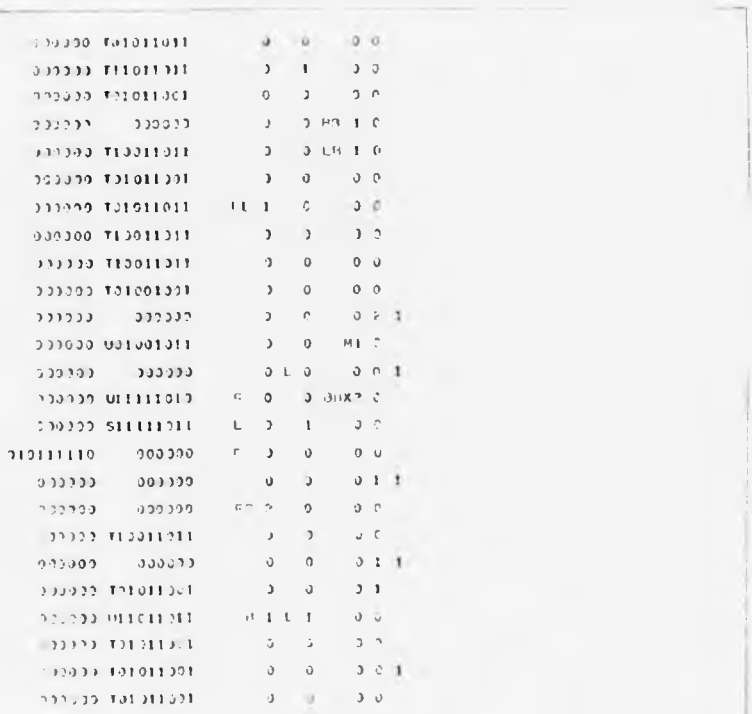


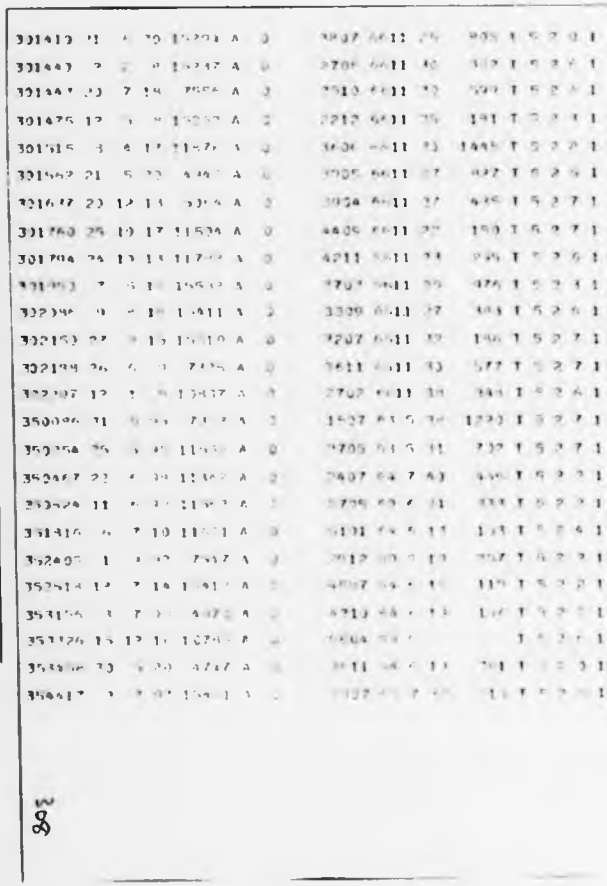
304

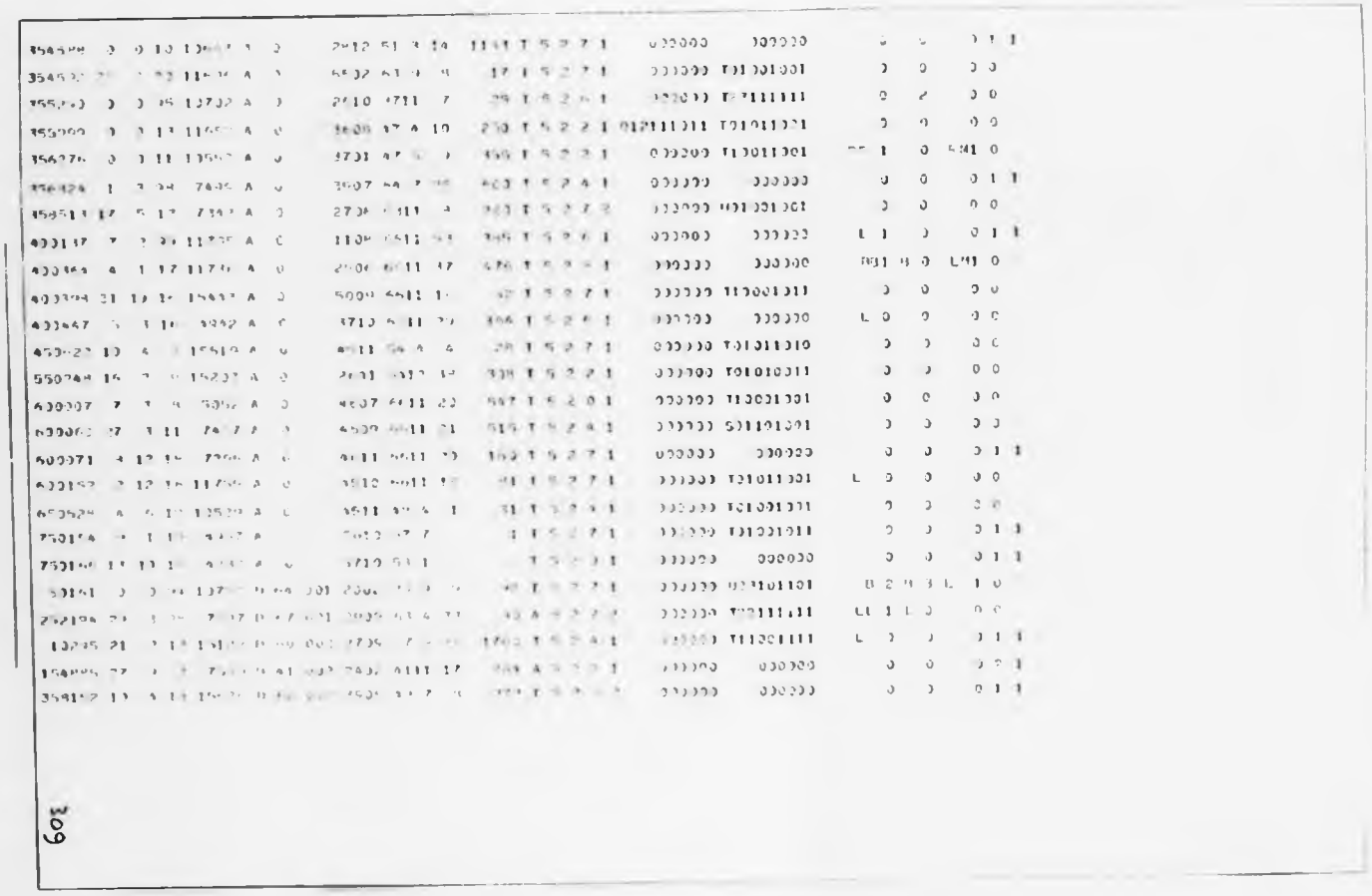
	0	0	0	0		100110101	000000
1	1	0	0	0		000000	000000
1	1	0	0	0		110110101	000000
1	1	0	0	0		000000	000000
1	1	0	0	0		000000	000000
	0	0	0	0		110110101	000000
1	1	0	0	0		110111011	000000
	0	0	0	0		110110101	000000
	0	0	0	0		110110101	000000
	0	0	0	0	┐	110111101	000000
1	1	0	0	0		000000	000000
	1	0	0	0		100111101	000000
1	1	0	0	0		000000	000000
1	1	0	0	0		000000	000000
1	0	0	0	0		110110111	000000
1	0	0	0	0		100110101	000000
	0	0	0	0		110100101	000000
	0	0	0	0		000000	000000
1	1	0	0	0		000000	000000
	0	0	0	0		100110011	000000
1	1	0	0	0		000000	000000
	0	0	0	0		100110101	000000
	0	0	0	1	┐	100100101	000000
	0	0	0	0		000000	000000
	0	0	0	0		100110101	000000

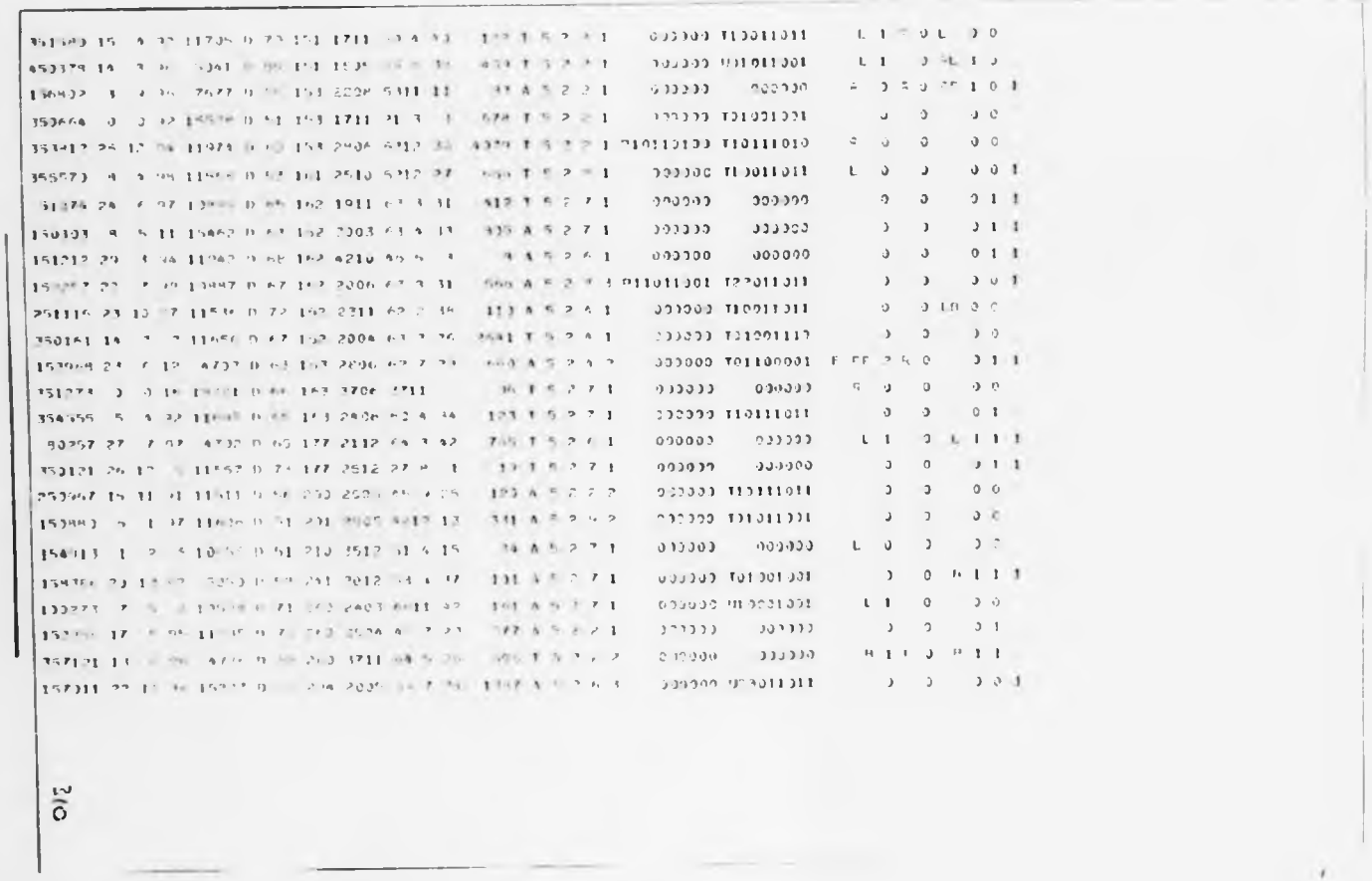


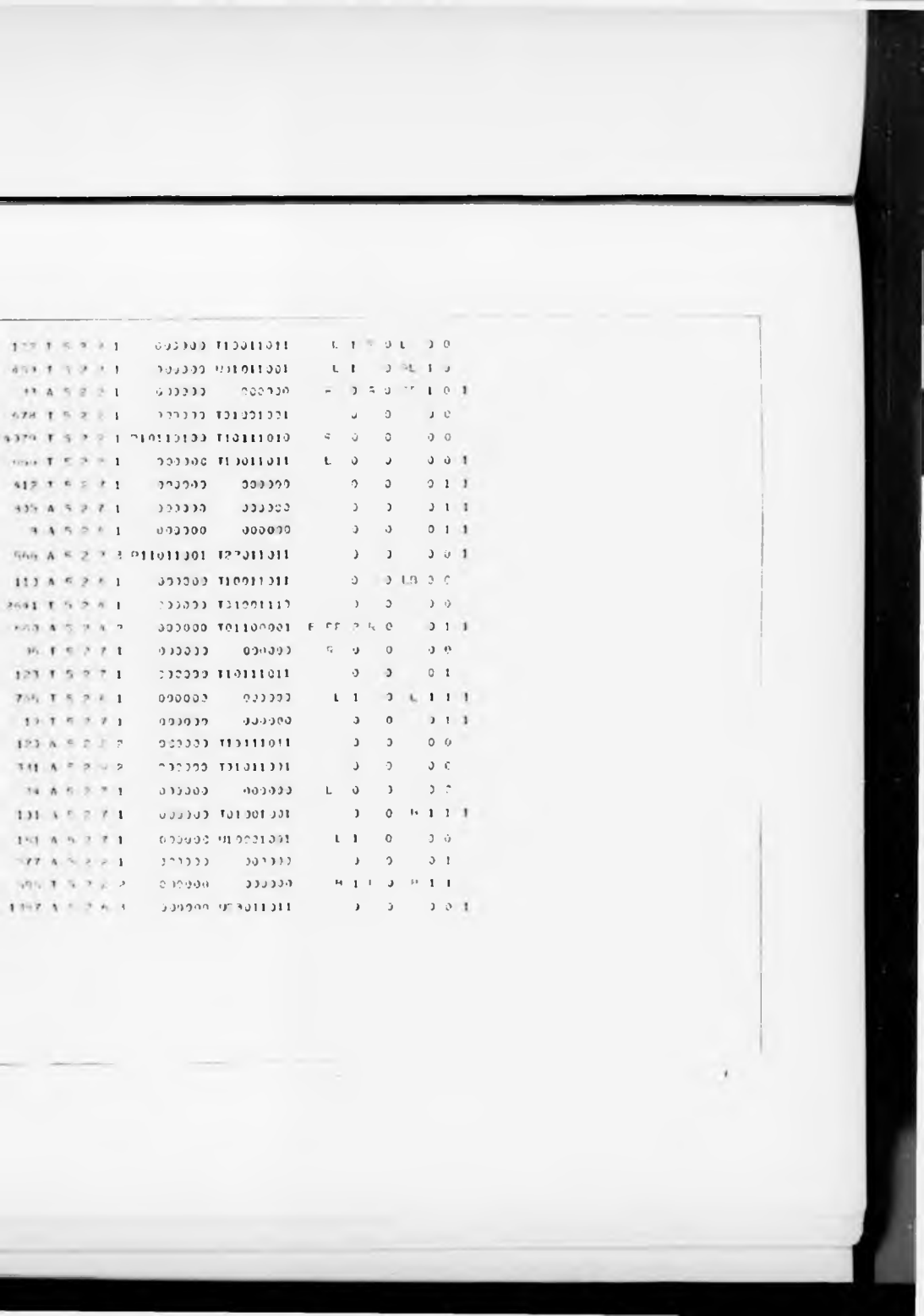


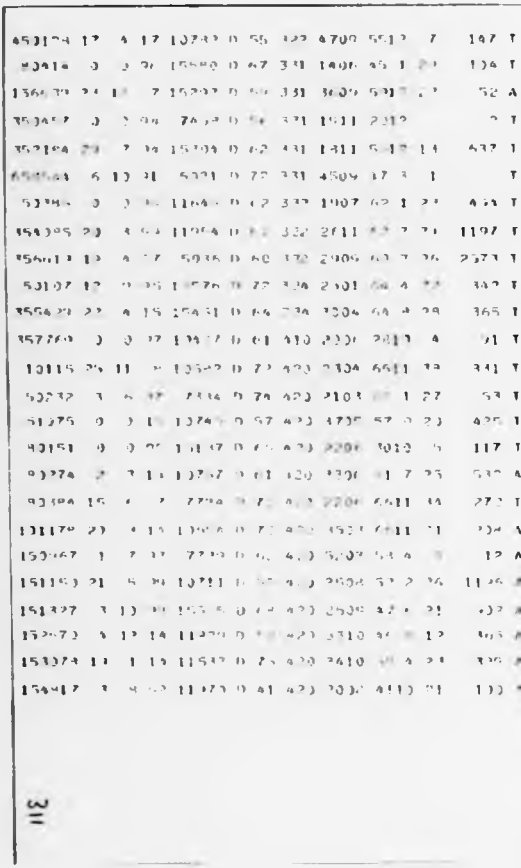


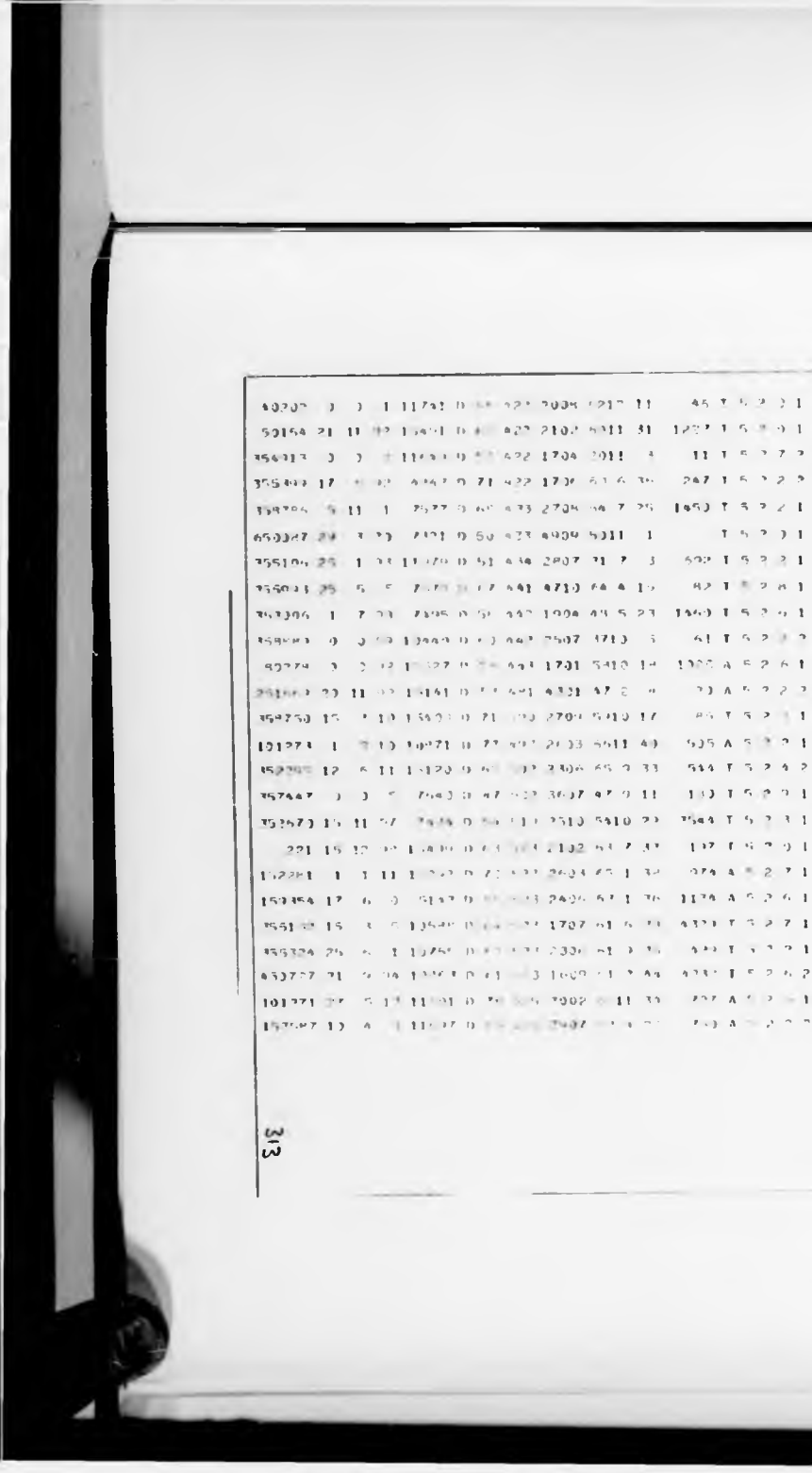




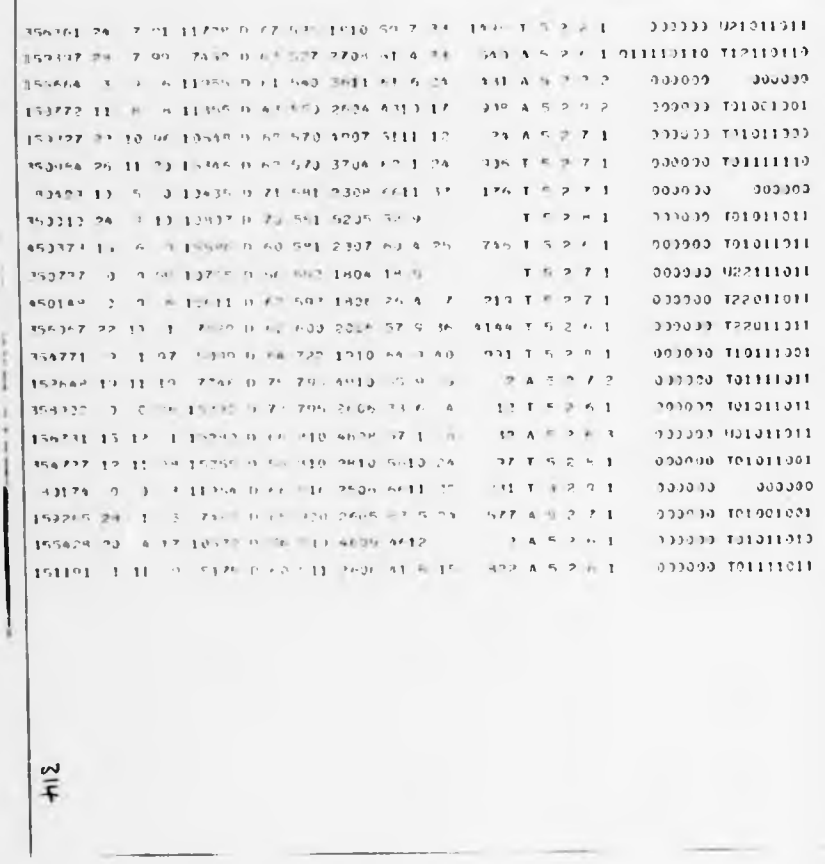








	B	1	B	3			0	0	
E	L	1	B	0			0	0	1
		0		0			0	1	1
		0		0			0	0	
		0		0			0	0	
		0		0			0	0	
		0		0			0	1	1
		0		0			0	0	
		0		0			0	1	1
		0		0		L	1	0	
		0		3			0	1	
		0		0		BB	1	0	
	LB	2	G	0			0	1	1
		0		0			0	0	
		0		0			0	0	1
		0		0			0	2	1
		0		0			0	0	
		0		0			0	1	
		0		0			0	0	
		0		0			0	0	
		0		0			0	0	



COHORT "B"

Reader 6

"Normals"

pp. 316 - 336

"Less-than-normals"

pp. 337 - 348

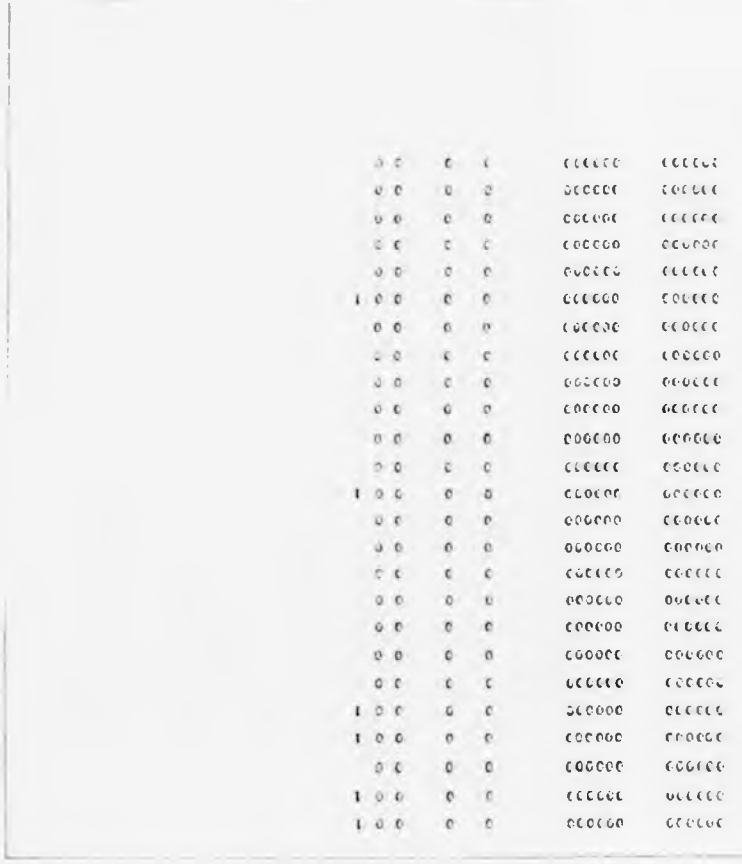
0	0	0	0	000000	000000
0	0	0	0	000000-0	000000-0
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

12	4	2	12	8926	A	0	2907	6010	21		563	A	6	1	7	1	
12	9	9	17	7243	A	0	4209	49	7	6	21	A	6	1	7	1	
25	1	6	15	9813	A	0	4305	46	9	3	45	A	6	1	4	2	
26	10	11	9	9444	A	0	4504	46	7	1	5	A	6	1	0	1	
32	25	4	6	6336	A	0	5210	55	9	2	3	A	6	1	2	1	
40	17	2	26	6177	A	0	1610	4412	29		409	A	6	1	2	2	
83	12	9	97	9030	A	0	2005	6110	41		123	A	6	1	2	3	
95	6	1	16	6082	A	0	4304	47	2	3	61	A	6	1	8	1	
232	22	1	11	9431	A	0	2608	6611	24		1208	T	6	1	2	1	
10097	30	9	17	3210	A	0	3609	6611	25		193	T	6	1	2	2	
10496	30	1	14	6180	A	0	4508	6611	20		109	T	6	1	7	2	
10525	14	1	0	9319	A	0	4510	6611	17		35	T	6	1	4	1	
10590	19	12	14	6224	A	0	4603	6611	17		36	T	6	1	6	1	
10693	21	2	4	9638	A	0	2910	6611	17		38	T	6	1	2	2	
10732	4	10	20	7130	A	0	3911	6611	20		220	T	6	1	6	1	
10750	23	5	13	6393	A	0	4507	6611	11		50	T	6	1	2	1	
10785	2	12	18	6779	A	0	4605	6611	13		113	T	6	1	6	2	
10792	2	6	14	9535	A	0	4609	6611	11		63	T	6	1	3	2	
10794	25	4	14	9459	A	0	3610	6611	25		710	T	6	1	2	1	
10862	27	2	20	9428	A	0	3909	6611	13		23	T	6	1	7	1	
11036	13	4	13	8481	A	0	5803	6611	8		52	T	6	1	2	1	
11072	19	2	16	7069	A	0	3307	6611	29		410	A	6	1	7	3	
50147	0	0	12	9100	A	0	2609	75	6	6	140	T	6	1	7	1	
50179	25	11	20	6436	A	0	4526	47	8	1	135	T	6	1	0	1	
50195	11	6	29	6876	A	0	1206	75	4	11	76	T	6	1	6	1	

50221	0	0	30	6531	A	0	1907	23	4	7	1103	T	6	1	0	2
50368	7	1	20	6905	A	0	4409	61	3	16	57	T	6	1	7	2
50455	26	9	10	5769	A	0	4506	48	7	1	12	T	6	1	7	1
50529	11	1	11	6771	A	0	2710	4610		9	13	T	6	1	8	2
50656	22	3	20	8870	A	0	4511	53	3		1	T	6	1	9	1
50738	0	0	07	9237	A	0	2008	47	3	1	9	T	6	1	2	1
50765	24	11	17	9021	A	0	3311	47	4	4	799	T	6	1	0	1
80003	24	9	7	7195	A	0	2909	6611		25	312	A	6	1	6	2
80005	19	11	19	6748	A	0	4608	6611		20	90	A	6	1	7	3
80027	0	0	16	6719	A	0	3903	6611		19	167	T	6	1	0	1
80046	0	0	19	5780	A	0	3511	6611		19	278	T	6	1	4	1
80061	0	0	12	7279	A	0	3405	6611		24	73	T	6	1	7	1
80092	0	0	16	9432	A	0	3509	6611		27	1317	T	6	1	3	1
80119	0	0	19	8918	A	0	4109	6611		24	97	A	6	1	9	2
80125	24	5	14	6546	A	0	3806	6611		18	41	A	6	1	8	2
80141	0	0	14	9366	A	0	3309	6611		23	131	T	6	1	7	1
80231	0	0	17	7266	A	0	4204	6611		23	234	T	6	1	7	2
80250	7	10	16	9147	A	0	4601	5611		12	67	T	6	1	7	1
80300	30	4	17	6910	A	0	4105	54	1	7	242	A	6	1	6	1
80317	14	2	5	6375	A	0	2904	47	9	17	49	A	6	1	2	1
80319	0	0	15	9327	A	0	3609	5211		2	19	T	6	1	7	1
80363	21	9	13	6572	A	0	3911	48	1	7	32	A	6	1	4	1
80372	12	7	7	7012	A	0	3612	4810		11	29	A	6	1	2	1
80379	12	2	13	9261	A	0	2906	41	1	11	620	A	6	1	0	1
80520	0	0	33	6571	A	0	1905	2912		1	5	T	6	1	2	1

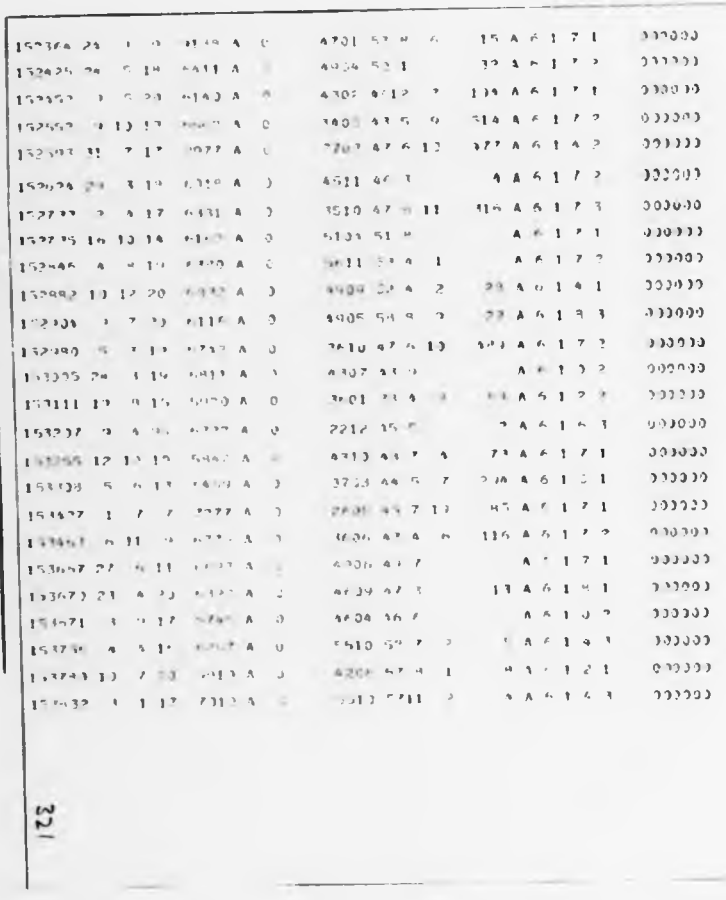
1	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
1	0	0	0	0	000000
1	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000
	0	0	0	0	000000

	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000



101563	1	17	14	6257	A	0		3608	6611	32		651	A	6	1	7	2
101586	6	3	13	7314	A	0		3513	6611	31		56	A	6	1	3	2
101590	15	4	3	9363	A	0		4806	6611	15		42	A	6	1	7	3
101631	21	8	17	9838	A	0		4708	6611	19		52	A	6	1	8	3
101665	5	10	13	6342	A	0		4901	6611	17		132	A	6	1	7	2
101676	19	11	14	6759	A	3		3611	6611	33		33	A	6	1	5	2
150328	13	9	13	7335	A	0		2906	47	4	17	489	A	6	1	6	1
150395	29	4	14	6676	A	0		5009	55	5	5	18	A	6	1	8	1
150398	25	12	17	6356	A	3		4107	4611	4		153	A	6	1	4	2
150140	71	1	1	0640	A	0		2910	53	3	21	292	A	6	1	6	2
150123	8	2	11	9941	A	0		2408	4412	20		1282	A	6	1	7	2
150441	13	12	13	6711	A	0		5101	61	4			A	6	1	6	1
150551	13	8	13	6374	A	3		2904	43	7	19	333	A	6	1	7	1
150657	11	5	4	7252	A	0		2307	44	2	21	350	A	6	1	7	3
150901	17	8	20	7314	A	0		4601	4712	1		75	A	6	1	7	1
150333	6	10	20	7331	A	0		4604	50	3	1	45	A	6	1	6	2
150869	14	6	14	6483	A	3		4105	42	6	1	3	A	6	1	8	2
151166	20	3	11	9447	A	0		5507	55	0			A	6	1	6	1
151242	24	12	20	9345	A	0		5511	5412	9		47	A	6	1	8	2
151425	33	3	13	5274	A	0		4207	45	4	2	25	A	6	1	6	2
151827	27	6	14	7314	A	3		3609	46	5	6	117	A	6	1	7	2
151977	16	3	13	6641	A	0		3610	45	8	3	476	A	6	1	6	1
152309	14	4	17	7130	A	0		3703	44	4	6	213	A	6	1	3	2
152323	13	9	15	6266	A	0		4210	46	2	3	11	A	6	1	7	2
152357	25	4	18	9933	A	3		4213	46	8	3	61	A	6	1	7	1

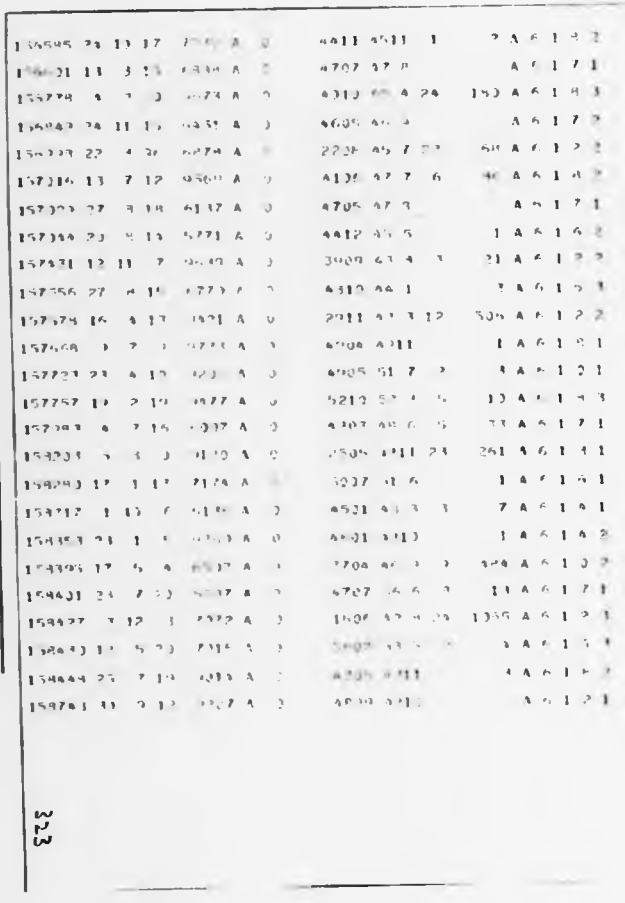
0	0	0	0	000000
0	0	0	0	000000
1	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
1	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
1	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
1	0	0	0	000000
1	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
0	0	0	0	000000
1	0	0	0	000000
0	0	0	0	000000



	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000

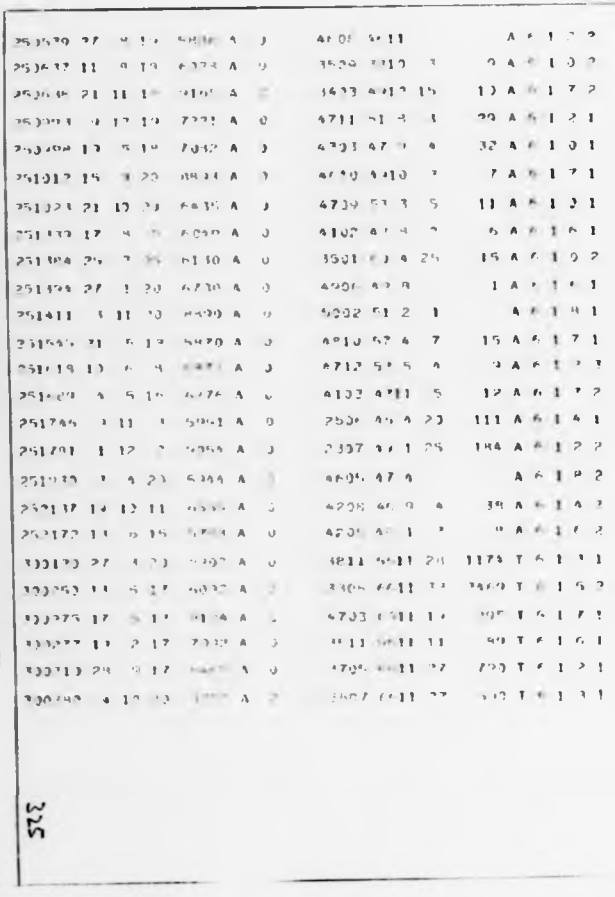
154139	28	3	15	6929	A	0	4304	51	6	2	13	A	6	1	0	1
154296	28	4	12	6404	A	0	3509	33	6	2	132	A	6	1	9	3
154306	12	4	14	7013	A	0	4809	49	12		2	A	6	1	2	2
154381	23	7	14	8336	A	0	3702	47	6	10	25	A	6	1	2	2
154425	10	2	16	9603	A	0	4905	61	5	12	31	A	6	1	7	2
154437	17	12	14	6225	A	0	4908	49	9			A	6	1	8	2
154564	8	9	6	5961	A	0	4609	58	3	11	15	A	6	1	4	1
154578	26	4	35	6206	A	0	3910	41	9	1	4	A	6	1	6	1
154753	23	9	19	6496	A	0	4608	49	4	2	23	A	6	1	9	1
154791	24	8	8	6182	A	0	2808	30	8	2	233	A	6	1	0	1
154941	6	11	6	9509	A	0	4110	43	7	1	14	A	6	1	0	3
155009	27	11	47	7032	A	0	2509	44	7	18	234	A	6	1	2	2
155109	22	12	16	7126	A	0	4706	47	7			A	6	1	2	1
155268	17	9	16	9194	A	0	4706	58	7	11	25	A	6	1	7	2
155503	10	4	20	6934	A	0	4610	48	7	1	32	A	6	1	0	1
155535	23	4	12	7016	A	0	4310	46	9	2	53	A	6	1	9	2
155718	15	12	11	7196	A	0	5210	54	2	1	2	A	6	1	3	1
155786	16	8	10	9736	A	0	4901	49	6		1	A	6	1	5	2
155857	23	10	15	6452	A	0	4802	56	5	8	12	A	6	1	0	1
155945	1	8	20	5839	A	0	4906	63	10	14	53	A	6	1	7	2
156145	5	4	9	9553	A	0	2906	41	5	6	35	A	6	1	[illegible]	1
156198	3	1	11	9948	A	0	4705	52	2	4	17	A	6	1	0	1
156229	15	3	16	9147	A	0	3506	40	3	4	336	A	6	1	5	2
156279	19	12	15	9462	A	0	4701	51	7	4	13	A	6	1	7	1
156512	8	5	13	8956	A	0	4307	44	4		19	A	6	1	5	2

```
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
1 0 0   0   0     000000  000000
1 0 0   0   0     000000  000000
1 0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
1 0 0   0   0     000000  000000
  0 0   0   0     000000  000000
1 0 0   0   0     000000  000000
  0 0   0   0     000000  000000
  0 0   0   0     000000  000000
```

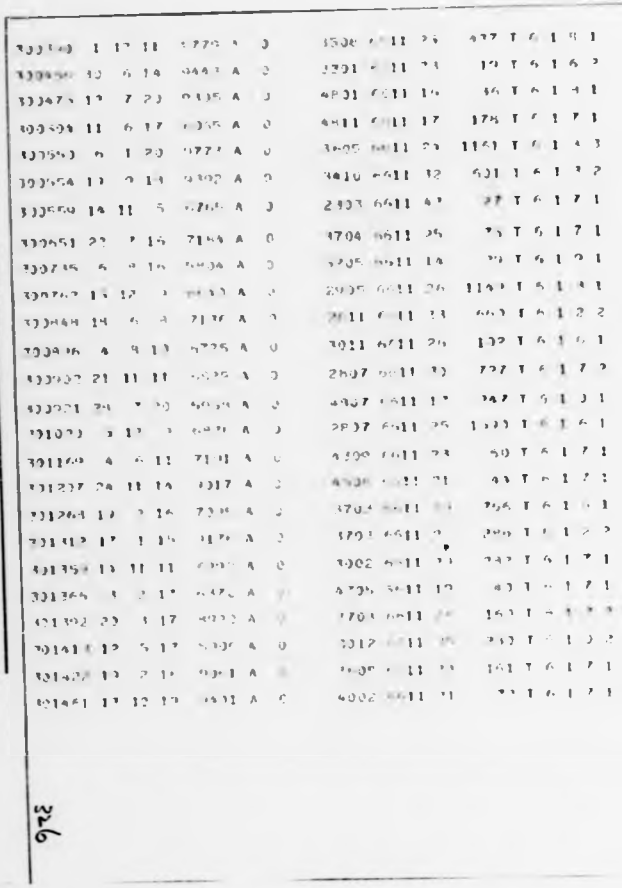


158897	31	5	97	5739	A	0		4904	49	8			A	6	1		
158457	12	8	15	9417	A	0		4905	57	5	8		7	A	6	1	
159332	23	6	13	8233	A	0		5607	58	5	1		3	A	6	1	
158959	22	2	19	6810	A	0		4806	62	4	14		28	A	6	1	
159353	6	5	0	9489	A	0		4208	64	6	21		46	A	6	1	
159263	27	7	96	9590	A	0		2511	61	8	33		611	A	6	1	
159331	4	4	14	6614	A	0		3305	46	5	13		219	A	6	1	
159332	24	9	98	6757	A	0		4209	5910	20			37	A	6	1	
159369	23	1	8	6785	A	0		4407	51	9	7		72	A	6	1	
159198	3	2	95	9230	A	0		2607	63	3	33		87	A	6	1	
159432	24	12	94	8827	A	0		2203	63	1	37		103	A	6	1	
159447	27	3	18	6376	A	0		4206	46	6	9		9	A	6	1	
159469	20	9	95	9704	A	0		1605	6010	25			223	A	6	1	
200373	20	5	20	9478	A	0		4006	6611	21			44	A	6	1	
200110	3	12	18	9209	A	0		4601	6611	20			45	A	6	1	
200186	13	11	20	9112	A	0		3911	6611	26			126	A	6	1	
200190	26	11	19	6350	A	0		3609	6611	24			59	A	6	1	
200257	1	10	17	9413	A	0		4509	6611	21			14	A	6	1	
200255	19	5	0	9243	A	0		3410	6611	24			26	A	6	1	
200301	28	10	6	9812	A	0		3705	6611	20			71	A	6	1	
250316	17	8	14	9429	A	0		4906	5712	8			17	A	6	1	
250134	7	1	1	6647	A	0		2201	24	6	2		143	A	6	1	
250141	7	12	12	6948	A	0		4107	6412	8			20	A	6	1	
250255	26	4	14	7344	A	0		4109	66	7	4		11	A	6	1	
250491	20	3	9	6219	A	0		4208	6413	2			3	A	6	1	

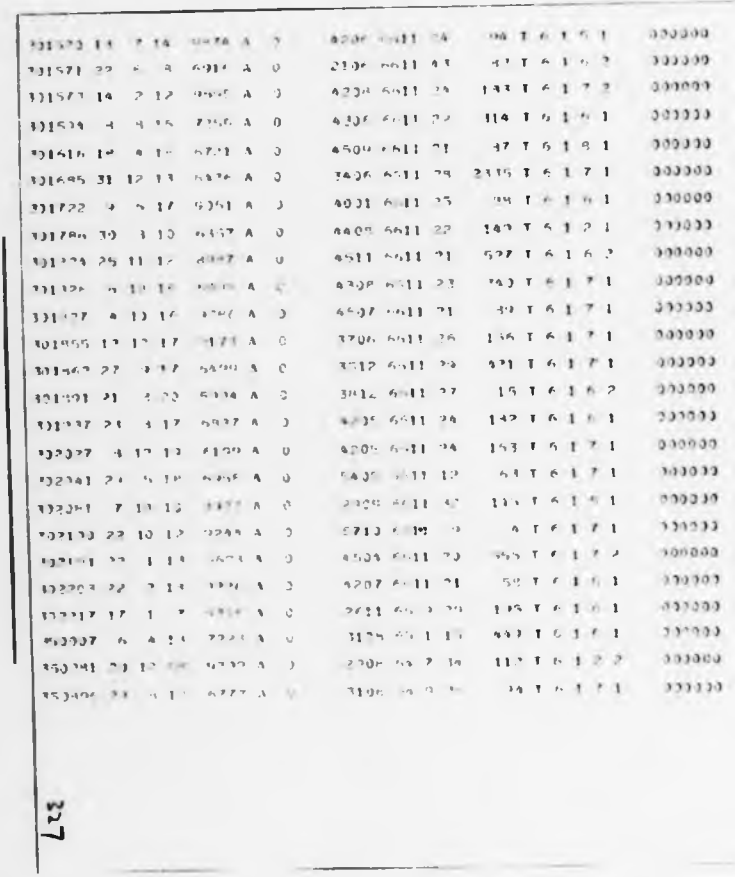
0	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
0	0	0	0	0	000000	000000



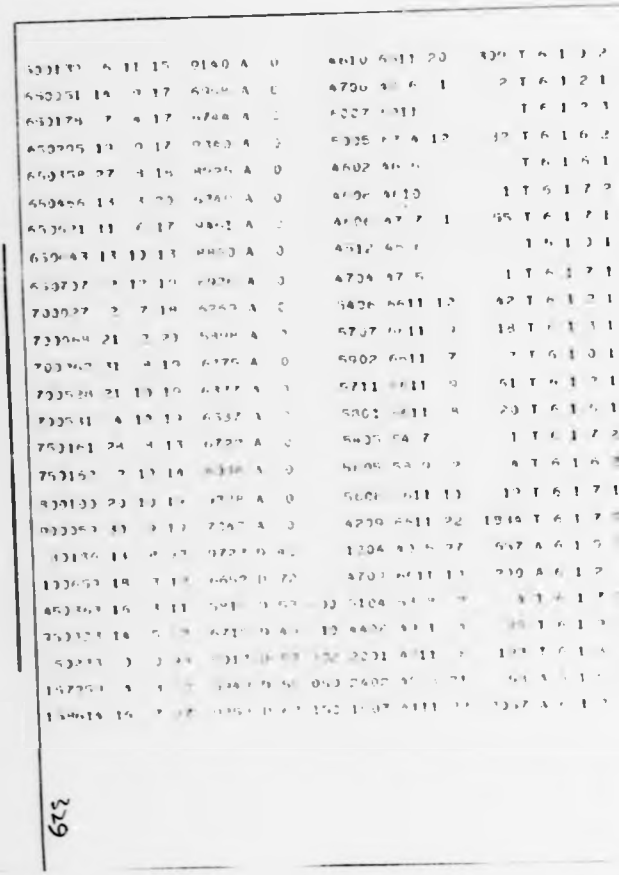
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000



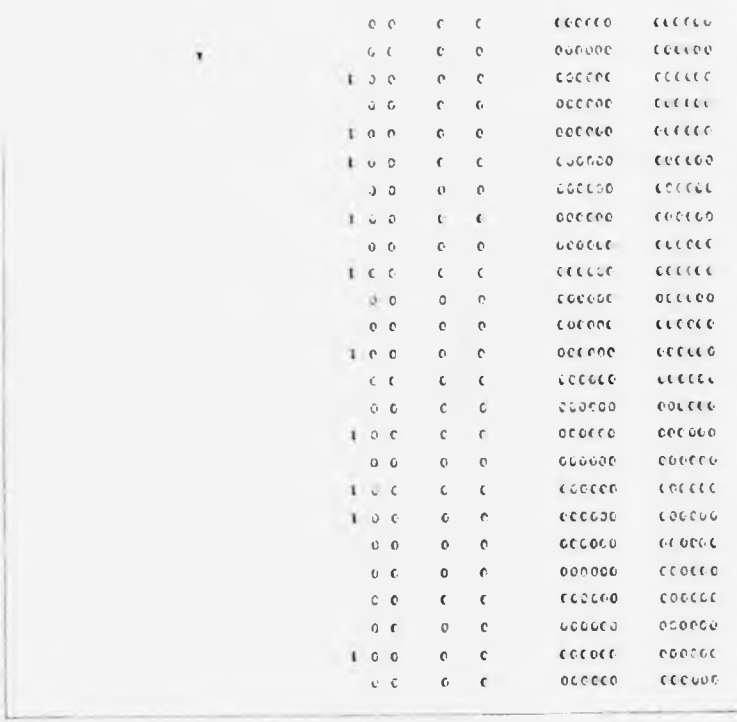
	0	0	0	000000
1	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
1	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
1	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000
	0	0	0	000000

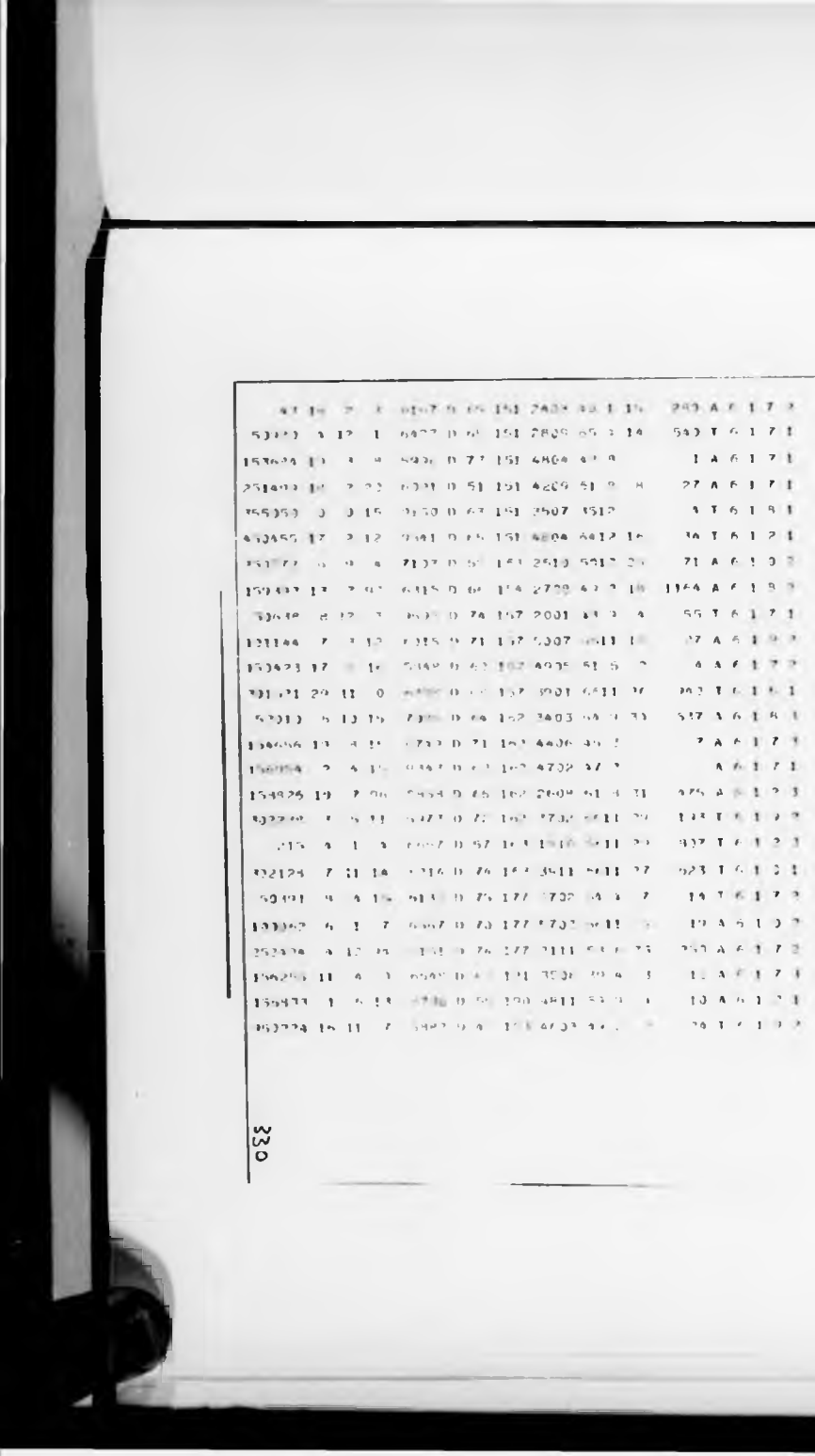


351346	4	4	17	7361	A	0			3835	5810	17		482	T	6	1	7	3
351954	7	3	15	6893	A	0			4607	46	9		9	T	6	1	7	2
352197	14	1	12	6343	A	0			4704	50	4	3	24	T	6	1	8	2
352438	29	3	08	7324	A	0			1811	64	8	35	268	T	6	1	6	1
352444	10	3	13	8946	A	0			4910	64	6	14	211	T	6	1	4	1
353067	26	6	14	6437	A	0			3709	42	7	8	1247	T	6	1	6	1
353237	13	9	15	6624	A	0			4310	46	9	3	164	T	6	1	7	1
351469	5	11	4	5835	A	0			4302	64	8	21	723	T	6	1	2	2
351904	0	0	6	9136	A	0			3604	53	6	17	147	T	6	1	6	1
351936	23	12	13	5969	A	0			3601	64	7	28	315	T	6	1	7	2
354643	13	5	05	9310	A	0			1510	63	5	42	136	T	6	1	2	1
354639	26	6	00	7135	A	0			3008	64	7	33	170	T	6	1	2	2
355635	10	3	4	4268	A	0			2935	64	6	35	111	T	6	1	2	1
355641	25	12	13	6743	A	0			4408	51	5	6	344	T	6	1	4	2
355763	21	1	06	6685	A	0			1908	64	2	44	125	T	6	1	2	2
357561	14	3	03	6505	A	0			1709	64	6	40	243	T	6	1	7	2
357654	23	3	23	6333	A	0			5107	64	6	12	25	T	6	1	8	1
357772	28	6	9	7432	A	0			4109	64	3	22	132	T	6	1	7	1
357961	24	1	6	7267	A	0			5804	58	9			T	6	1	2	1
400196	1	8	14	7249	A	0			2905	5611	31		1273	T	6	1	8	1
400367	28	6	17	7037	A	0			5104	5611	15		67	T	6	1	1	1
500174	5	4	14	9765	A	0			6511	5611	1		2	T	6	1	2	1
500216	7	7	17	9642	A	0			6511	5611	1		2	T	6	1	0	2
600021	4	1	18	7414	A	0			4607	5611	10		141	T	6	1	7	2
600049	13	8	15	5747	A	0			5703	5611	9		11	T	6	1	7	1



329

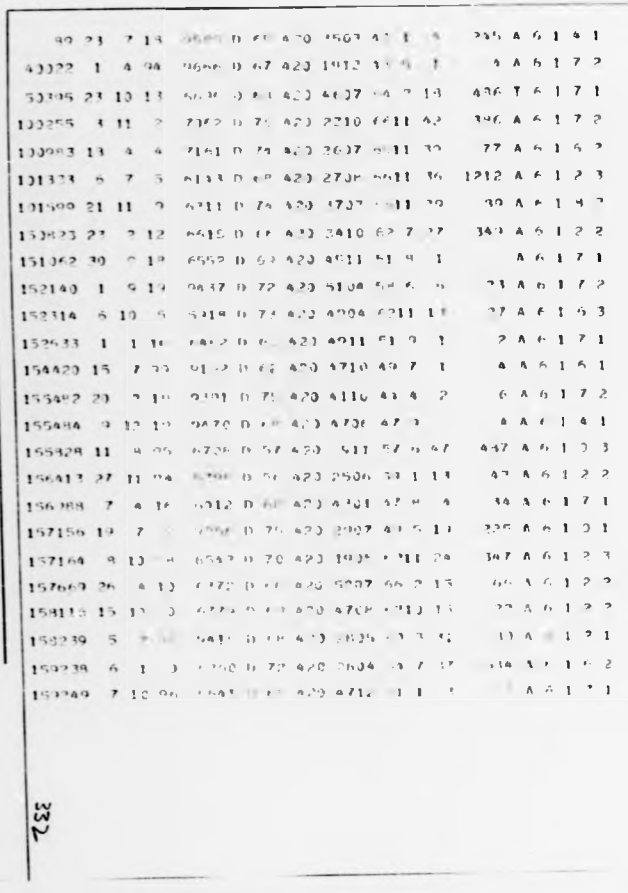




320

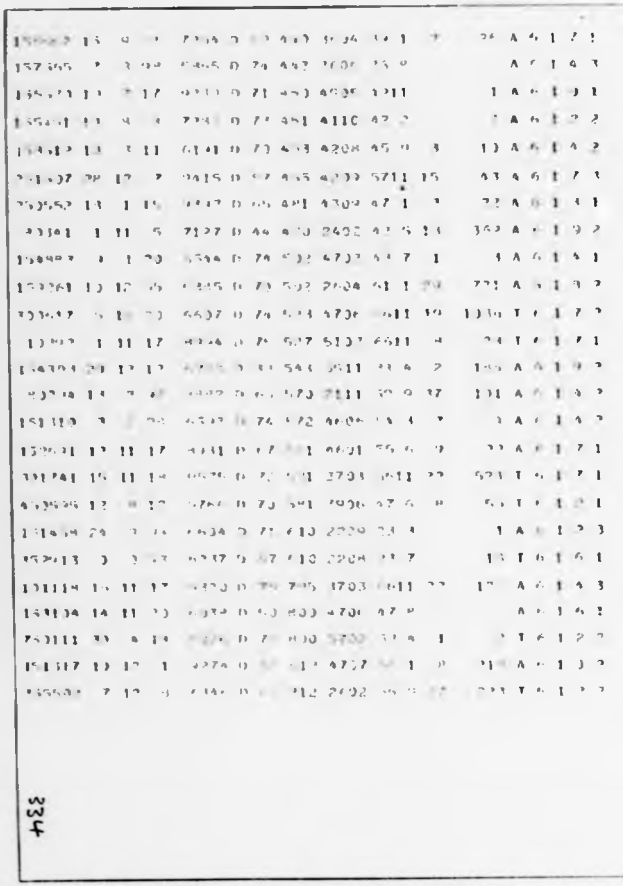
358330	0	4	17	6493	D	69	200	4001	47	5	7	52	T	6	1	8	1
200216	26	2	10	9217	D	74	202	2611	6611		26	93	A	6	1	6	2
201323	9	5	4	6931	D	69	203	3609	66	6	28	320	T	6	1	7	1
153705	22	7	98	9322	D	62	204	3703	37	5			A	6	1	8	2
150097	13	9	5	6085	D	65	241	4011	49	5	7	296	A	6	1	7	2
115	2	7	13	9225	D	65	293	4106	52	3	10	103	A	6	1	7	1
350384	0	0	12	7181	D	67	297	3702	47	6	6	15	T	6	1	9	1
152539	23	8	13	6934	D	72	307	4209	43	7		5	A	6	1	8	2
400084	11	11	7	9602	D	72	330	2701	6611		39	1076	T	6	1	6	1
40043	0	7	5	9384	D	61	331	2707	46	4	2	67	A	6	1	0	1
151740	7	4	6	8941	D	62	331	2406	60	8	36	301	A	6	1	4	2
151764	19	6	8	6442	D	70	331	2604	57	8	31	82	A	6	1	9	1
156384	11	3	2	7124	D	74	331	4208	48	4	5	42	A	6	1	6	1
157010	13	3	8	6234	D	66	331	3509	47	7	11	553	A	6	1	6	1
159470	1	12	98	9739	D	75	331	4310	6312		20	52	A	6	1	2	1
351766	21	1	99	3600	D	70	331	1804	6010		37	239	T	6	1	7	2
354662	0	0	2	7087	D	70	331	2211	47	5	22	439	T	6	1	6	1
359329	23	11	99	8330	D	58	331	4108	57	3	15	28	T	6	1	7	2
155490	13	1	9	9137	D	74	332	4107	4610		5	51	A	6	1	0	2
350174	9	9	10	9244	D	64	332	5802	58	9		1	T	6	1	7	3
352733	26	11	33	9956	D	70	332	1706	6111		30	173	T	6	1	2	3
159215	6	3	6	9230	D	69	334	4311	60	3	16	34	A	6	1	2	1
50268	0	0	11	6252	D	65	353	2603	43	7	5	129	T	6	1	7	1
352200	27	12	2	4554	D	67	355	5802	58	9		19	T	6	1	2	3
251051	8	11	0	6687	D	60	414	2303	43	5	25	43	A	6	1	4	1

0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
1	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000
0	0	0	0	000000	000000

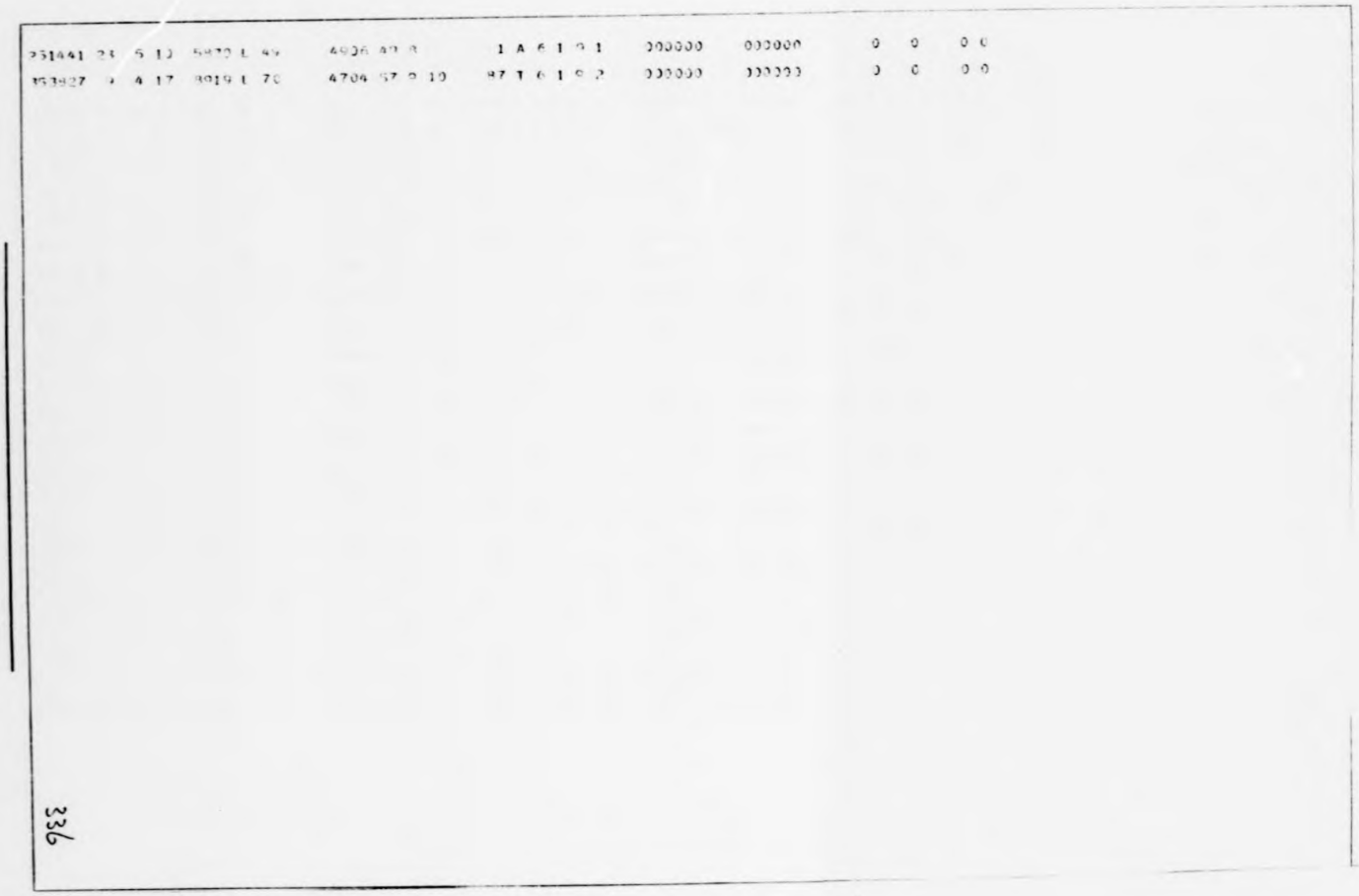


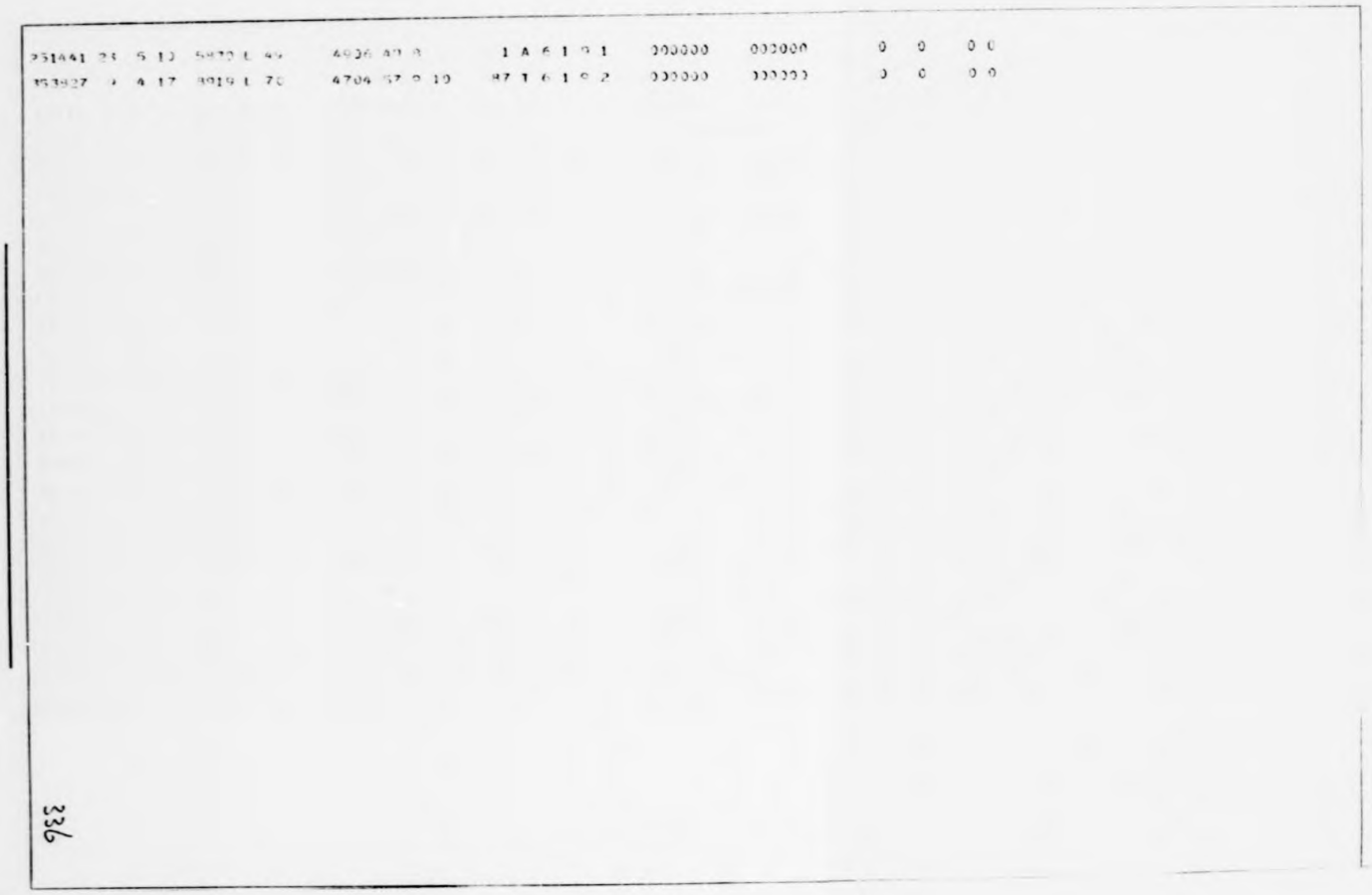
153434	22	9	36	7111	D	65	420	1607	63	1	43	1497	A	6	1	2	3
153416	6	10	97	8885	D	64	420	2111	6111		36	98	A	6	1	8	3
200385	9	3	9	5812	D	74	420	2507	6611		35	786	A	6	1	7	3
250067	19	8	9	6957	D	57	420	4908	57	1	7	3	A	6	1	2	2
250144	30	1	14	6724	D	72	420	4304	49	5	6	172	A	6	1	7	1
250603	24	5	10	6458	D	69	420	3411	39	4	3	64	A	6	1	7	3
251147	2	5	14	5864	D	71	420	4611	47	9			A	6	1	0	1
251417	22	1	2	9428	D	64	420	2205	64	8	41	222	A	6	1	4	2
251574	25	5	15	5932	D	61	420	4410	61	4	16	129	A	6	1	7	1
251643	23	9	92	9439	D	57	420	1311	46	8	22	105	A	6	1	2	3
300425	22	4	19	9031	D	68	420	5501	6611		11	27	T	6	1	7	1
301349	9	8	16	8379	D	73	420	5202	6611		14	65	T	6	1	5	1
301484	25	6	13	7001	D	75	420	4705	6611		19	281	T	6	1	2	2
301866	7	6	5	9427	D	72	420	2306	6611		43	206	T	6	1	2	1
301332	5	3	3	9121	D	67	420	4009	6611		26	163	T	6	1	2	1
350530	14	2	18	6067	D	71	420	3703	64	5	10	354	T	6	1	8	1
351571	22	4	7	6683	D	57	420	2511	57	2	31	605	T	6	1	6	3
352218	23	3	36	5357	D	57	420	1605	5712		41	184	T	6	1	6	2
354121	26	6	27	4964	D	66	420	2003	52	6	35	115	T	6	1	7	1
356421	31	1	3	6134	D	55	420	3425	55	1	13	786	T	6	1	7	3
358924	12	7	7	7355	D	74	420	4410	39	8	2	133	T	6	1	7	2
420233	7	6	13	3155	D	75	420	2608	6611		38	409	T	6	1	5	2
653362	17	1	17	6333	D	63	420	5103	63	7	13	339	T	6	1	7	2
153308	9	2	34	6613	D	53	422	1711	63	2	32	1248	A	6	1	6	2
251658	12	11	8	5327	D	14	422	4608	50	2			A	6	1	8	1

	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
1	0	0	0	0	000000	000000
	0	0	0	0	000000	000000

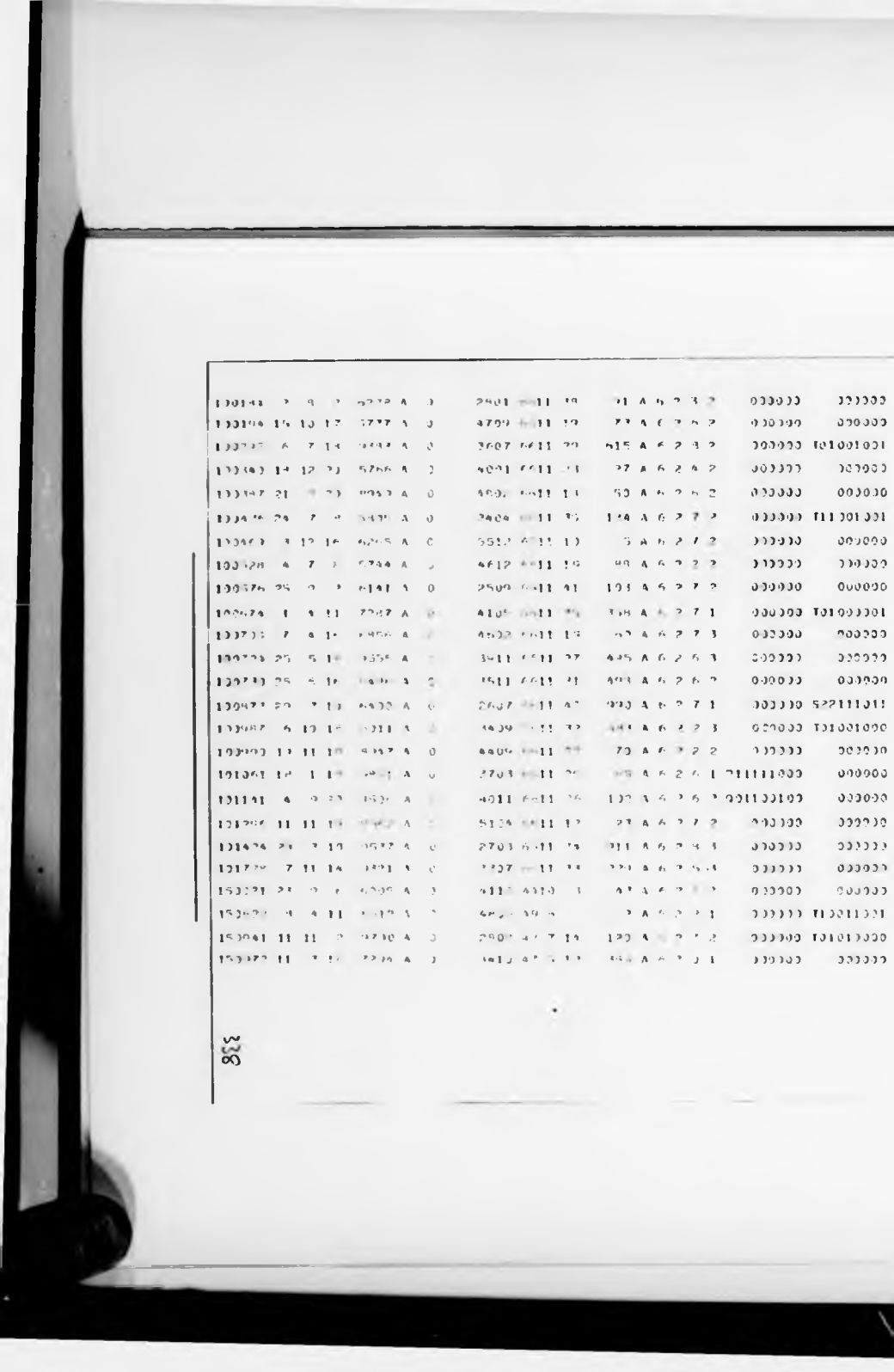


```
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
  0 0    0    0      000000-0  000000-0
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
1 0 0    0    0      000000    000000
  0 0    0    0      000000    000000
  0 0    0    0      000000    000000
```


231441 24 5 13 5870 L 44 4936 42 8 1 A 6 1 0 1 000000 000000 0 0 0 0
353927 4 A 17 3019 L 70 4704 57 9 10 87 1 6 1 0 2 000000 000000 0 0 0 0

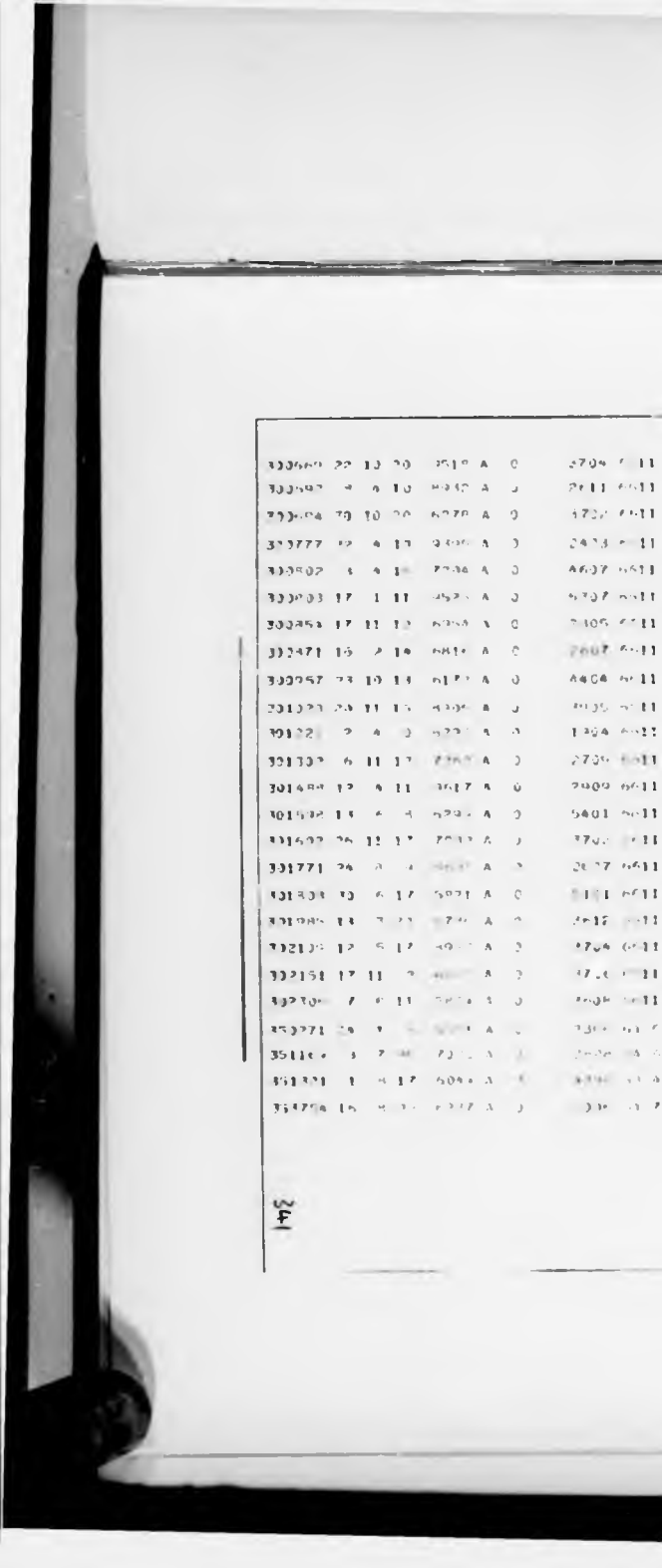

951441 23 5 12 5870 E 40 4936 87 0 1 A 6 1 9 1 000000 000000 0 0 0 0
953927 7 4 17 3919 E 70 4704 57 0 19 87 1 6 1 9 2 000000 000000 0 0 0 0

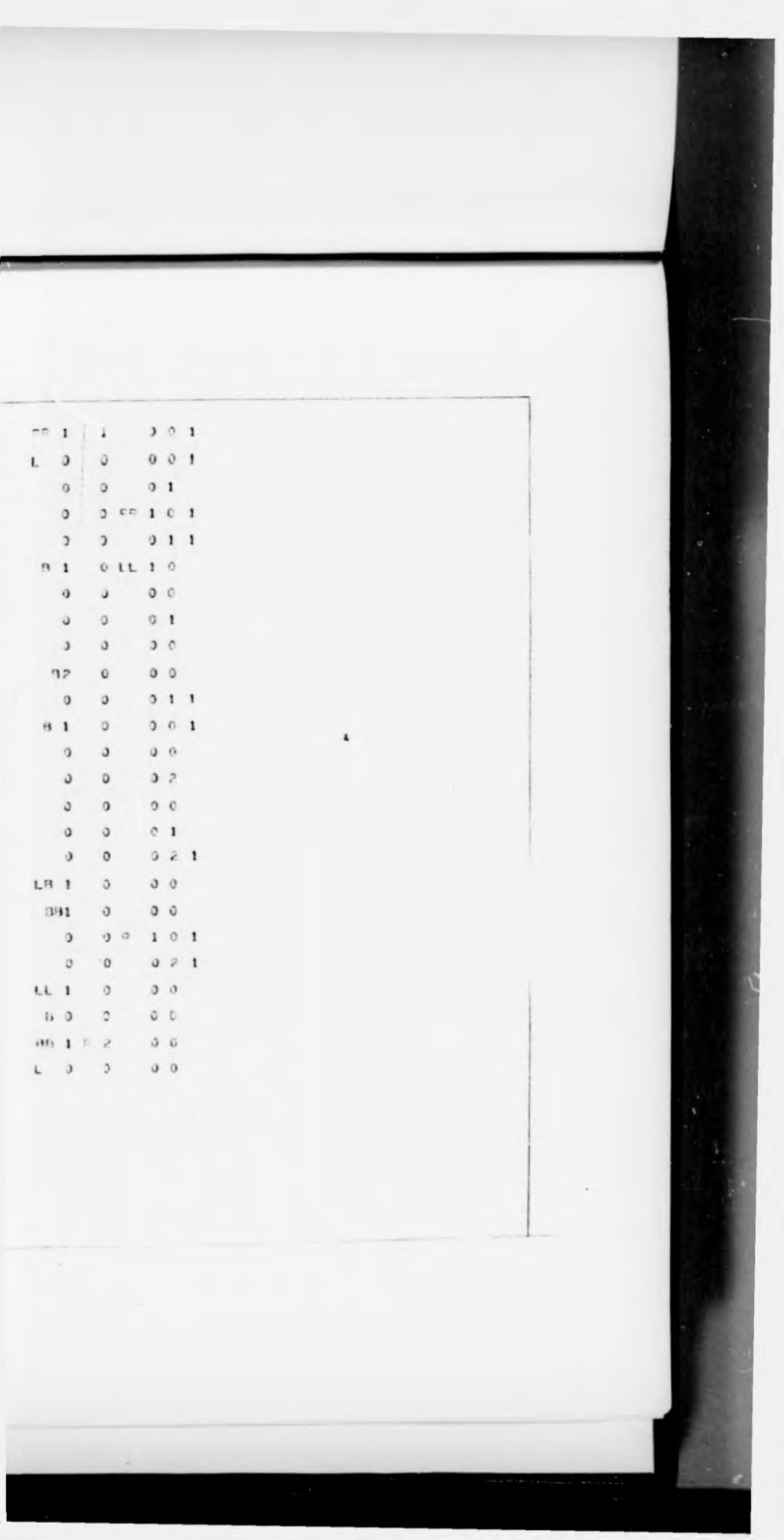
304	27	10	36	6646	A	0'	1710	6611	18		
10070	5	4	14	8595	A	0	4410	6611	21		
10079	9	0	8	7359	A	0	2206	6611	29		
10228	3	5	14	7575	A	2	5130	6611	14		
10415	4	10	13	8392	A	0	3706	6611	27		
10473	28	2	1	6896	A	0	2101	6611	26		
10627	14	5	12	7985	A	0	3011	6611	27		
10683	24	7	3	8395	A	0	1907	6611	21		
10718	26	8	11	7036	A	0	4704	6611	12		
10869	23	2	13	8687	A	0	5307	6611	13		
53258	14	2	32	6453	A	0	1404	62	6	46	
60429	29	12	0	5332	A	0	2610	6611	33		
60533	17	5	13	7963	A	0	4402	59	6		
83107	11	7	13	6627	A	0	2909	6611	32		
83338	3	0	16	9111	A	3	3606	6611	29		
83042	3	0	2	6647	A	3	2903	6611	33		
83049	3	0	12	6825	A	2	3704	6611	17		
83053	3	3	13	9257	A	0	2911	6611	30		
83097	3	3	17	9845	A	3	3626	6611	25		
83121	3	3	17	6475	A	0	3706	6611	13		
83124	1	1	7	9156	A	3	2810	55	2	11	
83210	3	3	1	6137	A	3	1506	6611	16		
83428	11	5	1	6113	A	2	2206	45	8	9	
139037	24	4	16	8734	A	3	4710	6611	19		
139074	13	11	11	6111	A	3	4710	6611	28		

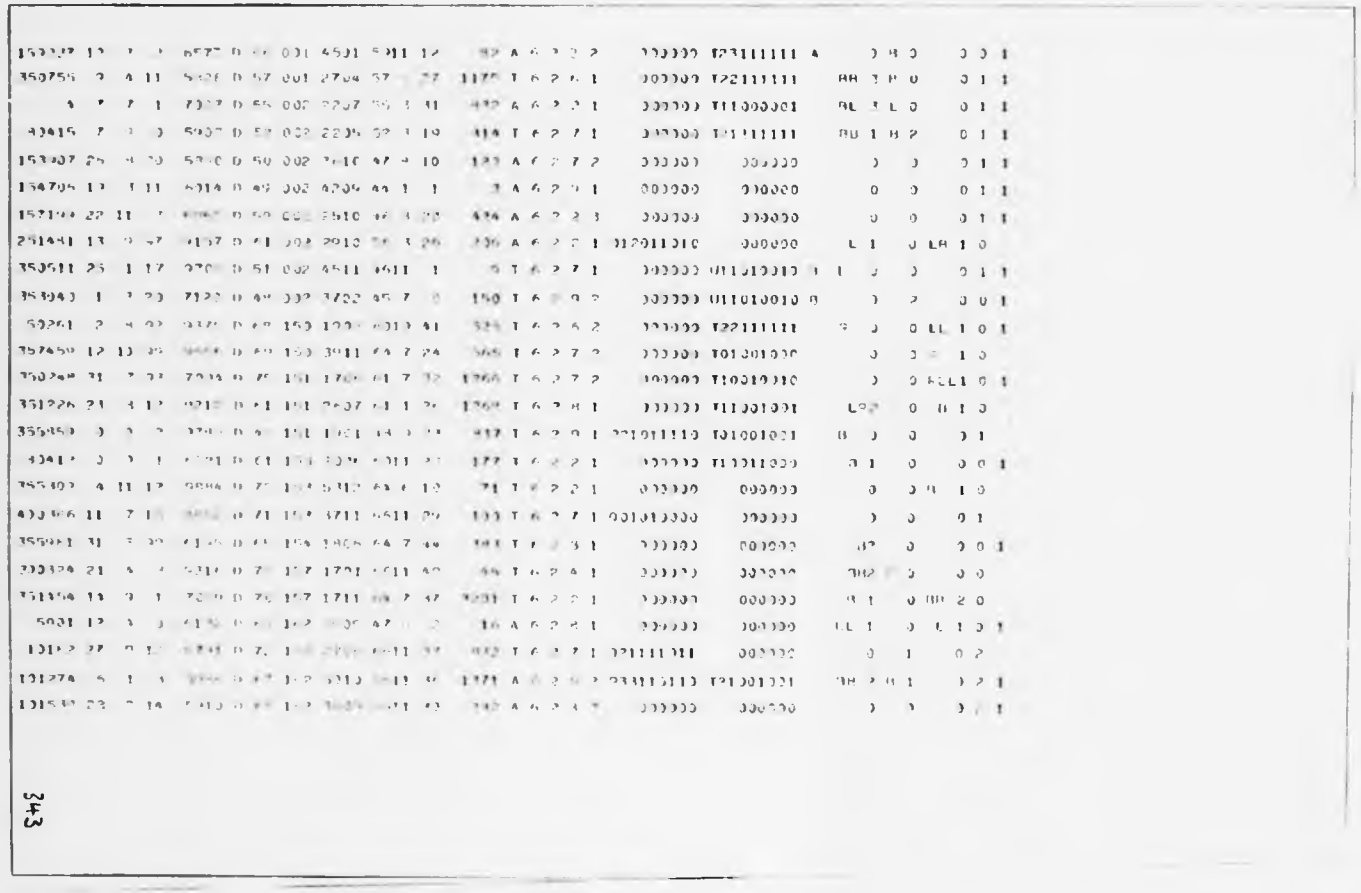


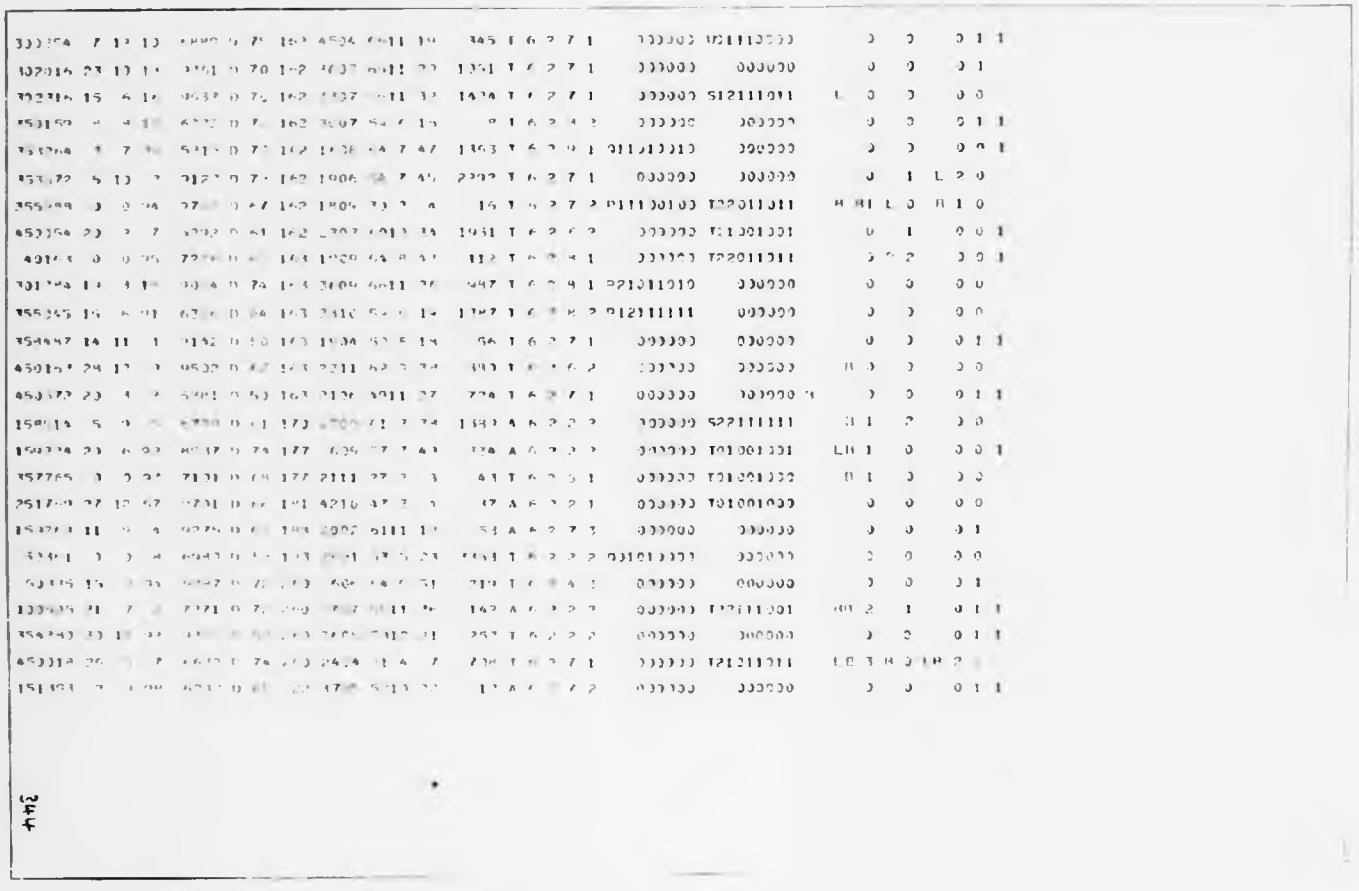
338

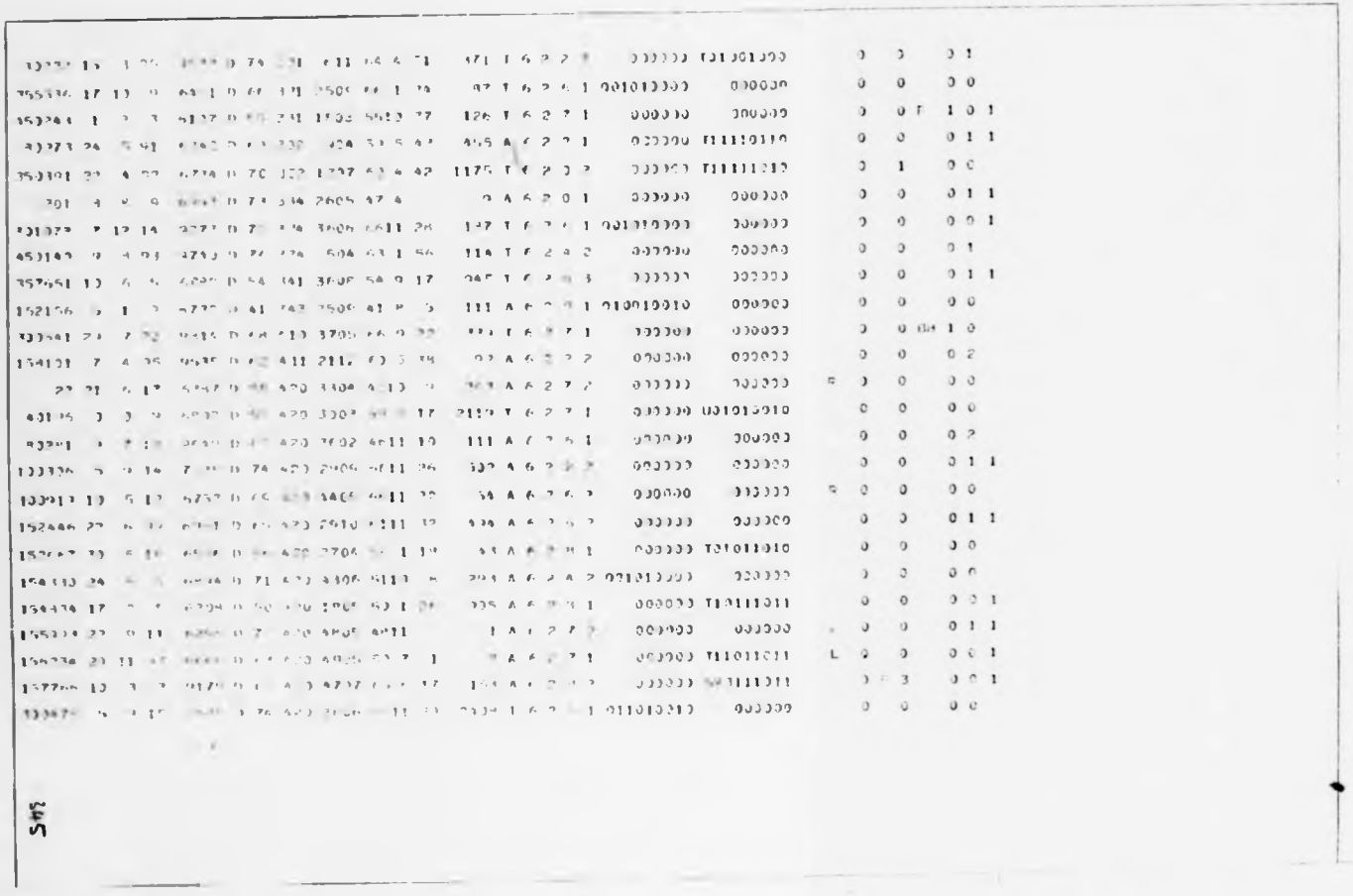
151[illegible]	21	8	16	[illegible]	A	0	[illegible]	[illegible]	[illegible]	[illegible]
151573	19	7	1	5971	A	0	1704	49	7	
151614	4	5	2	4305	A	0	2431	37	4	
152037	15	1	11	5946	A	2	4739	48	7	
152035	5	7	13	5356	A	0	4907	52	11	
153748	3	1	[illegible]	4294	A	0	4238	41	0	
154137	26	13	13	4913	A	0	4709	50	1	
154554	15	4	11	7174	A	0	4704	49	1	
155037	20	3	17	[illegible]	A	3	4403	[illegible]	[illegible]	
155654	16	8	1	6788	A	0	2010	[illegible]	[illegible]	
156237	13	2	0	6347	A	0	4601	45	3	
156335	[illegible]	2	14	4585	A	0	5207	58	8	
156474	23	1	13	6534	A	0	4136	43	1	
156483	17	10	13	6536	A	0	4110	40	7	
157237	21	3	4	4731	A	3	2907	30	[illegible]	
157611	26	7	13	5911	A	0	2107	21	0	
157683	27	3	17	7105	A	3	3703	36	9	
157761	25	4	13	9715	A	0	4139	42	11	
157763	17	5	13	3640	A	3	4703	47	5	
157874	11	3	13	6834	A	0	5107	55	7	
158767	23	4	15	8356	A	3	4811	47	5	
[illegible]	[illegible]	[illegible]	[illegible]	7111	A	3	4107	[illegible]	[illegible]	
159131	4	3	5	[illegible]	A	3	2033	19	9	
159661	21	3	17	[illegible]	A	3	4705	[illegible]	[illegible]	
159662	21	7	5	5347	A	3	4234	41	5	











333646	1	3	14	9040	0	74	420	2701	6611	35			
351785	24	7	11	3870	0	65	430	3911	6511	24			
352153	1	2	5	9268	0	61	423	7403	61	1	75		
352233	3	3	0	2130	0	60	422	1804	72	2	7		
351053	29	9	93	6291	0	69	420	698	61	3	55		
354524	3	10	4	6640	0	66	420	1606	66	3	85		
354641	3	9	96	9688	0	72	420	1001	64	4	32		
355547	0	3	2	6525	0	62	420	1711	2611		3		
356503	0	3	11	6567	0	56	420	2501	33	5	1		
357284	21	9	12	3587	0	63	420	2901	63	4	34		
453062	30	12	0	6872	0	51	420	2309	51	5	19		
453279	18	5	93	6730	0	66	420	707	63	1	54		
450554	24	7	5	6670	0	59	420	2601	59	3	33		
600146	22	7	14	7230	0	71	420	4608	6611	19			
53211	1	4	22	6347	0	69	422	1807	6012	71			
152180	24	11	6	9335	0	65	422	4307	4313				
300768	22	2	0	5762	0	70	422	2705	6611	70			
357646	0	3	27	6113	0	51	422	2408	51	4	25		
900102	11	11	19	6530	0	69	422	4005	6611	26			
43077	3	3	92	6574	0	65	423	905	6611		8		
351525	6	12	97	1776	0	65	423	2506	6513	25			
356651	2	7	96	6204	0	65	443	2001	6513	26			
356720	0	0	96	7162	0	71	444	2303	21	5			
352793	8	7	6	9338	0	75	451	2907	64	6	34		
355373	29	9	92	7243	0	57	453	1205	53	3	36		

346