AN INVESTIGATION OF THE EFFECTS OF INDUSTRIAL POLLUTION AROUND A COMBINED INDUSTRIAL COMPLEX ON THE ISLAND OF GRAND BAHAMA, BAHAMAS

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OF INDUSTRIAL POLLUTION AROUND A

HARBOUR AND INDUSTRIAL COMPLEX ON THE

ISLAND OF GRAND BAHAMA, BAHAMAS.

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This report represents the culmination of several years of intense lobbying, preparations and hard work by a very dedicated and ambitious staff who should be congratulated. The chief investigator was Dr. [illegible] [illegible], the then Acting Medical Officer of Health with responsibility for Community Health Services including Epidemiology, [illegible], Ministry of Health. He was assisted with the design and conduct by Dr. Eric Brown, then a medical officer in the Community Health Services and by Nursing Officers [illegible] and Vivian Brathwaite also of the Community Health Services. However, without the support of the government through its chief representative for health, the Honourable Dr. [illegible], Health Minister, who has a special interest in health promotion including environmental matters, the project would have never gotten off the ground. The Chief Medical Officer, Dr. [illegible] also provided invaluable ongoing support throughout the study and is particularly appreciated. Special thanks [illegible] administrator, and the staff of the [illegible] Hospital, especially Dr. [illegible] Medical [illegible]

[illegible] Laboratory Division). Thanks are also due to the Minister of Education and specifically to the District Education Officer responsible for Grand Bahama, Mr. Clarence Farrell, and to the Principals of the Schools. Also we cannot forget the ever important teachers, students and parents of the students and members of the various communities who unselfishly agreed to participate in this study. Without your support there would have been no study. Special thanks must also be extended to the management and staff of the industrial community whose cooperation greatly facilitated this project.

Last but by no means least, special thanks go to Mr. Terrance [illegible], Epidemiologist and the staff of the Health Information [illegible] of Health [illegible] Ms. [illegible] who undertook all secretarial duties. [illegible] the initial design of the study [illegible] the arduous task [illegible] there would be [illegible]

[illegible]

ABSTRACT: The effects of industrial exposure on the eyes, ears, respiratory function, blood function, liver function, kidney function, skin function and the reproductive function was assessed by a cross-sectional method for four groups on the island of Grand Bahama in the Bahamas. These groups were students, teachers, workers in the industries and a random selection of residents from the community. In order to evaluate the findings, the exposed cases were those members of the above groups that either went to school, taught, worked in or lived in the exposed area, a 5 mile radius around the industrial site, for a minimum of 5 years. No association was found between exposure to the pollution and disorders of either the respiratory system, blood function, liver function, or kidney function based on exam and/or lab results. However, [illegible] although [illegible] than significant [illegible] indicated [illegible] reported [illegible] in either one or several of the [illegible] groups. These [illegible] included hypertension, [illegible] of the [illegible] gastrointestinal disorders, [illegible] respiratory disorders and symptoms associated with [illegible] colds and fevers, for disorders of the eyes and skin observed through physical examinations the results [illegible]

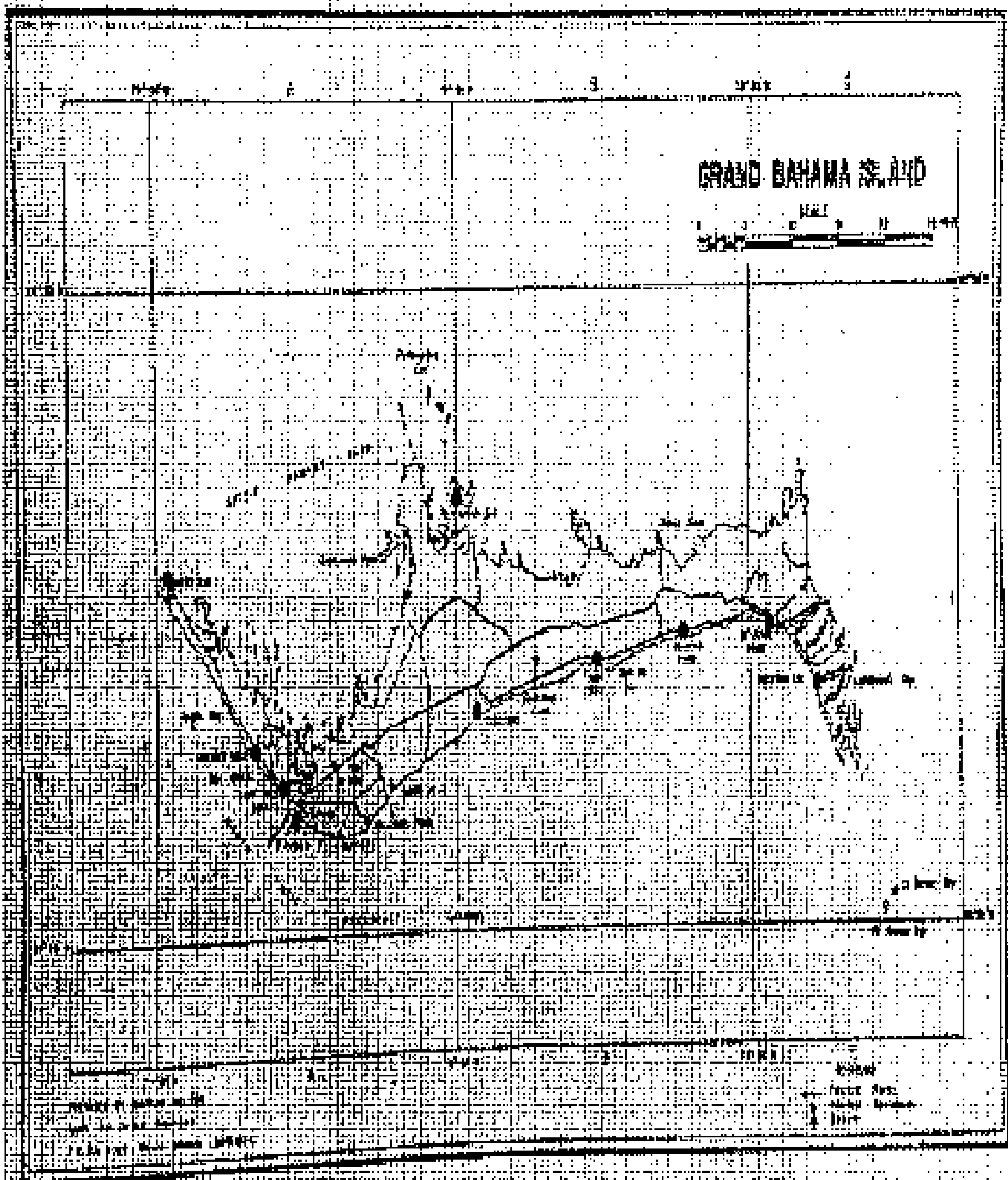
indicated several significant associations. For the eyes these included chronic conjunctivitis in the workers and community groups. While eye conditions were initially recorded, the method of these examinations must be questioned and therefor the findings will not be quoted until further study and analysis. The skin exams showed excess cases of acute eczema in the [illegible] exposed workers, teachers and those from the communities and of ulcerative lesions in the exposed group from the community as well as from the sample of students.

INTRODUCTION

Many developing countries are undergoing rapid industrialisation involving changes in methods of work and new occupational health and safety hazards. Quite often, these new industries are not only hazardous to the workers employed by them, but they also present a threat to the entire environment surrounding the plants. These countries industrial development has not been associated with a corresponding development of an environmental health program and as a result, national environmental safety and health monitoring programmes are often weak and under-developed.

The Industrial Park located in south-western Grand Bahama (Figure 1.1-2) has been in existence over [illegible] the [illegible] when the Bahamas Oil Refining Company (BORCO) was established. Over the years [illegible] [illegible] [illegible] the power company and the [illegible] companies [illegible]

FIGURE 1



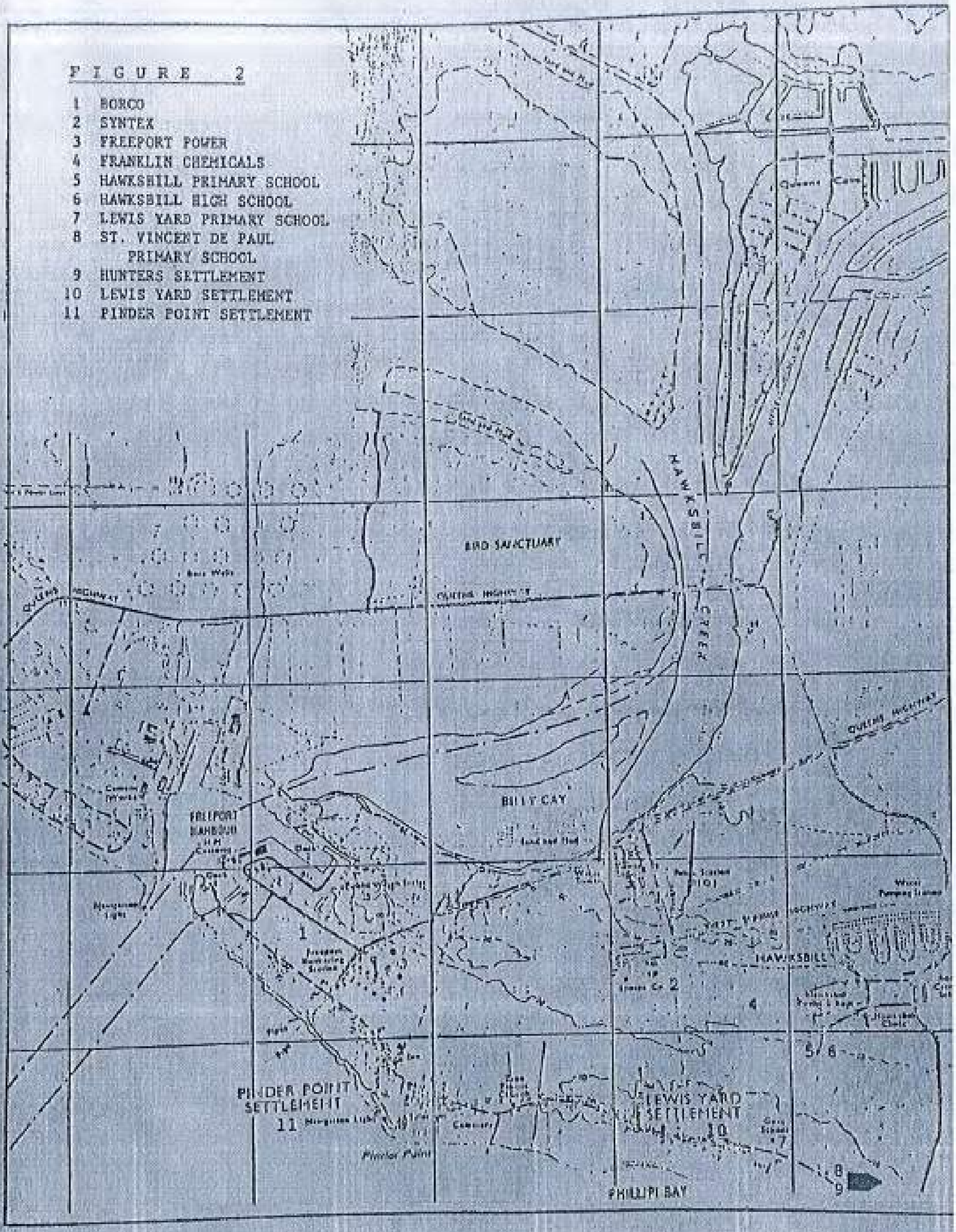


FIGURE 2
1 BORCO
2 SYNTEX
3 FREEPORT POWER
4 FRANKLIN CHEMICALS
5 HAWKSBILL PRIMARY SCHOOL
6 HAWKSBILL HIGH SCHOOL
7 LEWIS YARD PRIMARY SCHOOL
8 ST. VINCENT DE PAUL PRIMARY SCHOOL
9 HUNTERS SETTLEMENT
10 LEWIS YARD SETTLEMENT
11 PINDER POINT SETTLEMENT
BIRD SANCTUARY
HAWKSBILL CREEK
QUEENS HIGHWAY
BILLY CAY
FREEPORT HARBOUR
HAWKSBILL
PINDER POINT SETTLEMENT
LEWIS YARD SETTLEMENT
Pinder Point
PHILLIPI BAY

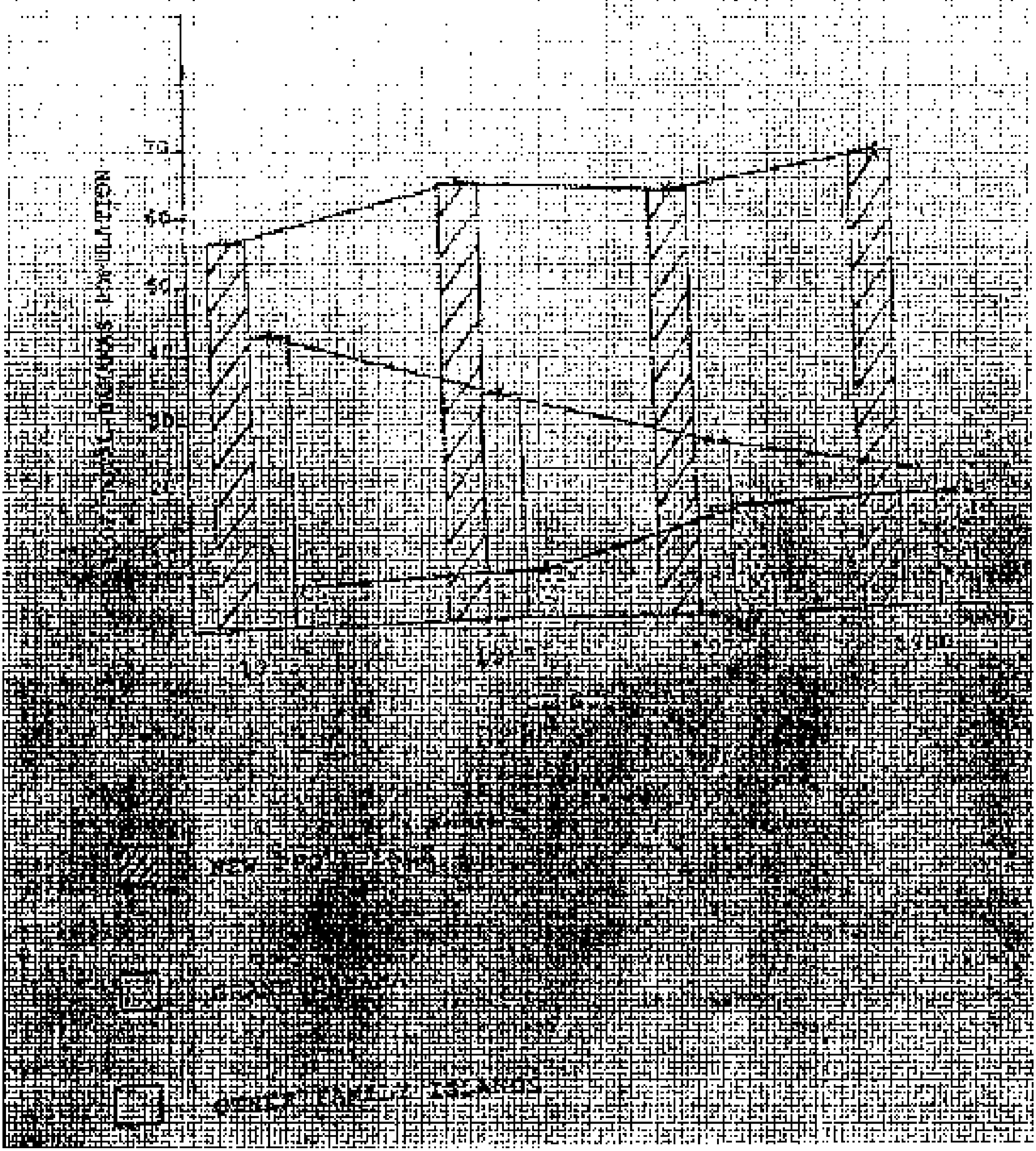
operations going on at the refinery. From their inception, these industries contributed substantively to the Jamaican economy and as the number of available jobs increased, so did the population surrounding the park, unchecked. (Figure 3)

Ever since the mid 1970's there have been documented complaints relative to these industries and their potential environmental pollutants. Over the past few years however, the number of complaints have escalated and according to the nearby residents, this is in direct proportion to the severity of the pollution. There have been reports of foul smells and [illegible] oily substance settling on the schools located in this area. On many occasions these schools had to be dismissed and the students sent home as a result of reported cases of nausea and vomiting, headaches, [illegible] fainting and [illegible] allegedly related to the emissions from these industries. This has resulted in the loss of [illegible] days [illegible] schooling hours [illegible] with reduced teaching hours.

Although the Ministry of Health [illegible] concerns about the symptoms apparently associated with the [illegible]

Figure 3

PERCENTAGE DISTRIBUTION OF POPULATION
BY ISLAND FOR CENSUS YEARS 1943 - 1980



pollution, it is as concerned about the long term effects, if any, and to what extent the immediate environment endangered. There will always be odour and some pollution associated with an industrial park and therefore the environment cannot be 100% risk free, but at what levels these pollutants exist and whether these concentrations have a serious long term health effect on the population as a result of continuous exposure is the required information that is now a priority within the Ministry.

To this end, the Ministry [illegible] epidemiological study, the results of which will [illegible] identifying the need for control [illegible] health hazards and in identifying [illegible] training, research and legislation. It would [illegible] as a baseline for the evaluation of the [illegible] and preventive health measures introduced.

LITERATURE REVIEW

Many of the chemicals involved in petroleum refining, chemical manufacturing and electricity generating companies are toxic in various ways and may produce harmful effects when taken into the organism in doses exceeding the capacity of the body to deal with them. In particular, many aromatic amines, nitrosamines, organometallics, halogenated hydrocarbons and polyaromatic hydrocarbons have been shown to be mutagens, carcinogens or both (1). Because some of these substances are released into the atmosphere (2), and indeed this is the case in Grand Bahama as evidenced by the Department of Environmental Health Services (DEHS) Environmental Monitoring and Risk Assessment Division's (E.M.R.A.) ongoing ambient air study (3), it is highly possible that residents of those communities surrounding petroleum, chemical, and electrical plants are at an increased risk of developing some associated adverse health effects.

Many epidemiological studies have been conducted in an attempt to show a relationship between mortality and/or morbidity and exposure, through either occupation or residence, to industrial pollutants (4-15). Generally, ambient levels of these emissions or pollutants tend to be relatively low, and [illegible] with lower outdoor [illegible] [illegible] Dr. Lance Wallace of the Environmental Protection Agency (E.P.A.) in a pollution study [18] found that airborne levels of more than a dozen known or suspected carcinogens are two to 10 times higher indoors than outside; and this is one reason why occupational studies are often used as "markers" for potential environmental effects. Although these previous studies differed in both size and design and covered different periods, many of them did in fact show similar abnormalities with significant excesses among exposed individuals when compared with the general population or with non-exposed persons [11-15]. The majority of these studies however, were limited to either cancer incidence and/or mortality with very few studies attempting to correlate other diseases or abnormalities with petroleum or chemical industry exposure [illegible]. As for why very few studies have been [illegible] other health risks due to the potential environmental impact from [illegible] product distribution [illegible] in [illegible] including pollution of [illegible] contributing to the many [illegible] in part [illegible] factors, may be the reason. These possible confounders which can strongly influence disease rates may include lifestyle (smoking and diet), automobile and other industrial emissions, population migration and density, occupational exposures, and socio-economic status (17).

Reports of occupational related health problems within the pharmaceutical industry alone date back more than 40 years when Watrous (18) outlined the hazards of handling crude vegetable drugs, solvents, and the by-products of organic synthesis. Since then, various illnesses associated with drug manufacture have been reported. These include allergies (4), liver disorders (5), adrenocortical suppression (6), and feminization syndromes (7). In addition, certain chemotherapeutic agents produced may themselves carry a risk of neoplasia (15). In a population based study by Hoover and Fraumeni (20) that compared average annual age adjusted cancer mortality rates from 1950 to 1969 between whites residing in chemical industry counties and whites residing in other United States counties, excess mortality was found for [illegible] [illegible] whites resided in chemical industry counties. [illegible] deaths were for total cancers, bladder cancer, liver and gallbladder neoplasms, cancer of the nasopharynx and nasal sinuses, and malignant melanoma. These results were not readily explained by confounding due to degree of urbanisation, socio-economic class, or employment in non-chemical industries. On the other hand, in a study designed to investigate whether the mortality of British pharmaceutical industry workers showed any evidence of occupationally related patterns associated with particular sections of the industry, with special emphasis on cancers and respiratory diseases, Harrington and Goldblatt (30) concluded that there was no evidence on the basis of their study to suggest any excess mortality risk from employment in the pharmaceutical industry; this was in spite of observing an inconsistent excess mortality for cancer of the large intestine. A major drawback with their study however, was that the occupation stated on the census form, this was a census based study, related only to the job that was currently held, and which could be irrelevant to the long-term or lifetime exposure. Such an approach should be used mainly in industries with relatively stable working populations. In studies of petroleum or oil refinery workers and of communities surrounding these industries, there again appear, based on the literature, to be [illegible] associations between cancers of multiple sites and exposure to [illegible]. The cancer sites that have been implicated in more than one study include cancers of the respiratory system, stomach, lymphopoietic tissues, the pancreas, brain [11-15]. In addition, Wen et al [16] in studying a large refinery cohort that was divided into three sub-cohorts according to hire dates, observed increases in cancers of the pancreas, prostate, as well as leukemia among those employees recruited during 1940-45 versus those hired before [illegible].

In order to evaluate the findings of a previous mortality ratio analysis study that revealed elevated mortality from brain tumors, stomach cancer, leukemia and other cancers among the Oil, Chemical And Atomic Workers International Union (O.C.A.W.) members employed in three Texas Gulf Refineries, Thomas et al [17] compared the complete work histories of cases to a matched set of controls who died from other causes. Work histories were summarized by classifying each job title and department [illegible] into one of several broad work categories or refinery unit operations. A worker was considered exposed if a work category at no [illegible] was known to have worked at least 1 day in that category 25 or more years prior to his death. From their analyses, no strong associations for brain tumor risk were seen with any work categories but a slight association for leukemia was seen among workers in the treating category, which included unit operations that reduced the level of arsenic and sulfur constituents of petroleum products and combined them with additives to improve their quality. Stomach cancer risk was also elevated among maintenance workers and workers exposed to lubricating oils and paraffin wax processing. Conversely, in a cohort study of 14,170 current and former Chevron USA employees in California, in which the observed mortality of the cohort by cause was compared with the expected based on the United States mortality rates standardized for age, race, sex and calendar time, mortality from all causes for the entire cohort was only 72.4% of that expected, a difference that was statistically significant (21). In addition, a significantly lower mortality was found for all forms of cancer combined, digestive cancer, lung cancer, heart disease, non-malignant respiratory disease, diseases of the digestive system, and accidents. Only lymphopoietic cancer showed a pattern of increased risk suggestive of [illegible] this relation to an occupational exposure and [illegible] this association appeared questionable when a follow up case analysis of the lymphatic cancers failed to identify a common exposure pattern.

In terms of exposure to combined emissions from several different industries, an analogy that could serve as a warning can be made between the industrial area in Northern California (Contra Costa County) and Grand Bahama. Since the beginning of the century, the north and west portions of Contra Costa County have been the center of the petroleum refining and chemical manufacturing industries in Northern California. Because of the recent public concern over possibly elevated cancer rates in that county, a study was designed by Kaldor, Harris et al.(22) to investigate the relationship between exposure to combined air emissions produced by the petroleum and chemical industries and average annual cancer incidence and [illegible] by [illegible] among [illegible]. In [illegible] residents exposed to petroleum and chemical air [illegible] was associated with an increased incidence of [illegible] cancer of the [illegible] and pharynx [illegible] standard incidence ratios for cancers of the [illegible]

[illegible]

lung, prostate and kidney and urinary organs were also associated with petroleum and chemical plant air emission exposure. In both cases, they found a strong positive association between degree of residential exposure and death rates from cardiovascular disease and cancer, and finally a less strong positive association between exposure and death rates from cerebrovascular disease.

Because confounding variables must be considered as possible explanations for the associations or lack of associations observed in the various studies reviewed, the public health implications of these findings remain unclear. The evidence presented, however, is sufficient to warrant additional studies based on individual data in which possible biases can be more readily controlled. This is especially so in developing countries like the Lebanon where such studies were never previously undertaken and where some industries are known to relax certain protective standards that would normally be used (23).

METHODS

STUDY DESIGN

In attempt to determine the role that environmental factors play in the development of a particular disease or condition, several types of Epidemiological study designs have proven to be useful. However, these designs are not alternatives that could be chosen freely for any given situation. The choice of a study design depends primarily on the objective of the study and on constraints imposed by factors such as resources available, the time limit within which at least provisional answers are required, accessibility of the population to be studied, and ethical considerations.

As earlier mentioned, there have been no other epidemiological studies conducted in Grand Bahama to assess the health impact of the industries to date, and therefore it remains unknown whether any serious long term threat to health exists, and if it does, the extent of the problem. With this in mind, the study has a cross sectional study, a design chosen primarily because estimates of exposure and measurements of personal characteristics and biological effects were able to be which at the same time. Additionally, it enabled information on interesting questions to be provided relatively quickly and with an acceptable level of expenditure while also avoiding other technical complications which arise when considering repeated measurements on the same individuals at different times. The study was not oriented to the verification of a specific working hypothesis, but was more of an exploratory character.

The study commenced by determining the exposure of four groups (students, teachers, workers and the community) to the emissions reportedly given off by one or all of several industries located in the industrial park area of Grand [illegible]. Data was then reviewed in order to ascertain if the participant had either in the past or was then exhibiting any abnormalities based on other studies [illegible] known to be associated with environmental contaminants from industries of this nature. These results were then compared to [illegible] previously [illegible] control group to see if there were any significant differences while controlling for any potential confounders.

In previous studies of the health effects of industry or emissions, or community and disease either according to the presence or absence of industry, or according to monitoring station levels. Although neither of these approaches are ideal nor do they specifically define exposure to petroleum and chemical plant emissions because of the proximity of these plants to other industries and major highways, the former method is much more feasible in our situation than any other approach. Exposure, for study purposes, was limited to an area within a five-mile radius of the industrial site but additionally participants had to be exposed for a minimum of five years in order to be included in this study as exposed subjects. All other participants, those sampled from Freeport which is beyond the exposed area and who had never attended school, taught, worked or lived in the exposed area for any length of time, were considered the control or comparison group. The reasons for the five mile radius for exposure and the five year minimum exposure time were because the investigators felt that the emissions level would be significantly different beyond the five mile radius and that a five year exposure period would have been quite adequate to show any important physiological changes that may indicate the development of chronic effects.

The index of occurrence of disease in a cross-sectional study is prevalence, or the prevalence rate, i.e. the number of persons in the group who are currently affected expressed as a proportion of the total number in the group.

STUDY POPULATION

In planning and analysis of any community health survey, the most important steps are in (i) determining and defining the needs and problems of the community (ii) deciding on what information is required to deal with these needs and problems, (iii) ascertaining whether this information is already available so as not to duplicate efforts and in the process waste both time and money, (iv) in deciding whether a survey is the best means by which to get the required information and (v) deciding on the sampling plan. Inherent in the choice of a sampling plan are answers to the questions how are the people to be selected for inclusion in the survey and how many are to be included.

In order to know exactly what is going on in a population, the ideal would be to survey the entire population from which accurate measures of any or all parameters can be obtained. Generally, however, populations of interest are so large as to render the obtaining of all measurements infeasible and so what is normally done in such cases is to obtain a subset of all the measurements in the population. This subset of measurements comprises a sample, and from the characteristics of samples conclusions can be drawn about the characteristics of the populations from which the samples came. Samples from populations can be obtained in a number of ways; however, to reach valid conclusions about populations by inference from samples, statistical procedures typically assume that the samples are obtained in a random fashion. To sample a population randomly requires that each member of the population has an equal and independent chance of being selected. That is, not only must each member in the population have an equal chance of being chosen as a member of the sample, but the selection of any member of the population must in no way influence the selection of any other member.

The selection of a study population for the [illegible] Survey involved several different phases [illegible] which answered to such questions [illegible] risk groups were, and [illegible] be included in the study [illegible]. The investigat[illegible] [illegible]

The target population was identified mainly through complaints from various institutions and civic groups as well as from the review of the literature. It included students, teachers, workers and the non-institutional population of residents of settlements in South-western Grand Bahama.

Students - For the selection of the survey student sample, the schools chosen were all primary schools, in both the exposed and unexposed areas that were open and functioning at the time the study was designed. Three schools, Saint Vincent De Paul, Lewis Yard and the Hawksbill Primary School were selected from the exposed area. Schools from the Freeport area that were used for the selection of controls included the Mary Star Primary School, Sunland, St. Paul's and the Seventh Day Adventist's Primary School. One additional primary school in the Freeport area that was open during the study, the Walter Parker Primary School, was not inlcuded in the study because when the study was designed it was yet to be opened and therefore no students would have attended that school for the minimum required period of five years.

All students included in the study were chosen from the 6th grade (11-12) and assumed that they had spent at least five years in that school. The reasons why this particular grade was chosen versus an older sample taken from a higher grade with more exposure time, was because (i) the investigators wanted to capitalize on the fact that younger children (all were between ages (9-12) react more quickly to toxic environmental contaminants ( ) while still meeting the study criteria (ii) they also wanted to avoid the possible confounding effects of smoking and alcohol use that is seen in older populations, and (iii) they wanted to avoid the physiological changes that normally occur due to puberty.

The actual method used in choosing the students was conducted separately for each school involved in the study. The number of students that were eventually selected from each school was directly proportional to that school's eligible population compared to the total eligible population from all schools [illegible] both the exposed and unexposed groups. After the sampling frame of all eligible 6th graders were [illegible] a systematic random sampling approach [illegible] the final participants.

Teachers - Like all other subjects in the study, [illegible] teachers included were exposed and unexposed. All teachers were required to have worked at their respective schools for a minimum of 5 years. The sampling process was the exact same as that used in the selection of the students, the only difference being that the sampling frame consisted of all eligible teachers. After all the requirements were met, the sample of teachers for the exposed area were selected from 3 schools; the [illegible] Ward Primary, Hawksbill Primary, and the Hawksbill High School. No teachers were selected from the Saint Vincent De Paul Primary School so teachers from the Hawksbill High School were used to make up numbers. For the comparison group, the teachers were selected from the very same schools that were used in the selection of control students, namely the Mary Star Primary, [illegible], St. Paul's, and the Seventh Day [illegible] Schools.

Workers - Since work occupies such a large part of modern life, it is not surprising that it can have a tremendous influence on people's health. Because most, if not all, of the environmental complaints in the industrial area of Grand Bahama have been relative to the industries and more specifically the emissions from [illegible] industries. It was only natural to assume that the workers in these industries would themselves be at an increased risk of developing some industrial exposure related diseases. As evidenced in the literature review, this is indeed the case with most studies in environmental epidemiology being conducted on various occupational groups. The industries from which study participants were selected included all three industries within the industrial park that were operating during the time of the study. These included the Bahamas Oil Refining Company, the Freeport Power Company, and the Syntex Pharmaceutical Company. All employees of these industries that were employed for 5 years or longer were eligible to be included in the study. [illegible] sampling frames were established using the various company records and the number to be sampled from each industry proportionately calculated. The sample was again chosen using the systematic random process. Although it was known that different [illegible] within the same industry have different [illegible] this was not included in the selection [illegible] employees, regardless of whether they worked [illegible] or white collar job, or whether they worked in the factory's production area versus an office, were handled [illegible] as [illegible] group and included in the common sampling frame. This was done for each of the industries in the exposed group. For the control group selected from the [illegible] area, the population of workers at the Rand Memorial Hospital served as the sampling frame from which these participants were selected. It was felt that a sample from this population would serve as an adequate control group because they represent a variety of different job functions with exposure to a variety of factors.

Community -- The decision by the investigators to study yet a fourth group, the community, was made because of the proximity of the settlements to the industries. Selecting representative samples from communities or non-institutional resident populations is never easy, for the design has to ensure that any one area, or particular class of people are not over-represented at the expense of another. Study participants representing the industrial or exposed areas were selected from all settlements within the 2 mile radius of the industrial site. This included the settlements of Lewis Yard, Pinder's Point and Hunters. The control group for the community were all selected from Freeport. The reasons control groups that had ever worked, attended school, lived or was still living within the exposed area. By including these persons in the various control groups, we would have ran the risk of creating a gross selection bias that could have nullified any true exposure differences between groups. This might have caused any normally apparent exposure related risk of disease to appear statistically as if it did not exist.

DATA COLLECTION

By design, data collection involved both the Ministries of Health and Education, the industries, and the individuals chosen to be included from the community. Generally, they were all quite supportive with the Ministry of Education ensuring cooperation from their schools through the District Education Officer. All examinations and tests were performed at the Rand Memorial Hospital (RMH) with the resources for these tests being provided by the Ministry of Health. Data were collected by Eric Brown, M.D. and Sarhat Mahmood (Acting Medical Officer of Health) both of the Public Health Department, Bahamas Ministry of Health, and by Vivian Brathwaite, R.N., and Rosemary Hall, R.N., both Nursing Officers in the Community Health Services, Ministry of Health.

All of the subjects were well informed through a series of meetings and by the use of a letter which clearly explained the nature of the study [illegible] (See Appendix A) [illegible] the students who were all minors, informed consent was required. This was achieved by the distribution of [illegible] accompanied the former and which had to be signed [illegible] by a parent or guardian (See Appendix B). When necessary, these letters were followed up either by a phone call, a visit, or both to the student's homes. Additionally, a member of the study team was also available at the RMH to answer any questions that might have arisen.

In an effort to facilitate the procedures and reduce on the numbers of persons that may have appeared at the RMH haphazardly, attempts were made to examine all members of a selected group before moving on to another. For the students, who were collected from the schools and bussed to the Rand, this was not always possible due to unforeseen absentees and delays in the receipts of the signed consent forms. The other groups were contacted either personally, in the case of the community group, or through their various institutions and asked to come to the hospital within a given time period. The majority of the survey data collection was completed between February and May, 1987.

At the hospital, participants were first of all individually taken into a private room and administered a standard questionnaire (See Appendix C). The questions were asked either by [illegible] [illegible] and the [illegible] included information that could be grouped into the following sections:

(a) Demographic and Social Characteristics: Day of Birth, Name, Sex, Date of Birth, Length of [illegible] and Occupation, Residence, Trade of [illegible] Present Employment, Residence, Income, [illegible] and that Residence, Study Classification.

(b) Medical history including check-ups and admissions, hospital treatment, established diagnoses and the use of medicines.

(c) Alcohol and Cigarette use.

(d) Some questions pertaining to the reproductive system (e.g. [illegible] contraceptives for women and earlier and [illegible] [illegible] children [illegible] [illegible] deceased [illegible] and functional disorders in men.

For efficiency, questions to the participants [illegible] employment history dealt with the job currently held. It was felt that in most cases this would correctly identify the exposure status of most subjects while offering considerable savings in time of interview. It is however [illegible] by not covering the entire work history [illegible] possible to also miss [illegible] jobs of high risk [illegible] creating a possible selection bias. The medical history [illegible] concentrated on the five year period [illegible] however [illegible] [illegible] the study and the [illegible] [illegible] attempts were made to cross-check the information [illegible] received with any existing records.

After the questionnaires were completed, the participants were then given physical examinations that included an eye and ear examination by the nurse and an examination of the normally exposed portions of the skin by the doctor. The ears were tested with the use of an audiometer and provided data on the degree of hearing loss. Both the left and the right ears were tested at four different frequencies, 500 hertz (Hz), 1000 Hz, 2000 Hz, and 4000 Hz and recorded in one of four noise intensity categories: less than 25 decibels (dB), 25-40 dB, greater than 40 dB and no response. Noise was considered to be any unwanted sound that may adversely affect the health and well-being of individuals or populations and machines [illegible] like those [illegible]

[illegible]

been [illegible] individuals who may be particularly susceptible to noise-induced hearing loss and therefore early detection of such hearing impairment is most important in the prevention of progressive deafness.

The eyes were examined for signs of chronic conditions of the conjunctiva, cornea and lens that may have been due to the presence of the various gases, fumes or dusts. Simple vision tests, both near and distant were performed using vision charts to determine the ability to discriminate objects that subtend particular angles of the eye. The dermatological examinations were essentially clinical in nature and included examinations of the hands and arms, feet and legs, face and neck, the scalp and the trunk. The presence of eczema, either acute or chronic, increased or decreased pigmentation, ulcerative lesions, neoplasms, granulomata or chloracne on any of these body parts were recorded. Additionally, any other skin diseases that were observed were also recorded.

After the physical examinations were completed, the subjects were then sent to the laboratory where a necessary specimens to complete the laboratory tests were then taken. A complete blood count (C.B.C.) as well as other lab tests to assess kidney and liver function were performed. The information obtainable from laboratory evaluation of blood cells is pertinent both to disorders of the haematological system and to diseases primarily affecting many other organs in which blood cell changes occur as secondary manifestations. Included in the blood count were measurements of Haemoglobin (HB), Haematocrit (HCT), White Blood Cells (W.B.C.), Neutrophils, Eosinophils, Basophils, Lymphocytes and Monocytes.

To assess kidney function, samples of urine were tested. These included tests on Specific Gravity which helped to assess functional changes, for Proteinuria which could indicate early renal injury, and tests for kidney Sediments. Kidney damage is indicated by the number of epithelial cells and the presence of microscopic haematuria may evoke the possibility of cancer of the [illegible] or bladder.

For the liver function tests, measurements of bilirubin, both direct and indirect as well as [illegible] were provided. [illegible] S.G.O.T. and S.G.P.T. [illegible] and [illegible] the presence of Hepatitis B surface antigen were also performed.

To observe the possible effects on the respiratory system or more specifically the lungs, a chest radiograph was performed. These X-rays looked at the upper, middle and lower portions of both the right and left lungs. All lab and X-ray tests were performed by the trained lab and X-ray technicians employed by the [illegible] Road. The equipment that were used were standardized prior to the specific tests that required such procedure.

Since the study also involved school children who were examined in their uniform school, as groups that were invited to the R.M.H. within a particular time period, it was not always possible to blind the investigators to the exposure categories during the physical examinations. However, the laboratory personnel who performed the tests and the radiologists who read and interpreted the X-ray were blind to the exposure categories of the different groups. After the physical examinations were performed, the subjects were all given study numbers to be used as their only means of identification for all subsequent tests. This ensured that all laboratory and X-ray results remained anonymous. The specimens were identified solely by their study numbers with only the investigator holding the key data sheet that matched names with numbers. Any abnormal findings were reported to the patients physician when possible or the patient was referred for treatment through the government services.

DATA ANALYSIS

With the objectives of the Grand Bahama Population Study having been (i) to look into all possible body functions of the sampled groups (students, teachers, workers and the community, with a view towards identifying any physiological abnormalities and (ii) to determine if any one group was at an increased risk of developing any industrial pollutant related illness; the analysis of this study involved comparing [illegible] the sampled groups from the exposed or the more polluted area with their counterparts in the unexposed or less polluted area as well as looking at any intra-exposure group differences.

The main independent or predictor variable of the study, Exposure, for analysis purposes was binomial and recorded for each subject as either exposed if a subject was exposed based on the pre-defined criterion, or unexposed if the subject had spent no prolonged time period in the exposed area. However, an additional variable was included that indicated the number of years a subject belonged to his or her particular study group and which allowed for the possibility of taking a closer look at the disease distribution in the case of the more [illegible] the demographic variables, date of birth, used to calculate age, a co-factor in the development of most chronic diseases, and sex, coded as either male or female, were best utilized as interval and nominal variables respectively.

Other independent variables on which data were collected, those indicative of a subject's lifestyle and including data on smoking and alcohol use, both binomial, were recorded as either positive if a subject currently smoked or drank alcoholic beverages or negative if they did not. A variable was also used to indicate the number of health check-ups a person had within the last five years. This was extremely important because the more health examinations a person had the greater was the chance of an abnormality being detected. If any one group had more check-ups than any other group then logically there would have existed a [illegible] chance for this group to report any abnormalities. This could have had the effect of biasing the [illegible] away from the null hypothesis, indicating a [illegible] greater or much less than that which actually existed in the population.

The dependent variables studied that examined the on c.l.o., cornea and lens of the eyes were acute and chronic conjunctivitis, opacity and cataract respectively. They were all nominal and coded as present if there were signs of these abnormalities, or absent if there were none. For the ears, four frequency levels were used to test hearing and the noise intensity or decibel level at which each frequency was picked up was recorded and for analysis purposes placed in one of the four categories previously described.

The variables studied that indicated skin conditions, acute and chronic eczema, ulcerative lesions, neoplasms, granulomata and chloracne were all recorded as either present or absent based on whether or not the condition existed.

Of the three variables used to assess kidney function, two of them, urinary sediment and protein, were nominal and based specifically on their presence. The third, specific gravity of urine was discrete with the exact measurements obtained having been recorded. All the variables from the complete blood count: Hb, HCT, W.B.C., Neutrophils, Eosinophils, Basophils, Lymphocytes and Monocytes were also discrete, the [illegible] while higher percentage again having been recorded. SGOT, SGPT, direct and indirect bilirubin variables designed to assess liver function were all continuous while total bilirubin was coded for analysis purposes as either one or less, or greater than one.

Any opacities detected from the chest X-rays were studied and subsequently interpreted by the investigators as to their relation to the industrial pollution.

All previous disorders or established diagnoses, for purposes of analysis, were recorded in one of seventeen categories. This was done with the use of the 1975 Revision of the World Health Organization's International Classification of Diseases (ICD 9). Up to three different abnormalities for each individual were recorded and therefore each of the three established diagnoses variables contained the seventeen categories. For each of the three established diagnoses variables there was another [illegible] variable, medicine use, which indicated whether medicine was used for the corresponding disease. The seventeen categories listed in order are hypertension, [illegible], respiratory [illegible] diseases, genito-urinary diseases, musculoskeletal diseases, nervous system diseases, gastro-intestinal diseases, ear, nose and throat diseases, eye diseases, other cardiovascular diseases, endocrine and metabolic diseases, injuries and poisonings, anemias and blood disorders, signs, symptoms and ill-defined conditions, neoplasms, skin diseases and coughs, colds and fevers.

The primary design feature of this cross-sectional study was the observation of the existing or prevalent cases of disease in the population. The prevalence rate of disease was estimated by dividing the number of cases of the disease or abnormality of interest by the study sample that they came from (Figure 4).

FIGURE 4 PREVALENCE RATES

	DISEASE STATUS		
EXPOSURE	DISEASE	NO DISEASE	
YES	a	b	[illegible]
NO	c	d	[illegible]
TOTAL	[illegible]		n

Disease Prevalence of Exposed

$PE+ = a/n_1$

Disease Prevalence of Unexposed

$PE- = c/n_0$

The measure of association between the exposure to the industrial pollution and the development of the condition under study was calculated using the prevalence ratio. This was estimated in a manner similar to the estimation of the risk ratio in cohort studies and allowed us to state how many times the exposed subjects were more or less likely or at risk than the unexposed subjects of having a particular disease (Figure 5). Generally, the rule for interpreting the prevalence ratio states that if the prevalence ratio is equal to or very close to the value 1, then, based on that study there is no association between the exposure variable and the disease or condition under study. If the value is greater than 1, then the exposure variable is positively associated with the disease in that its presence increases the risk of disease development. If the value is less than 1, then there is a negative association between the exposure and the disease or the presence of the exposure [illegible] the risk of disease development.

FIGURE 5

Prevalence Ratio

PR = [illegible]

The 95% confidence limits for the prevalence ratios were also calculated using test-based interval estimation (Miettinen, 1974a, 1976a) programmed into a Hewlett Packard (HP) 41 cv. If the calculated interval contained the value 1, the results were not considered to be significant. This is because the statistic indicates that if 100 samples were drawn from this population and the prevalence ratios calculated, 95% of the time the observed ratio will fall between these limits which contain the value (1), indicative of no association.

To control for possible confounding by other variables, it was sometimes necessary to analyze the study results by stratifying the data into two or more subgroups. For this, the Mantel-Haenszel procedure was used. In the event that the prevalence ratios were relatively constant across subgroups, being consistently elevated or reduced, they were combined to form a summary estimate. This estimate was referred to as having been adjusted for the effects of those variables used in the stratification. If the crude or unadjusted prevalence ratios and the adjusted ratios were considerably different, the adjusted variable is said to have been confounding or diluting the effects of the exposure variable on the disease outcome. No adjusted prevalence ratios were calculated if the variables were found to have been interacting (if the stratum specific prevalence ratios were quite different from each other). Because of small numbers, only one variable was stratified at a time.

Rates were compared using the chi-square (X^2) for contingency tables generated by the statistical program SPSS or by the exact test of Fisher, calculated again with the use of the Hewlett Packard 41 CV, when cell numbers were small (less than 5). The students t-test was used to compare means, and all tests were two tailed unless otherwise stated.

RESULTS

Students

In this study, 46 (38.3%) of 120 exposed students selected came from St. Vincent de Paul, 26 ([illegible]%) from [illegible] and [illegible] ([illegible]%) from [illegible] Primary. Of these, [illegible], [illegible] and [illegible] respectively were eventually examined.

For the control group of students, the selection process was basically the same as that of the industrial group and this resulted in [illegible] ([illegible]%) of the [illegible] students being chosen from Mary Star, [illegible] ([illegible]%) from [illegible], 27 ([illegible]%) from St. [illegible] Paul and [illegible] ([illegible]%) from the Seventh Day Primary School. Of these, [illegible], [illegible], [illegible] and [illegible] respectively were eventually examined. In spite of the precautions taken to ensure that the control group did not receive any exposure through their residing within the five mile radius of the industrial site, it was discovered during the analysis that three control students did live in the exposed area and so they had to be deleted from the study.

As a result, the final analysis included data on a total of [illegible] students, [illegible] ([illegible]%) exposed and [illegible]

Fisher (47.9%) [illegible] (52.1%) controls (Table [illegible]. Of the [illegible] females with 42 of them exposed and 45 not exposed [illegible] the total the 79 males, that accounted for 52.1% of the total students, 52 (57.1%) were exposed while the remaining 46 (46.5%) were not (Table 3.2). There was no statistical difference between the numbers of exposed males and exposed females analysed based on the exact test of Fisher (p = .5504, 1 Tailed). In looking at the mean ages of the two groups, the exposed group with a mean of 15.80 years was significantly younger than the group of controls who had a mean age of 17.00 years (p [illegible]) (Table 3.2).

Based on past diagnosed reporting by the students, there appeared to be an excess number of cases [illegible] the exposed group when compared to the control students for Gastro-intestinal Disorders, Disorders of the eyes and for symptoms related to coughs, colds and [illegible] (Table 3.4). There [illegible] disorders [illegible] student group [illegible] population [illegible] exposed [illegible] population for the controls [illegible] ratio [illegible] 6.20 [illegible] (p = .049) and indicated the [illegible] chances of the exposed students of having been diagnosed with a gastro-intestinal disorder was more than 2 times that of the students attending schools in Freeport. For reported cases of disease of the eye, 4 of the 5 total cases were from the exposed students. The crude prevalence ratio of 3.32 (95% CI = 1.9 - 6.52) which seemed high was not significant when tested at the .05 level of significance (p = .215).

Based on the episodes of coughs, colds and flu that were reported by the students, the exposed group's chances of having had any of these symptoms was about twice that of the controls (PR = [illegible]). There were 24 total cases, 16 ([illegible]%) of which were in the exposed. The confidence limits ([illegible] - [illegible]) which were wide, too, but did not contain the value 1, which indicated an association, reflected the results obtained from the significance test (p < .[illegible]). As a check to make sure that one group did not have more preventive check-ups than the other thereby increasing their chances of finding abnormalities, a test on the mean number of check-ups was performed. This test indicated that the average number in the group of exposed was in no way different [illegible] students (p = .04[illegible])

[illegible]

(Table [illegible])

Data were analyzed on the eyes of the entire 188 students examined in the study. There were 47 cases of acute conjunctivitis, 5 cases of chronic conjunctivitis and 2 cases of cornea opacity. There was no evidence of cataract in any of the students.

Of the 47 cases of acute conjunctivitis, 27 [illegible] were from the exposed group with the other [illegible] amongst the controls. From these data, the prevalence rate of acute conjunctivitis, expressed as a percentage in 8th graders during this study period was [illegible] per 100 for the exposed group and [illegible] the controls. The crude prevalence ratio (PR) was [illegible] and indicated that the exposed [illegible] increased risk of having [illegible] (Table [illegible]). The results from [illegible] determine if acute [illegible] exposure was not significantly [illegible] between exposed [illegible] and unexposed groups (X^2 [illegible]

[illegible] sex differences. For males there were 15 cases among the exposed and 14 among the controls. The prevalence rates were [illegible] cases and [illegible] cases per 100 respectively, for a stratum specific prevalence ratio of [illegible]. This figure (PR) in itself indicates no increased or decreased risk for the exposed group as the PR is extremely close to the value of one which signifies equal rates. This is supported by the results of the chi-square test (X^2 = [illegible], p = [illegible]). In the women, 12 (66.7%) of the 18 cases were exposed and 6 (33.3%) were not, for prevalence rates of [illegible]% in the exposed group and 14.2[illegible]% in the controls. The PR for this stratum was 1.75 and indicated that the exposed females chances of having had conjunctivitis was almost twice that of the controls. These results, although apparently showing a larger rate in the exposed group, were not statistically significant (X^2 = 1.2[illegible], p = .26). The Mantel-Haenszel summary prevalence ratio which adjusted out any effects due to sex differences was 1.109 and was not significantly different from the crude PR of 1.0[illegible] although it was increased slightly removing the effects of sex.

Of the 8 cases of chronic conjunctivitis [illegible]

[illegible] Table 1.7) [illegible] [illegible] Table 1.8) [illegible] [illegible] [illegible] although [illegible] [illegible] population [illegible] [illegible] significant.

For the skin examinations, the entire student sample was again examined. No data was missing. There were 7 cases of acute eczema of the hands diagnosed among the students, 4 cases of acute eczema of the legs, 7 cases of acute eczema of the face and 1 case of acute eczema of the trunk (Table 1.9). No differences were observed for the two groups, exposed and controls, for acute eczema on any of these body parts. Of the 198 total students, there were only 2 observed cases of chronic eczema: 1 case of chronic eczema of the [illegible] and 1 case of chronic eczema of the hands. [illegible] were from the exposed population of the [illegible] both were males (Table 1.10).

Based on the analysis of the [illegible] cases of ulcerative [illegible] hand and arm and 4 on the legs [illegible] of the [illegible] the 4 cases of ulcerative [illegible] the exposed group giving an exposure group specific prevalence rate of 3 cases per 100 exposed. The prevalence ratio was 2.64 but based on the chi-square test, this was not significant (p = .191). There were no differences between groups for observed cases of ulcerative lesions of the legs either, for 2 of the cases were exposed and the other 2 were observed in the controls. The prevalence ratio was .880.

There were 9 cases of chloracne of the face and 1 case of chloracne of the trunk (Table 1.12). The single case of chlorance of the trunk was observed on an unexposed female. Of the 9 cases of chloracne of the face, 5 were exposed and 4 were controls. The prevalence ratio was 1.10 and revealed no correlation between exposure to the pollution and the presence of chloracne.

Also recorded from the skin examinations were cases of increased and decreased pigmentation. Again the results showed no significant differences in the recorded cases of either increased pigmentation (Table 1.13) or decreased pigmentation (Table 1.14).

Based on the results from the laboratory trials, the mean specific gravity of urine for the entire sample was 1.020 with a range of 1.004 to 1.033. After further dividing into exposed and unexposed groups, the mean of the exposed group, 1.0164, was significantly different from the mean of the unexposed group, 1.0231 ($p = .014$). When only the exposed and unexposed males were studied, the means were not significantly different, but for females, they were ($p = .014$) (Table 1.15). For ALA, the values ranged from 5.8 to 71 and the mean was 19.175. There were no statistical differences between the means for total exposed versus not exposed ($p = .574$) nor for males ($p = .772$) or females ($p = .458$) (Table 1.16). For ZPP, the mean for exposed and unexposed groups were statistically different for the females ($p = .048$) but not for the males or the total group. The values ranged from 2.0 to 78.0 and the overall mean was 10.183 (Table 1.17).

The [illegible] (Table 1.18) and hematocrit (Table 1.19) [illegible] from 10.0 to 22.? and [illegible] overall mean [illegible] 17.82 and 38.50 respectively) [illegible] on the t-test [illegible] significant difference [illegible] circumstances. The mean white blood cell count in the control sample was also not significantly different from that in the controls.

Additionally, there were no differences between the exposed students and the controls in hearing tests using the audiometer nor were there any lung opacities seen on any of the 133 students.

TEACHERS

For the teachers, the final analysis yielded a total of 38 subjects, 17 (44.7%) from the exposed group and the other 21 (55.3%) from the group of controls. Of the exposed group, 9 or 52.9% were from the [illegible] Primary and 2 High School, 6 (35.3%) from the [illegible] (11.8%) from the Lewis Yard Primary School. For the control group, Mary Star, [illegible] St. Pauls and the Seventh Day Adventist School yielded a total of 9 (42.8%), 6 (28.6%), 5 (23.8%) and 1 (4.8%) teachers respectively (Table 2.2). In terms of number of years teaching at their various schools, while the exposed group with a mean of 10.25 years appeared to be the more stationary of the two groups, this difference was not significant (p = .225). The mean of the control group was 8.59 teaching years (Table 2.4). The mean age of the two groups, which also indicated [illegible] differences, were 40.6 years for the exposed [illegible] 40.3 years for the (exposed) [illegible] controls [illegible] 2.3). Of the 38 teachers, only 2 [illegible] were [illegible] [illegible]

As an indicator of [illegible] smokers for [illegible] drinking were also collected [illegible] smokers was defined as current tobacco smokers and drinkers referred to those persons that admitted to drinking any alcoholic beverage under any circumstances. As a pleasant surprise, none of the teachers that were included in the sample smoked. However, 54.7% of the exposed and 70.2% of the control group did admit to taking a drink of an alcoholic beverage at one time or another. Statistical tests did not indicate any differences between the two exposure groups (Fisher's Exact p = .6748). (Table 2.5)

After interviewing the teachers about all established diagnoses within the 5 years just prior to the study, it appeared as if the exposed group were more likely to have had both Hypertension and Disorders of the Genito-urinary System. There were a total of 8 cases of Hypertension for an overall rate of [illegible]. Of these, 5 cases were from the exposed group and 3 from the control. These were rates of 20.[illegible]% and 1[illegible]% respectively. The differences, however, were not significant. In attempting to get a picture on these cases, we were limited by small numbers for both the variables sex and smoking while the admitted drinkers did have a slightly higher prevalence than the non-

[illegible] data [illegible] and [illegible] confirmed the crude association between exposure and [illegible]. Of interest, 4 (80%) of the 5 cases in the exposed group were from the [illegible] High School, a prevalence of 44.4% (Table 2.6).

A total of 9 cases of Disorders of the Genito-Urinary System were reported by the teachers. Of these, 4 cases (prevalence = 29.5%) were from the exposed group. The Prevalence Ratio was 2.47 but again insignificant. None of the institutions had an exceptionally large proportion of cases and again it was impossible to control for any other variables as a result of the small numbers (Table 2.7).

Of concern to the investigators was the possibility of greater numbers in this past history section for the exposed group due mainly to more checkups. It was felt that because of the number of recent [illegible] persons might start to think more in terms of prevention. The assumption that proved unfounded [illegible]. In checking the average number of check-ups for the group over the last 5 years, no differences were observed for this variable (Table 2.8).

Based on the eye examinations, the only abnormality [illegible] a [illegible] excess in the exposed group was Corneal Opacity. All of the 5 cases diagnosed were from the exposed group. Four (4) of the cases were female, reflecting the sample sex distribution and 4 were drinkers. On further examination of the institutions, it was again observed as for hypertension that 4 (80%) of the 5 cases were from Haskabill School (Table 2.8). There were a total of 15 cases of acute conjunctivitis discovered, however, with a prevalence ratio of .88 there were no differences whatsoever in the rates of the two groups. (Table 2.10).

Also tested with the use of an audiometer were the ears. There did not appear to be any major hearing loss in any of the teachers. The dermatological examinations, although not showing much in terms of numbers, said a lot in terms of the institutional distribution. Exposure group excesses were found for acute eczema of the hands as well as legs. Of the 2 cases of the hands and the single case of the legs, all were again observed in the sample from Haskabill High. (Table 2.11).

Based on information contained in the literature that showed environmental lead to be a risk factor for abortions and stillbirths. It was decided that data on these variables as well as others related to the reproductive system would also be collected. The two groups were compared both on the total number of abortions and stillbirths as a proportion of the total number of pregnancies in the groups as well as on the year of first abortions. For the latter comparison the year 1975 which was the year that the industrial park would have been in existence for five years was used as a cut-point. There were no differences observed for either the total number of abortions reported by the two exposure groups (PR = 1.1) or for the total number of first abortions occurring after [illegible]. Because the occurrence of one abortion [illegible] risk factor for another, the number of females reporting at least one abortion were also compared and showed [illegible] exposure group difference [illegible] were exposed [illegible] high [illegible] early as [illegible] the [illegible]

In [illegible]

kidney function. It was determined that no grossly abnormal urinary sediments or proteins indicating some malfunction were present. The mean specific gravity of urine in the exposed group was not significantly different from that in the unexposed group, and this was for both total cases (p = .676) as well as for females only (p = .602). There were no differences between the sexes (p = .455) for this variable [illegible]. Results from the liver function tests were basically the same when the entire exposed group was compared to the group of controls. For both SGOT and SGPT, although the means did appear lower in the exposed teachers, statistically they were not. In the comparisons of females only, however, for both SGOT (p = .058) and SGPT (p = .046) there seem to be some correlation with the variable exposure. Neither variation showed any significant sex difference, but this was because of the small number of males (Tables 2.14 - 2.16). Based on the complete blood count, neither haemoglobin nor the white blood count showed any exposure difference, although there was a sex difference for haemoglobin (p = .005) (Table 2.15 - 2.18). For Hematocrit, statistics did show a significant difference in the total group (p = .028) but after separating the sexes, the difference was not as pronounced in the females (p = .078). (Table 2.17) No comparison for males was possible since there were no males in the control group. It should be noted however, that despite the statistics, these figures had no real biological meaning at this time since both the means were within a normal range.

There were no abnormal results observed on the x-rays in either group at all.

RESULTS

The final analysis for the sample of workers was performed on 84 cases, 38 (45.2%) of which were not exposed and worked at the Rand Memorial Hospital and 46 exposed workers. These 46 exposed workers were recruited from the Syntex Pharmaceutical Company (14 cases), the Freeport Power Company (9 cases), and the Bahamas Oil Refining Company (24 cases) (See Table 3.1). The mean years of employment for the two groups, exposed (11.42) and controls (11.24), were not statistically different (See Table 3.2) and neither were the mean ages of the two groups (exposed = 38.16, control = 35.44) (Table 3.3).

Of the total 84 cases, 52 (61.9%) were male and 32 (38.1%) were female. In looking at this sex distribution by exposure categories, the exposed group of 46 cases consisted of 40 (88.9%) men and 5 (11.1%) women while the control group of 38 had a total of 12 (30.8%) men and 27 (69.2%) women (Table 3.4). This imbalance in the sexes should have been controlled in the design with the use of stratification. It would have allowed for a more even distribution as well as be nullify the effects of any sex specific biologics differences. There were basically no differences in the prevalences of drinking (Table 3.5) and smoking (Table 3.6) between the two exposure groups nor was there any difference observed for the number of preventive checkups (Table 3.7). This fact was very important because it meant that the chances of the industrial workers reporting more abnormalities based on the sheer fact that they may have had more check-ups thereby increasing their chances of discovery was non-existent. This was indeed a concern since it was known that certain industries encourage their employees to undergo routine check-ups. Choosing the control group from the hospital's staff who can see a doctor at almost anytime however counteracted any possible biases that may have resulted. In spite of this fact, the threat of the healthy worker effect was still present [illegible] diagnosed with a malady are more likely [illegible] illness if employed by government than if they were working for a private company which [illegible] profit organizations and requires a higher level of worker productivity.

Based on the subjects reporting of past diagnoses, there appeared to be an excess of cases in the exposed sample for Respiratory Diseases, Genito-urinary Disorders, Disorders of the Gastro-intestinal System as well as for Diseases of the Ear, Nose and Throat. Of the total 5 cases of Respiratory Diseases, 4 were in the exposed group. For both the disorders of the Genito-urinary System and the Gastro-intestinal System, all of the 4 cases in each were from the exposed group. There were 6 total cases of diseases related to the Ear, Nose and Throat. Four (4) of these were reported by the exposed group. (Table 3.8).

Although the eye examinations showed slightly larger numbers in the exposed group for conjunctivitis and chronic conjunctivitis, neither of these differences were significant. There were a total of 43 cases of acute conjunctivitis, 24 ([illegible]) from the exposed sample and 19 ([illegible]) from the controls (Table 3.9). Of the 10 cases of chronic conjunctivitis, 8 (80%) were actually exposed to the industrial emissions (Table 3.10).

The hearing tests indicated no major signs of hearing loss by any of the two groups. The [illegible] examinations once again showed a pattern similar to the other study groups: namely the students, teachers and members of the community. Of a total of 6 acute eczema of the hands cases, 5 were from the exposed group. This gave a crude prevalence ratio of 4.3 (p = .07) indicating that the chances of the exposed group of having this disease is more than four times that of the control group. Four (4) of the 5 cases were also observed in the employees of BORCO (Table 3.11). Both of the cases of acute eczema of the legs were also from the exposed sample. One of the cases was from the BORCO group, the other from Syntex (Table 3.12). There were no other noticeable differences based on these exams.

In regards to the number of reported abortions, the control group had the larger numbers but when this was based on the total numbers of pregnancies in each group the rate in the exposed group (28 per 100 pregnancies) was more than double that in the controls (1[illegible] per 100 pregnancies). The fact that this was not significant at the .05 level of significance (p = .062) was probably due to the small number of females in the exposed sample (Table 3.13). There were no differences in the abortion rates after 1973 nor were the rates [illegible] between the two exposure groups any different (Table 5.14)

In total, there were three (3) reported cases of decreased libido and functional disorders, all from the exposed group (Table 5.15). Two cases from the [illegible] Power sample and the other from [illegible]. Two of these cases, however, did admit to being drinkers, a variable known to be associated with these types of disorders.

In the lab tests for early signs of liver and/or kidney damage, nothing unusual was seen in the [illegible] of specific gravity of urine (Table 5.16) nor were there any abnormal urinary sediments or proteins. For both SGOT and SGPT, the differences between groups were significant and based on the results of [illegible], the exposed group mean was much lower (23.7) than the mean of the control group (39.5) for the variable SGPT ($p = .045$) (Tables 5.17, 5.18). Data from the complete blood count indicated significant differences between the two groups for both Haemoglobin ($p = .002$) (Table 5.19) and Hematocrit ($p = .006$) (Table 5.20) as well as differences between the sexes. Again, all of the means were within the normal range.

There were no [illegible] reported [illegible] any of the [illegible]

Community

For purposes of this study, the community sample of 157 persons were drawn from a total of 4 areas; three in the industrial or exposed area and one outside of this area. Those settlements within the industrial area, Pinder's Point, Lewis Yard and Hunters contributed to [illegible] combined 73 cases (46.5%) with the remaining 84 (53.5%) having been sampled from Freeport. Of the 73 exposed cases the numbers per settlement were 26 (35.6%), 19 (26.0%) and 28 (27.45%) respectively (Table 4.1).

Of the 157 total cases, 61 (38.9%) were males and 96 (61.1%) females. When looking at the sex distribution by exposure category, 34 (55.7%) of the males were considered unexposed and 27 (44.3%) exposed. There were a total of 50 (52.1%) women in the control group and 46 (47.9%) in the exposed group (Table 4.2). In studying the age distribution between the two groups, the sample with an age range from 18 years to [illegible] years, [illegible] show that the exposed group with a mean of [illegible] years was significantly older than the unexposed sample (mean = 34.[illegible] p = [illegible]) (Table 4.3).

While the number of reported complaints [illegible] (potential) [illegible] may have risen over the last few years, there was no evidence to suggest that persons were alarmed to the extent where they took such drastic measures as moving. The average number of years spent in the current community was also significantly higher for the exposed (21.2 years) than for the unexposed (15.4 years, p = <.001). (Table 4.4)

Analysis of the variable Cigarette Smoking showed that although the percentage of persons that smoked in the exposed group (27.4%) seemed much higher than that in the control group (16.7%), this difference was far from significant (p = .282) (Table 4.5). There were also no observed differences in the number of alcohol drinkers (Table 4.6) or in the number of preventive check ups between the two groups (Table 4.7).

Results of the reported past diseases were then again grouped into 17 disease categories for ease of comparison. From this data, excess cases in the exposed group was indicated for Hypertension, Gastro-intestinal Diseases, Other Cardiovascular Disorders and Symptoms due to colds, coughs and fevers (Table 4.8).

Of a total 21 cases of Hypertension, 14 (67%) were amongst the exposed sample and 7 (33%) reported from the controls. The actual prevalence rates were 19.2 cases per 100 population for the exposed and 8.3 cases per 100 population for the controls. The prevalence ratio of 2.3 which was significant (p = .03) indicated that the exposed community's chances of having been diagnosed with hypertension was more than double that of the control group.

Of the total 6 cases of gastro-intestinal disorders, 4 (67%) were exposed and the prevalence ratio was again 2.3. However, because of the smaller cell numbers, these results were not significant. Subjects reported a total of 4 disorders that were grouped into other diseases of the cardiovascular system. Of these, 3 (75%) were in the exposed group. All of the reported cases (4) of symptoms due to illness such as the cold, cough or fever were exposed cases.

On examining the eyes, excess abnormalities in the exposed group when compared to the controls were seen for cases of chronic conjunctivitis, cornea opacity and cataracts. The prevalence ratio for the 10 cases of chronic conjunctivitis was 3.22 (Table 4.9) and indicated that persons currently living in the five mile radius around the industrial site are more than three times more likely to have this abnormality. These results were highly significant (p < .009) and even after controlling for the possible confounders of Sex, Alcohol and Smoking they did not change. In looking at these cases by settlement, 9 were from Pinder's Point, 1 from Lewis Yard and 4 cases were from Hunters.

There were a total of 31 cases of cornea opacity observed in the community sample of which 22 (71%) were from the exposed group. This accounted for an exposed group prevalence rate of 30.1 cases per 100 population and a significant crude prevalence ratio of 2.81 (Table 4.10). Again, after controlling for the variables of smoking, drinking and sex, the adjusted prevalence ratio was still basically the same as the crude indicating a lack of confounding. The 22 cases were made up of 12 cases from Pinder's Point, 5 from Lewis Yard and 5 from Hunters

Of a total of 16 cases of cataract, 11 cases were observed among the industrial groups and the other 5 among the unexposed group. The crude prevalence ratio was 2.33 with 95% confidence limits of [illegible] and a chi square p value of .00 (Table 4.11). Four of the 11 exposed cases were from Pinder's Point while Lewis Ford and Hansen accounted for 4 and 5 cases respectively.

Although all of the crude prevalence ratios and most of the adjusted appear significant, the results must still be taken with caution because of the lack of control of the variable age. Age appears to be highly associated with both corneal opacity and cataracts and to a lesser extent, chronic conjunctivitis. When the mean age of the respondents with these abnormalities were compared to those respondents without, in all three comparisons the difference between the mean ages were extremely significant (Table 4.12).

Results of the dermatological examinations were also very interesting as it appears [illegible] each other group. [illegible] with [illegible] among the exposed subjects were acute eczema [illegible] of the hands, legs and face, and [illegible] lesions of the hands and legs. There were [illegible] ulcers of the hands and all were exposed subjects.

the exposed, 6 were Tree Plant [illegible], 1 from [illegible] Yard and 3 from Sanders (Table 4.13). All of the cases of both rashes [illegible] of the legs (2 cases) and face (3 cases) were again from the exposed sample.

Of the 2 cases of ulcerative lesions on the hands, again both were exposed subjects. This is also true of the 2 cases on the legs. Because of the existence of empty cells, no statistics were possible (Table 4.14).

Through interviewing female subjects about their parity and reproductive system, it was discovered that 5 of the respondents, 4 (80%) of which were exposed, suffered from oligomenorrhoea or episodes of scanty bleeding during menstruation (Table 4.15). Although the rates based on the total number of females in each group were useful for showing the excess risk in the exposed sample (RR = 4.0), this as well as the variables indicating episodes of dysmenorrhoea and amenorrhoea (RR = 2.6) could have been better analyzed if the age at menarchy was also recorded. A denominator based on person time or years since menarchy would have proven more useful than that of total females in each exposure group. There were no statistical differences in the number of abortions and stillbirths between the two groups (Table 4.16). This was for both the total numbers reported as well as the numbers of first abortions and stillbirths reported since 1973.

For males, there were 3 reported cases of a decreased libido and 3 reported cases of some functional disorder of the sex organs. For both disorders, 2 (66.7%) of the 3 cases were in the exposed group (Table 4.17).

There were no problems of the ears detected in the two groups based on tests using the audiometer except for the two deaf subjects in the unexposed group that were determined to be deaf from birth. All lung opacities seen on the x-rays were reportedly the result of prior injuries and not due to the environmental pollution from the industries.

Based on the laboratory results, there were no malfunctions detected for the kidneys. However in the tests of liver function the mean SGPT was significantly lower (p = .039) in the exposed females than in the controls. For both SGOT and SGPT the differences between the sexes were also very significant (Tables 4.19, 4.20). From the complete blood count, no exposure group differences were observed for either Haemoglobin (Table 4.21), Hematocrit (Table 4.22) or in the white blood cells (Table 4.23), but again, all three showed significant differences when the means of the sexes were compared.

POWER ANALYSIS

Statistical power is the probability of avoiding a type II error, or not rejecting the null hypothesis of no association when in fact a difference between the compared groups actually exists and the null should be rejected. Ideally, a power analysis with sample size estimates should be conducted before a study is undertaken in order to determine if the research is likely to allow an adequate evaluation of the hypothesis. For this study, however, it was not done and thus a power calculation was done for the completed study. No estimates were necessary for the proportions of ill in both the exposed (P_1) and unexposed (P_2) as well as the allocation ratio (R) of the number of unexposed to exposed cases were already known. The ill in this case refers to those persons who either of examination or based on reported past medical histories were found to have some abnormality possibly related to the pollution.

As this study was designed to look at the prevalence of disorders in several bodily functions

The power analysis were conducted on two disorders in two different groups. They were those disorders that showed the strongest apparent association between the disease and exposure to the industrial pollution in one of the larger groups, the community, and in the smallest group, the teachers. This choice was made because study power depends not only on those factors already mentioned, namely [illegible] and R, but also on the total sample size. For example, if the proportions were kept constant and the sample size increased, the study power would also increase. Conversely, if the sample size was decreased, then so would the power. This means that the potential of the study to detect differences if they do exist, using a relatively small sample would not be very good. The disorders chosen to be analysed were cases of corneal opacities identified through eye examinations for the community group and cases of genito-urinary disorders reported by the subjects themselves for the group of teachers. Along with the power analyses, sample estimates using observed prevalence ratios were also conducted.

For the community, the proportion of cases of nea opacity in the exposed group (P_1) was .3% and for the unexposed group (P_0), .32. The allocation ratio was 1.5 and the test was done at a .05 level of significance. The calculated power of the completed study was .811 which meant that the probability of rejecting the null hypothesis when it is in fact false and should be rejected is 81%.

For cases of genito-urinary diseases in the teachers, the P_1 was .255 and the P_0 was .095. The allocation ratio (R) was 1.235 and it was again tested at the .05 level of significance. The calculated power was .297 and indicated that there was only a 30% probability of correctly rejecting the null hypothesis when it is in fact false. In looking at a sample size estimate for this illness which showed a prevalence ratio of 2.47, the sample that was required to produce a power of at least 80%, holding all other measurements constant, would have been 73 cases in the exposed group and 91 in the group of controls. For cornea opacity which had a prevalence ratio of 2.5, the sample required to show a power of at least 80% would have been 71 cases in the exposed group and 82 in the unexposed. The actual sample size used was larger and thus the power samples [illegible] Eighty percent power [illegible] considered acceptable for most studies.

What these results indicate is that while the inferences made on some abnormalities may be statistically safe, on others they should be accepted with caution. This is especially so for the group of teachers and for any institutional data looked at separate and apart from the main group which it belonged to.

As this was the first study of this kind on the industrial park area in Grand Bahama, it was essential that the study design was of an exploratory nature and not designed towards supporting or refuting any specific working hypothesis. Ideally, before any national occupational health program is adopted, information on the health status of workers in these sectors should be well documented. This will serve not only to provide evidence of problems that needs to be immediately addressed and rectified, but also to provide the baseline information to which future study results could be compared.

Based on the analysis of the results, some associations between exposure to the combined pollutants from the various industries did appear, some more consistent than others. Based on recall there did appear to be a weak association between hypertension and exposure in both the teachers as well as the sample from the community. There was also an association between exposure and disease of the genito-urinary tract in both teachers and the sample of workers supported the findings from other similar studies (9). A correlation between exposure and gastro-intestinal disorders was also evident in the workers and more strongly in the teachers sample. Although, as mentioned, some of the apparent associations were extremely weak, the fact that they occurred in more than one of the sample groups does in itself warrant some attention. Other apparent associations were observed between exposure and respiratory disorders in teachers and between exposure and coughs, colds and fevers as well as eye abnormalities in the student sample.

However, it should be noted that in attempting to obtain information on patients' past medical histories based on these patients' recall a number of special problems presented themselves. Namely some patients' recall were more accurate than others, and of more importance, some patients might have deliberately attempted to mislead the investigators. If recall or lack of it was the same for both the study and the comparison groups then this would be of no major concern and would not have jeopardized the validity of these results. However, if subjects were interested in the results for one reason or another and in an attempt to influence the results for their personal gain or any other reason they answered questions not truthfully but as they would have liked the 'truth' to be, then this would have introduced a serious bias that would have some impact upon the survey's validity. It will have the effect of either grossly over-estimating any true association or seriously under-estimating that association. In regards to the present study, it is of this writers opinion that if any such recall bias did occur, it would have had the effect of over-estimating the true association in the teacher and community groups because of the amount of registered complaints from them and would on the other hand under-estimate the effect in the group of workers. It is felt that this latter group would have reported less abnormalities for fear of job safety and security. Recall bias was not a concern in the groups of students as they would not at this stage see any direct gains from not telling the truth. Future studies of this nature should attempt to cross-check some of this information with existing medical records to verify that which is reported. This is especially so in those suspect groups.

Based on the results obtained with this sample, there were no strong indications of any association in any of the groups between exposure and the reproductive organs; and this was after comparing the two groups on both total reported cases (e.g. abortions, stillbirths, multiple pregnancies etc.) as well as for the numbers occurring after 1973 when the industrial park would have been in existence for 5 years. The rate of Stillbirths, Abortions, Multiple Pregnancies, etc. based on the total number of pregnancies were no different when the exposed groups were compared to the controls. Although this was especially encouraging since studies such as that by Harrington et al (7) have implicated certain environmental pollutants as possible "risks" for reproductive abnormalities, it should be pointed out that this was an area of the study in which the author felt there existed a considerable amount of design flaws. In conducting any study, the nature of any disease, illness, or abnormality, should be clearly defined in the event that the study is duplicated. This was not the case in this area of the study as exactly what was meant by the data collected on a number of variables was not clear. One of the more important variables is that of abortions. Although past studies have shown a relationship between pollution and abortions (24-27), are spontaneous abortions. In this study, the term abortion was used but it does not indicate whether this meant spontaneous, induced etc. If any induced abortion which in no way is affected by pollution is included in this group, again the results would have been distorted. Also, questions on abortions, stillbirths, pregnancies etc. were only asked of female subjects while studies such as that of Lindbohm, Hemminki et al (24) have also shown risks for spontaneous abortions in the wives of contaminated factory workers. Because there were very few female subjects in the exposed workers (5 or 11%) this automatically reduced the power of the study to detect any differences between the two groups. Any further studies should consider these facts especially in industries where female workers are under-represented.

Analysis of the data from the eye examinations, although not controlling for all possible confounders due to small numbers in some cases and lack of information in others, yielded some of the more consistent and implicative associations. Specifically, cases of cornea opacity, cataracts, and chronic conjunctivitis were far more prevalent in the exposed groups and indicated a much larger risk in that population. This becomes even more important due to the fact that this relationship is seen in not one but several of the study groups; namely the groups of workers and those from the community for chronic conjunctivitis, the group of students, teachers and the community for corneal opacities, and again the community group for cases of cataract. Additional information indicating conditions of lighting and eye strain would have proven useful but even without it, these results are enough to warrant further studies that concentrate on eye abnormalities. If conducted these studies should include a much larger sample, control for more variables, and should be conducted by experienced ophthalmologists. In the interim, the eyes should be protected as much as possible in areas known to have excessive pollution and more frequent eye examinations should be encouraged to help to determine both the extent of the problem and the threat, if any, of permanent damage.

Although it has been shown that industries such as those in Grand Bahama are generally noise polluters and does contribute substantially to noise-induced hearing loss (28), there was no evidence to support that based on this study. Results of the hearing tests were no different for the exposed groups when compared to the controls. These results coupled with the fact that there were no major complaints about noise by the surrounding community does bring up the question of whether the hearing tests were the best way of determining the effect of noise at this time. If the investigators felt that any noises produced by the industries might constitute a problem to the workers health or to the health of the surrounding communities, determining exactly what the noise levels were may have proven more effective. These results could have been compared to the safe levels recommended by accepted international organizations and then, if there were any concerns, tests on individuals could have been performed.

Generally, diseases of the skin, except for skin cancers, are rarely life threatening and do not cause a major concern. However, they can be of a considerable annoyance, both in terms of effects on an individual and in terms of the number of persons that may be affected

Past studies such as that by Del Corso et al (22) and El Batawi and Hochmayer (23) did indicate some association between diseases of the skin and environmental pollution and this study tends to support their results. Analysis of the skin examinations proved a strong association between exposure to the industrial pollution and the presence of acute eczema in the sample of workers, teachers and residents of the communities surrounding the industrial park. Additionally, the exposed students and community group were also more likely to have ulcerative lesions than their control groups. Although these results were all very significant, it is important to remember that the study was not designed to look only at skin diseases, and thus data on a number of important variables that may have confounded these results were not collected. If any additional studies designed to look specifically at the effects on the skin are conducted, it is recommended that information about a subject's general environment, food intake, use of drugs, cosmetics and other consumer products is taken into consideration. However, with the evidence from this study as strong as it is, persons exposed to the pollution for prolonged periods of time might want to cover as much skin as humanly possible until how and more [illegible] ence refutes that from the study. This is especially so in those cases where host factors such as idiosyncracy, hyperreactivity, and hypersensitivity may play a role.

Damage to the Renal System can be caused by many chemical compounds or physical factors. Depending on the type and concentration of the noxious agents, the intensity and duration of exposure, renal disease can be either acute or chronic. The tests on this bodily system during this study were not included so as to yield information about the specific causes of any renal dysfunction, but to provide a crude measure of the degree of renal damage. The early stages of renal damage are seldom accompanied by symptoms and thus laboratory tests were imperative.

The tests performed were to detect any functional changes by measuring the urinary specific gravity, to see if there were any early signs of kidney damage through an analysis of urinary sediments, and to test for glomerular function. Based on this study, there was no increased risk of development of any renal abnormalities by being exposed as the laboratory results from the exposed groups were no different from the results of the controls. This was also the case when tests were performed to detect signs of kidney damage, refuting the results of such studies as that by Jones et al (4).

Along with the direct tests for damage to the liver and kidneys, a complete blood count was also performed. The information from this evaluation was pertinent both to detection of disorders of the haematological system and to diseases primarily affecting many other organs in which blood cell changes occur as secondary manifestations. Although no significant and biological differences were detected between the two exposure groups, it should be noted that there is a wide range of normal values for most blood elements and therefore the counts cited as abnormal also vary greatly among laboratories. The values used were those commonly in use at the Rand Memorial Hospital's laboratory in Grand Bahama where the tests were performed (Appendix B). All automated machines were calibrated at regular intervals before the tests to ensure accuracy of results.

Unlike many of the studies that were reviewed (11-15), the results from the chest X-rays did not show any ass tion between exposure to the pollution an diseases of the respiratory system; this included the sample of teachers in which a slight excess of respiratory ailments were reported. However, it should be noted that the study was designed for the radiologist to describe and quantify the opacities observed in the x-rays, and this was not done. Rather, the chief investigator interpreted the findings as to their relationship to the exposure. This was not the ideal, but if this was the only solution, then a pair of qualified radiologists should have been consulted to make such judgements.

Additionally, one of the major concerns in using x-rays as an indicator of lung damage, is that the damage to be detected must be extremely severe, such as in the case of lung cancers. Tests that assess airway function during an expiratory maneuver such as with a spirometer are better for distinguishing normal from abnormal functioning and are in fact recommended for exploratory studies of this nature. Also, the dangers of excessive radiation is another reason that mass chest x-rays are discouraged. In this study, there were several pregnant female subjects on whom the x-rays were not done.

Generally, observations made in this survey could have been better documented by the use of more appropriate test criteria for the detection and quantitative evaluation of health hazards and of more specific diagnostic methods for the evaluation of disease occurrence. Concerns were also expressed about the internal as well as the external validity of the survey. In deciding to use those areas and institutions within the five mile radius around the industrial site as the exposed population, it should have been established from the outset that there was a definitive difference between the concentration of pollutants in this area versus those areas selected outside of the boundary. Although this approach has been used successfully in larger countries, in smaller islands such as Grand Bahama the differences if any should be quantified with periodic spot checks for known chemicals. If there is no difference in the level of exposure then how can it be proven that anything result from that exposure. The different exposure categories must be distinct. Also, more attention should have been paid to the selection of the controls. This is especially so in the wor ers gr p we o rom the Rend Memoria Hospital. n using such a broad group, the risk of selecting individuals, who based on their job function may be at an increased risk of developing some abnormalities under study was taken. Such is the case in using workers from hospital laboratories who studies show, in the case of females, may be at an increased risk for spontaneous abortions (27).

Within the exposed groups, attempts should have been made to demonstrate some sort of dose effect. This goes a long way in supporting study conclusions. There were no serious attempts within the exposed groups to quantify exposure and this could have been done in terms of time spent in the area; duration of employment, years of residence and just as important, a combination of both. Also, the type of job done; distance of residence or schools from the factory as well as whether they were normally located windward or leeward would have, either by themselves or together, aided in the strength of the design

There were also concerns about who exactly the five years time period referred to. Although the analysis were performed only on those persons from the various groups who were there for a period of five years or more, quite a large number of respondents, affecting all groups, had to be omitted because they were not eligible. This was based on their number of years or because that variable was not recorded. This step was necessary and is an example of what can occur when a subjects entire work history or place of residence is not recorded. There is no way of knowing or not knowing whether or not they had spent time in the exposed area. This is the case. Unfortunately, even for those individual in the control group who were eligible based on the five year period but who were not workers or residents in that same group when the industrial park was started. We can only accept their statements.

Just as important in such surveys is the need for blinding. In this study it was impossible to blind the investigators at all times because of students in uniforms, groups of teachers and workers. If the investigator felt at all pressured to bias the results a particular way, it was possible. Additionally, as a check on the quality of the laboratory results, duplicate samples from several respondents should have

been analysed at different times [illegible]
would have uncovered any glitches of quality control.

As to whether or not the size of those samples selected were sufficiently large enough to represent the populations from which they came, the power calculations in themselves can answer those questions. The larger groups of workers, students and those from the community were adequate as a group, but the numbers from the different institutions within a group was far too small and therefore institutional data should be looked at with caution. Under any circumstances, the teacher groups were far too small. This was coupled with the fact that only two were males, both of whom were exposed. The norms of males in certain laboratory tests are known to be different from those of females and since they are both in the same group, they could have a profound effect on any calculated means. Ideally this should have been taken care of in the design but since it was not, the results from the female teachers only should be given more attention in those tests. This is also the situation in the sample of workers. Because most exposed workers were males (88.9%) and most of the control workers were females (69.2%). There is the risk [illegible] findings could be interpreted [illegible] cooperation between [illegible] and [illegible].

Despite of the shortcomings of the study, useful data was collected nevertheless that pointed to the need for implementation of a national Occupational Health Program. Although the industries have shown concern over the situation, the decisions cannot be left solely to them. The government through the Ministry of Health has the responsibility for safeguarding [illegible] health and is committed to ensure that the environment remains as healthy and pollution free as possible. New and more protective legislation [illegible] and mandates full environmental impact assessments, with the public's input, for all new developments that may impact upon their surroundings. [illegible] manpower training in the areas of occupational health, environmental epidemiology and related fields made possible by publicized [illegible] [illegible] and periodic follow-up surveys will hopefully go a long way towards instilling faith and trust in the minds of the public. The undertaking of this survey would also be seen as a positive step.

In addition to the da a a was ai ei benefits that were gained from his study's undertaking was that the team of physicians, nurses and other health staff became familiar with preliminary survey methods and sampling procedures for epidemiological studies. This will help in future studies. The need for a coordinated team effort with input from all areas that would be involved in the study; from the design to the analysis, must be ensured. The opportunity for the Ministry of Health to work along with the industries must also be looked at as a giant step forward and hopefully this relationship will continue and be further strengthened.

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STUDENTS

TABLE 1.1 STUDY SIZE BY EXPOSURE AND INSTITUTIONS

INSTITUTIONS	SAMPLE SIZE	% EXPOSURE	% TOTAL
Exposed			
St. Vincent	34	34.0	18.1
Lewis Yard	25	25.0	13.3
Hawksbill Primary	41	41.0	21.8
TOTAL EXPOSED	100	100.0	53.2
Controls			
Mary Star	36	40.9	19.1
Sunland	20	22.7	10.6
St. Pauls	30	34.1	16.0
Seventh Day	2	2.3	1.1
TOTAL CONTROLS	88	100.0	46.8
GRAND TOTAL	188		100.0

STUDENTS

TABLE 1.2 SEX BY EXPOSURE

EXPOSURE	SEX				TOTAL
	MALES		FEMALES		
	No.	%	No.	%	
Exposed	52	53.1	48	53.3	100
Controls	46	46.9	42	46.7	88
TOTAL	98	100.0	90	100.0	188

FISHER'S EXACT p = .5434 (1) TAILED

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TABLE 1.3 MEAN AGE BY EXPOSURE

EXPOSURE	MEAN AGE
Exposed	11.33
Controls	11.53

STUDENT'S t = -2.01 p = .046

STUDENTS

TABLE I.4 PAST DIAGNOSES BY EXPOSURE

a) GASTRO-INTESTINAL DISORDERS BY EXPOSURE

EXPOSURE	GASTRO-INTESTINAL DISORDERS		TOTAL
	YES	NO	
Exposed	6	94	100
Controls	1	87	88
TOTAL	7	181	188

PE^+ = .060 PE^- = .011

PR = 5.280 95% CI = 3.07 - 9.09

X^2 = 2.97 p = .042

****

b) EYE DISEASES BY EXPOSURE

EXPOSURE	EYE DISEASES		TOTAL
	YES	NO	
Exposed	4	96	100
Controls	1	87	88
TOTAL	5	183	188

PE^+ = .04 PE^- = .011

PR = 3.52 95% CI = 1.90 - 6.52

X^2 = 1.442 p = .115

STUDENTS

TABLE 1.4 PAST DIAGNOSES BY EXPOSURE (CONT'D)

c) COLDS, COUGHS OR FEVER

EXPOSURE	ILL	NOT ILL	TOTAL
Exposed	16	84	100
Controls	8	80	88

PE^{+} = .16

PE^{-} = .091

PR = 1.76

95% CI = 1.642 - 1.886

X^2 = 1.75

p = .093

STUDENTS

TABLE 1.5 MEAN NUMBER OF CHECK-UPS BY EXPOSURE

EXPOSURE	MEAN NUMBER
Exposed	.130
Controls	.171

STUDENT'S t = -.77 p = .443

STUDENTS

TABLE 1.6 ACUTE CONJUNCTIVITIS

a) ACUTE CONJUNCTIVITIS BY EXPOSURE

EXPOSURE	ACUTE CONJUNCTIVITIS YES	NO	TOTAL
Exposed	37	[illegible]	100
Controls	10	68	88
TOTAL	47	141	188

PE^+ = .370

PE^- = .227

RR = 1.186

95% CI = 1.101 - 2.250

x^2 = .342

p = .559

****

b) ACUTE CONJUNCTIVITIS IN MALES BY EXPOSURE

EXPOSURE	ACUTE CONJUNCTIVITIS YES	NO	TOTAL
Exposed	15	37	52
Controls	14	32	46
TOTAL	29	69	98

PE^+ = .284

PE^- = .304

RR = .948

95% CI = .543 - .554

x^2 = .022

p = .883

STIRBNTE

TABLE 3.6 ACUTE CONJUNCTIVITIS (CONT'D)

c) ACUTE CONJUNCTIVITIS IN FEMALES BY EXPOSURE

EXPOSURE	ACUTE CONJUNCTIVITIS YES	NO	TOTAL
Exposed	12	36	48
Controls	6	36	42
TOTAL	18	72	[illegible]

PE^{+} = .250

PR = 1.750

X^{2} = 1.296

[illegible]

Mantel-Haenszel Analysis: Adjusted Prevalence Ratio

Prevalence Ratio (PR) = 1.160 [illegible]

STUDENTS

TABLE 2.7 CHRONIC CONJUNCTIVITIS

a) CHRONIC CONJUNCTIVITIS BY EXPOSURE

EXPOSURE	CHRONIC CONJUNCTIVITIS		TOTAL
	YES	NO	
Exposed	1	99	100
Controls	2	86	88
TOTAL	3	185	188

$PE^{+} = .010$

$PE^{-} = .023$

$PR = .440$

95% CI = .086 - 2.199

STUDENTS

TABLE 1.8 CORNEA OPACITY

a) CORNEA OPACITY BY EXPOSURE

EXPOSURE	CORNEA OPACITY		TOTAL
	YES	NO	
Exposed	2	98	100
Controls	0	88	88
TOTAL	2	186	188

$PE^+ = .020$ $PE^- = 0$

STUDENTS

Table [illegible] [illegible] ACUTE ECZEMA

a) ACUTE ECZEMA OF THE HANDS BY EXPOSURE

EXPOSURE	ACUTE ECZEMA - HANDS		TOTAL
	YES	NO	
Exposed	3	97	100
Controls	4	84	88
TOTAL	7	181	188

PE^{+} = .030 PE^{-} = .045

PR = .660 95% CI = .503 - .866

****

b) ACUTE ECZEMA OF THE LEGS BY EXPOSURE

EXPOSURE	ACUTE ECZEMA - LEGS		TOTAL
	YES	NO	
Exposed	1	99	100
Controls	3	85	88
TOTAL	4	184	188

PE^{+} = .010 PE^{-} = .034

PR = .293 95% CI = .027 - 3.246

STUDENTS

TABLE [illegible]   SKIN - ACUTE ECZEMA (CONT'D)

c) ACUTE ECZEMA ON FACE BY EXPOSURE

EXPOSURE	ACUTE ECZEMA - FACE		TOTAL
	YES	NO	
Exposed	3	97	100
Controls	4	84	88
TOTAL	7	181	188

$PE^+ = .030$ $PE^- = .045$

$PR = .660$ 95% CI = .500 - .855

****

d) ACUTE ECZEMA OF THE TRUNK BY EXPOSURE

EXPOSURE	ACUTE ECZEMA - TRUNK		TOTAL
	YES	NO	
Exposed	[illegible]	99	100
Controls	[illegible]	86	88
TOTAL	1	187	188

$PE^+ = .010$ $PE^- = 0$

STUDENTS

TABLE 1.10 SKIN - CHRONIC ECZEMA

a) CHRONIC ECZEMA OF THE TRUNK BY EXPOSURE

EXPOSURE	CHRONIC ECZEMA - TRUNK		TOTAL
	YES	NO	
Exposed	1	99	100
Controls	-	88	88
TOTAL	1	187	188

PE^{+} = .010

PE^{-} = 0

****

b) CHRONIC ECZEMA OF THE HANDS BY EXPOSURE

EXPOSURE	CHRONIC ECZEMA - HANDS		TOTAL
	YES	NO	
Exposed	1	99	100
Controls	-	88	88
TOTAL	1	187	188

PE^{+} = .010

PE^{-} = 0

STUDENTS

TABLE 1.13 SKIN - ULCERATIVE LESIONS

a) ULCERATIVE LESIONS OF THE HANDS BY EXPOSURE

EXPOSURE	ULCERATIVE LESIONS - HANDS		TOTAL
	YES	NO	
Exposed	3	97	100
Controls	1	87	88
TOTAL	4	184	188

PE^{+} = .030 PE^{-} = .0113

PR = 2.640 95% CI = 1.40 - 4.978

X^2 = .766 p = .191

****

b) ULCERATIVE LESIONS OF THE LEGS BY EXPOSURE

EXPOSURE	ULCERATIVE LESIONS - LEGS		TOTAL
	YES	NO	
Exposed	2	98	100
Controls	2	86	88
TOTAL	4	[illegible]	[illegible]

PE^{+} = .020 PE^{-} = .023

PR = .880 95% CI = 0.126 - 6.1376

STUDENTS

TABLE 1.12 SKIN - CHLORACNE

a) CHLORACNE OF THE TRUNK BY EXPOSURE

EXPOSURE	CHLORACNE - TRUNK		TOTAL
	YES	NO	
Exposed	-	100	100
Controls	1	87	88
TOTAL	1	187	188

$PE^{+} = 0$

$PE^{-} = .011$

****

b) CHLORACNE OF THE FACE BY EXPOSURE

EXPOSURE	CHLORACNE - FACE		TOTAL
	YES	NO	
Exposed	5	95	100
Controls	4	84	88
TOTAL	9	179	188

$PE^{+} = .050$

$PE^{-} = .045$

PR = 1.100

STUDENTS

TABLE 1.13 SKIN - INCREASED PIGMENTATION BY EXPOSURE

EXPOSURE	INCREASED PIGMENTATION	
	HANDS	LEGS
Exposed	1	-
Controls	2	1
TOTAL	3	1

****

TABLE 1.14 SKIN - DECREASED PIGMENTATION BY EXPOSURE

EXPOSURE	DECREASED PIGMENTATION			
	HANDS	FACE	LEGS	TRUNK
Exposed	-	2	-	[illegible]
Controls	2	-	1	-
TOTAL	2	2	1	1

[illegible]

TABLE 1.15 SPECIFIC GRAVITY OF URINE

a) TOTAL STUDENT SAMPLE

MEAN	RANGE
1.020	1.004 - 1.030

****

b) MEAN SPECIFIC GRAVITY BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.0194
Controls	1.0211

STUDENT'S t = -2.50 p = .013

****

c) MEAN SPECIFIC GRAVITY IN MALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.0196
Controls	1.0205

STUDENT'S t = -1.02 p = .315

STUDENTS

TABLE 1.15 SPECIFIC GRAVITY OF URINE (CONT'D)

d) MEAN SPECIFIC GRAVITY IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.0192
Controls	1.0218

STUDENT'S t = -2.50 p = .014

****

e) MEAN SPECIFIC GRAVITY BY SEX

SEX	MEAN SPECIFIC GRAVITY
Males	1.0200
Females	1.0204

STUDENT'S t = -.58 p = .562

STUDENTS

TABLE 1.16

SGOT

a) TOTAL STUDENT SAMPLE

MEAN	RANGE
19.175	5.0 - 71.0

****

b) MEAN SGOT BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	19.4570
Controls	18.8545

STUDENT'S t = .64

p = .524

****

c) MEAN SGOT IN MALES BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	20.000
Controls	19.550

STUDENT'S t = .29

p = .770

STUDENTS

TABLE 1.16 SGOT (CONT'D)

d) MEAN SGOT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	18.8688
Controls	18.0929

STUDENT'S t = .75 p = .458

****

e) MEAN SGOT BY SEX

SEX	MEAN SGOT
Males	19.7888
Females	18.5067

STUDENT'S t = 1.41 p = .161

STUDENTS

TABLE 1.17

SGPT

a) TOTAL STUDENT SAMPLE

MEAN	RANGE
10.183	2.000 - 76.000

****

b) MEAN SGPT BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	10.2680
Controls	10.0864

STUDENT'S t = .17

P = .868

****

c) MEAN SGPT IN MALES BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	10.1154
Controls	11.7261

STUDENT'S t = -.88

P = .382

TABLE 1.17

SGPT (CONT'D)

d) MEAN SGPT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	10.4333
Controls	8.2905

STUDENT'S t = 2.03   P = .046

****

e) MEAN SGPT BY SEX

SEX	MEAN SGOT
Males	10.8714
Females	9.4333

STUDENT'S t = 1.37   P = .172

STUDENTS

TABLE I.18 HAEMOGLOBIN (HB)

a) TOTAL STUDENT SAMPLE

MEAN	RANGE
12.815	10.000 - 22.700

****

b) MEAN HB BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	12.7480
Controls	12.8909

STUDENT'S t = -.84

P = .400

****

c) MEAN HB IN MALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	12.7673
Controls	12.8130

STUDENT'S t = -.23

P = .821

STUDENTS

TABLE 1.18 HAEMOGLOBIN (HB) (CONT'D)

d) MEAN HB IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	12.7271
Controls	12.9762

STUDENT'S t = -.89 p = .374

****

e) MEAN HB BY SEX

SEX	MEAN HB
Males	12.7888
Females	12.8439

STUDENT'S t = -.31 p = .757

[illegible]

TABLE [illegible]19

HEMATOCRIT

a) TOTAL [illegible] SAMPLE

MEAN	RANGE
39.497	24.500 – [illegible]

****

b) MEAN HEMATOCRIT BY EXPOSURE

EXPOSURE	MEAN HEMATOCRIT
Exposed	[illegible]
Controls	[illegible]

STUDENT'S t = -.0[illegible]

p = [illegible].976

****

c) MEAN HEMATOCRIT IN MALES BY EXPOSURE

EXPOSURE	MEAN HEMATOCRIT
Exposed	39.6027
Controls	39.1196

STUDENT'S t = [illegible]

p = .306

STUDENTS

TABLE 1.19 HEMATOCRIT (CONT'D)

d) MEAN HEMATOCRIT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HEMATOCRIT
Exposed	39.358
Controls	39.931

STUDENT'S t = -.57 p = .572

****

e) MEAN HEMATOCRIT BY SEX

SEX	MEAN HEMATOCRIT
Males	39.379
Females	39.626

STUDENT'S t = -.39 p = .699

STUDENTS

TABLE 1.28 WHITE BLOOD COUNT (WBC)

a) TOTAL STUDENT SAMPLE

MEAN	RANGE
6137.234	3100.00 - 12,100.00

****

b) MEAN WBC BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	6091.0000
Controls	6189.7727

STUDENT'S t = -.42

P = .672

****

c) MEAN WBC IN MALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	6146.1538
Controls	6197.8261

STUDENT'S t = -.15

P = .877

STUDENTS

TABLE 1.20 WHITE BLOOD COUNT (WBC) (CONT'D)

d) MEAN WBC IN FEMALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	6031.2500
Controls	6180.9524

STUDENT'S t = -.46 p = .649

****

e) MEAN WBC BY SEX

SEX	MEAN WBC
Males	6170.4082
Females	6101.5111

STUDENT'S t = .30 P = .765

TEACHERS

TABLE 2.1

TEACHERS BY SCHOOLS AND EXPOSURE

SCHOOL	SAMPLE SIZE	% EXPOSURE	% TOTAL
Exposed			
Lewis Yard Primary	2	11.8	5.2
Hawksbill Primary	6	35.3	15.8
Hawksbill High	9	[illegible]	23.7
TOTAL EXPOSED	17	100.0	44.7
Controls			
Mary Star	9	42.9	23.7
Sunland	5	23.8	13.2
St. Paul's	6	28.6	15.8
Seventh Day	1	4.8	2.5
TOTAL CONTROLS	21	100.0	55.3
TOTAL	38		100.0

TEACHERS

TABLE 2.2

YEARS TEACHING BY EXPOSURE CATEGORY

EXPOSURE	MEAN YEARS
Exposed	10.27
Controls	8.50

Student's t = 1.30 P = .203

****

TABLE 2.3

MEAN AGE BY EXPOSURE CATEGORY

EXPOSURE	MEAN AGE
Exposed	4?.5
Controls	[illegible]

STUDENT'S t = .13 P = .9?5

****

TABLE 2.4

SEX BY EXPOSURE

EXPOSURE	MALES		FEMALES		TOTAL	
	TOTAL	%	TOTAL	%	NO.	%
Exposed	[illegible]	[illegible]	[illegible]	[illegible]	1?	5?.?
Controls	[illegible]	[illegible]	4?	5?.?	21	4?.?
TOTAL	[illegible]	100.0	35	100.0	3?	100.0

TEACHERS

TABLE 2.5

DRINKING BY EXPOSURE CATEGORY

EXPOSURE	DRINKERS	NON-DRINKERS	TOTAL
Exposed	11	6	17
Controls	16	5	21
TOTAL	27	11	38

Fisher's Exact $p = .6750$

2.6 ESSENTIAL HYPERTENSION

TABLE 2.6a

PAST HISTORY OF HYPERTENSION BY EXPOSURE

EXPOSURE	HYPERTENSION YES	NO	TOTAL
Exposed	5	12	17
Controls	3	18	21
TOTAL	8	30	38

PREVALENCE IN EXPOSED GROUPS

$$PR^{+} = \frac{5}{17} = .294$$

PREVALENCE IN UNEXPOSED GROUPS

$$PR^{-} = \frac{3}{21} = .143$$

PREVALENCE RATIO (PR)

$$\frac{.294}{.143} = 2.056$$

95% CI = 1.552 – 2.720

χ^2 = 2.026 p = .156

* *

TABLE 2.6b

HYPERTENSION BY SCHOOLS

SCHOOLS	HYPERTENSION DISEASE	NO DISEASE	TOTAL
Controls			
St. Paul's	2	4	6
Mary Star	1	[illegible]	5
Exposed			
Hawksbill Primary	1	4	5
Hawksbill High	4	[illegible]	9

TEACHERS

TABLE 2.8 MEAN NUMBER OF CHECK-UPS BY EXPOSURE

EXPOSURE	MEAN # CHECK-UPS
Exposed	.6471
Controls	.6190

STUDENT'S t = .08 p = .935

TEACHERS

TABLE 2.7

PAST HISTORY OF GENITO-URINARY DISEASES
BY EXPOSURE

EXPOSURE	DISEASE	NO DISEASE	TOTAL
Exposed	4	13	17
Controls	2	19	21

PE^{+} = .235

PE^{-} = .095

PR = 2.47 95% CI = 1.59 - 3.85

χ^2 = 1.350 p = 0.123

TEACHERS

TABLE 2.9

CORNEA OPACITY

2.9a BY EXPOSURE

EXPOSURE	CORNEA OPACITY		TOTAL
	DISEASE	NON-DISEASE	
Exposed	5	12	17
Controls	0	21	21
TOTAL	5	33	38

$PE^+ = .294$

$PE^- = 0$

****

2.9b CONTROLLING FOR SEX

(i) MALES

EXPOSURE	DISEASE +	DISEASE -	TOTAL
+	1	1	2
-	0	0	0
TOTAL	1	1	2

(ii) FEMALES

EXPOSURE	DISEASE +	DISEASE -	TOTAL
+	4	11	15
-	0	21	21
TOTAL	4	32	36

TEACHERS

TABLE 2.9 (CONT'D)

CORNEA OPACITY

2.9c CONTROLLING FOR DRINKING

(i) DRINKERS

EXPOSURE	DISEASE +	DISEASE -	TOTAL
+	4	7	11
-	0	16	16
TOTAL	4	23	27

(ii) NON DRINKERS

EXPOSURE	DISEASE +	DISEASE -	TOTAL
+	1	5	6
-	0	5	5
TOTAL	1	10	11

****

2.9d CORNEAL OPACITY BY SCHOOLS

SCHOOLS	CORNEA OPACITY		TOTAL
	DISEASE	NO DISEASE	
Exposed			
Lewis Yard	1	1	2
Hawksbill High	4	5	9

TRACHEAS

TABLE 2.39

ACUTE CONJUNCTIVITIS BY EXPOSURE

EXPOSURE	ACUTE CONJUNCTIVITIS		TOTAL
	DISEASE	NO DISEASE	
Exposed	5	12	17
Controls	7	14	21
TOTAL	12	26	38

PE^{+} = .294

PE^{-} = .333

PR = .882   95% CI = .340 – 2.27

X^2 = .046   F = 0.425

TEACHERS

TABLE 2.11 SKIN DISEASE BY EXPOSURE

2.11a ACUTE ECZEMA HANDS

EXPOSURE	DISEASE	NO DISEASE	TOTAL
Exposed			
Sawmill High	2	16	[illegible]
Control	0	21	[illegible]
TOTAL	2	35	[illegible]

* *

2.11b ACUTE ECZEMA FACE

EXPOSURE	DISEASE	NO DISEASE	TOTAL
Exposed			
Sawmill High	[illegible]	[illegible]	[illegible]
Control	0	[illegible]	21
TOTAL	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

TABLE [illegible] REPRODUCTIVE [illegible]

a) TOTAL [illegible] BY EXPOSURE

EXPOSURE	STILLBIRTHS		TOTAL PREGNANCIES
	YES	NO	
Exposed [illegible]	2	59	61
Controls	-	43	43
TOTAL	2	102	104

PE[+] = .001   PR = [illegible]

****

b) TOTAL ABORTIONS BY EXPOSURE

EXPOSURE	ABORTIONS		TOTAL PREGNANCIES
	YES	NO	
Exposed	11	[illegible]	61
Controls	[illegible]	[illegible]	[illegible]
TOTAL	21	83	104

PE[+] = .18

PR = [illegible]

[illegible]

****

c) YEAR OF FIRST ABORTION BY EXPOSURE

EXPOSURE	AFTER 197[illegible]	BEFORE 197[illegible]	TOTAL
Exposed	6	3	9
Controls	4	2	6
TOTAL	10	5	15

FISHER'S EXACT P = .7132 (1 TAILED)

TEACHERS

TABLE 2.17 REPRODUCTION SYSTEM DISORDERS (CONT'D)

(g) NUMBER OF FEMALES WHO WERE PREGNANT AT LEAST ONCE AND HAD AT LEAST ONE ABORTION

EXPOSURE	# WITH AT LEAST ONE ABORTION	# OF FEMALES EVER PREGNANT
Exposed	9	[illegible]
Controls	6	[illegible]
TOTAL	15	[illegible]

FISHER'S EXACT p = .212

TABLE 2.13 MEAN SPECIFIC GRAVITY OF URINE

2.13a MEAN SPECIFIC GRAVITY OF URINE BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.0184
Controls	1.0177

STUDENT'S t = .42 P = .474

****

2.13b MEAN SPECIFIC GRAVITY OF URINE BY SEX

SEX	MEAN SPECIFIC GRAVITY
Male	1.0190
Female	[illegible]

STUDENT'S t = -.74 P = .462

****

2.13c MEAN SPECIFIC GRAVITY BY EXPOSURE (FEMALES)

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.019
Controls	1.018

STUDENT'S t = .49 P = .630

TABLE 2.14 MEAN EGOT

2.14a MEAN EGOT BY EXPOSURE

EXPOSURE	MEAN EGOT
exposed	13.255
controls	16.146

STUDENT'S t = -1.16 P = .255

****

2.14b MEAN EGOT BY SEX

SEX	MEAN EGOT
male	16.560
female	16.179

STUDENT'S t = 1.19 P = .640

****

2.14c MEAN EGOT BY EXPOSURE (FEMALES)

EXPOSURE	MEAN EGOT
exposed	13.7[illegible]
controls	[illegible]

STUDENT'S t = -1.96 P = .059

TEACHERS

TABLE 2.15 MEAN SGPT

2.15a MEAN SGPT BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	17.566
Controls	14.424

STUDENT'S t = 0.56 p = .593

****

2.15b MEAN SGPT BY SEX

SEX	MEAN SGPT
Males	17.600
Females	12.491

STUDENT'S t = 1.22 p = .311

****

2.15c MEAN SGPT BY EXPOSURE (FEMALES)

EXPOSURE	MEAN SGPT
Exposed	9.16
Controls	14.42

STUDENT'S t = -2.38 p = .046

FINDINGS

TABLE 2.16 MEAN HEMOGLOBIN

2.16a MEAN HEMOGLOBIN BY EXPOSURE

EXPOSURE	MEAN HEMOGLOBIN
Exposed	12.935
Controls	12.427

p = .107

STUDENT'S t = 1.49

****

2.16b MEAN HEMOGLOBIN BY SEX

SEX	MEAN HEMOGLOBIN
Males	14.[illegible]
Females	12.[illegible]

p = .000

STUDENT'S t = 8.85

****

2.16c MEAN HEMOGLOBIN BY EXPOSURE (FEMALES)

EXPOSURE	MEAN HEMOGLOBIN
Exposed	[illegible]
Controls	[illegible]

p = .414

STUDENT'S t = .83

TEACHERS

TABLE 2.17 MEAN HEMATOCRIT

2.17a MEAN HEMATOCRIT BY EXPOSURE

EXPOSURE	MEAN HEMATOCRIT
Exposed	39.71
Controls	37.16

STUDENT'S t = 2.27 P = .029

****

2.17b MEAN HEMATOCRIT BY SEX

SEX	MEAN HEMATOCRIT
Males	[illegible]
Females	38.73

STUDENT'S t = 2.54 P = .194

****

2.17c MEAN HEMATOCRIT BY EXPOSURE (FEMALES)

EXPOSURE	MEAN HEMATOCRIT
Exposed	38.23
Controls	37.16

STUDENT'S t = 1.88 P = .073

EXPOSURE

TABLE 2.15 MEAN WHITE BLOOD CELL

2.15a MEAN WHITE BLOOD COUNT (WBC) BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	6655.[illegible]
Controls	7073.85

P = .037

STUDENT'S t = -[illegible].79

****

2.15b MEAN WBC BY SEX

SEX	MEAN WBC
Males	6955.00
Females	6567.[illegible]

P = .0[illegible]

STUDENT'S t = -2.20

****

2.15c MEAN WBC BY EXPOSURE (FEMALES)

EXPOSURE	MEAN WBC
Exposed	[illegible]
Controls	[illegible]

P = .[illegible]63

STUDENT'S t = -1.[illegible]5

TEACHERS

TABLE 2.19

MEAN COMPLETE BLOOD COUNT DIFFERENTIAL

TESTS	MEAN EXPOSURE		T-TEST	P-VALUE
	EXPOSED	CONTROLS		
Neutrophils	49.82	53.71	-1.18	.246
Eosinophils	3.35	2.71	.38	.709
Basophils	-	-		
Lymphocytes	46.35	42.67	.96	.344
Monocytes	.18	.05	.94	.357

WORKERS

TABLE 3.[illegible] WORKERS BY INSTITUTION AND EXPOSURE

INSTITUTION	SAMPLE SIZE	% EXPOSURE	% TOTAL
Exposed			
Syntex	14	31.[illegible]	16.[illegible]
Freeport Power	[illegible]	[illegible]	[illegible]
BORCO	28	5[illegible]	[illegible]
TOTAL EXPOSED	45	100.0	[illegible]
Controls			
Rand	39	100.0	[illegible]
TOTAL CONTROLS	39	100.0	[illegible]
G R A N D T O T A L	84	[illegible]	100.[illegible]

RESULTS

TABLE 3.2 — MEAN YEARS OF EMPLOYMENT BY EXPOSURE

EXPOSURE	MEAN # YEARS
Exposed	11.47
Controls	[illegible]

STUDENT'S t = [illegible] P = .7[illegible]

****

TABLE 3.3 — MEAN AGE BY EXPOSURE

EXPOSURE	MEAN AGE
Exposed	[illegible]
Controls	38.4[illegible]

STUDENT'S t = -1.2[illegible] P = .22[illegible]

****

TABLE 3.4 — SEX BY EXPOSURE

EXPOSURE	MALES		FEMALES		TOTAL	
	NO.	%	NO.	%	NO.	%
Exposed	[illegible]	[illegible]	5	15.[illegible]	45	5[illegible].5
Controls	[illegible]	[illegible]	27	84.4	39	[illegible]6.4
TOTAL	5[illegible]	100.0	32	100.0	84	100.0

FISHER'S EXACT P = 6.4[illegible] E-08

WORKERS

TABLE 3.5

DRINKING BY EXPOSURE

EXPOSURE	DRINKERS	NON DRINKERS	TOTAL
Exposed	37	8	45
Controls	28	11	39
TOTAL	65	19	84

FISHER'S EXACT p = 0.3850

****

TABLE 3.6

SMOKING BY EXPOSURE

EXPOSURE	SMOKERS	NON SMOKERS	TOTAL
Exposed	6	39	45
Controls	4	35	39
TOTAL	10	74	84

FISHER'S EXACT p = 0.5287

****

TABLE 3.7

MEAN NUMBER CHECK-UPS BY EXPOSURE

EXPOSURE	MEAN CHECK-UPS
Exposed	[illegible].643
Controls	[illegible].8265

STUDENT'S t = -1.02 p = 0.309

WORKERS

TABLE 3.8 REPORTED CASES BASED ON PAST DIAGNOSES

EXPOSURE	RESPIRATORY DISEASES	GENITO-URINARY DISORDERS	GASTRO-INTESTINAL DISORDERS	DISEASE OF THE EAR, NOSE & THROAT
Exposed	4	4	4	4
Controls	1	-	-	2
TOTAL	5	4	4	6

WORKERS

TABLE 3.9 ACUTE CONJUNCTIVITIS BY EXPOSURE

EXPOSURE	ACUTE CONJUNCTIVITIS YES	NO	TOTAL
Exposed	24	21	45
Controls	19	20	39
TOTAL	43	41	84

PE^+ = .533

PE^- = .487

RR = 1.095

95% CI = 1.087 - 1.103

χ^2 = 0.087

P = 0.384

****

TABLE 3.10 CHRONIC CONJUNCTIVITIS BY EXPOSURE

EXPOSURE	CHRONIC CONJUNCTIVITIS YES	NO	TOTAL
Exposed	6	39	45
Controls	4	35	39
TOTAL	10	74	84

PE^+ = 0.133

PE^- = 0.103

RR = 1.3

95% CI = 1.153 - 1.416

χ^2 = 0.164

P = 0.342

[illegible]

TABLE 9.11 ACUTE ECZEMA OF HANDS BY EXPOSURE AND INSTITUTION

EXPOSURE	ACUTE ECZEMA OF HANDS YES	NO	TOTAL
Exposed			
Bakelite	4	20	24
Syntex	1	13	14
TOTAL EXPOSED	5	33	38
Controls	2	38	39
TOTAL	6	78	84

FE[1] = 0.11

FE = [illegible]

FE[2] = 0.[illegible]

X^2 = [illegible]

[illegible] = [illegible]

χ^2 = [illegible]

P = [illegible]

* *

TABLE 9.12 ACUTE ECZEMA OF LEGS BY EXPOSURE AND INSTITUTION

EXPOSURE	ACUTE ECZEMA OF LEGS YES	NO	TOTAL
Exposed			
Bakelite	1	23	24
Syntex	1	13	14
TOTAL EXPOSED	2	43	45
Controls		39	39
TOTAL	2	82	84

FE[1] = .[illegible]

FE[2] = [illegible]

[illegible]

[illegible]

TABLE 3-19

a) TOTAL ABORTIONS BY EXPOSURE

EXPOSURE	ABORTIONS	TOTAL PREGNANCIES
Exposed	5	33
Controls	12	86
TOTAL	17	114

PE = .125

95% CI [illegible] .625 [illegible]

PE = .213

PE = 0.11

R = 0.068

X^2 = 2.377

****

b) YEAR OF FIRST ABORTION BY EXPOSURE

EXPOSURE	AFTER 1973	BEFORE 1973	TOTAL
Exposed	3	2	5
Controls	5	5	12
TOTAL	8	[illegible]	[illegible]

FISHER'S EXACT P = 0.023

****

c) NUMBER OF FEMALES WHO WERE PREGNANT AT LEAST ONCE WHO HAD AT LEAST ONE ABORTION

EXPOSURE	# FEMALES WITH AT LEAST ONE ABORTION	TOTAL # OF FEMALES EVER PREGNANT
Exposed	[illegible]	[illegible]
Controls	[illegible]	[illegible]
TOTAL	12	[illegible]

FISHER'S EXACT P = .774

WORKING

TABLE 3.14 **TOTAL STILLBIRTHS BY EXPOSURE**

EXPOSURE	STILLBIRTHS	TOTAL PREGNANCIES
Exposed	1	18
Controls	2	96
TOTAL	3	114

$PR^{+} = .056$ $PR^{-} = .021$

$PR = 2.67$ $95\%\ CI = 0.396 - 18.25$

WORKERS

TABLE 3.15 DECREASED LIBIDO AND FUNCTIONAL DISORDER CASES REPORTED BY MALES BY EXPOSURE

EXPOSURE	DISORDER		TOTAL
	YES	NO	
Exposed	3	37	40
Controls	-	12	12
TOTAL	3	49	52

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WORKERS

TABLE 5.16 SPECIFIC GRAVITY

a) MEAN SPECIFIC GRAVITY OF URINE BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.020
Controls	1.021

STUDENT'S t = -1.3

P = .193

****

b) MEAN SPECIFIC GRAVITY FOR MALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.020
Controls	1.02[illegible]

STUDENT'S t = -.57

P = .511

WORKERS

TABLE 3.16 SPECIFIC GRAVITY (CONT'D)

c) MEAN SPECIFIC GRAVITY FOR FEMALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.021
Controls	1.022

STUDENT'S t = -.32 p = .762

****

d) MEAN SPECIFIC GRAVITY BY SEX

SEX	MEAN SPECIFIC GRAVITY
Male	1.020
Female	1.022

STUDENT'S t = 1.19 p = .238

WORKERS

TABLE 3.17 EGOT

a) MEAN EGOT BY EXPOSURE

EXPOSURE	MEAN EGOT
Exposed	18.09
Controls	17.15

p = .[illegible]69

STUDENT'S t = .[illegible]

****

b) MEAN EGOT IN MALES BY EXPOSURE

EXPOSURE	MEAN EGOT
Exposed	19.34
Controls	[illegible]

p = .2[illegible]1

STUDENT'S t = [illegible]

WORKERS

TABLE 3.17 SGOT (CONT'D)

c) MEAN SGOT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	12.86
Controls	12.31

STUDENT'S $t = .19$ $p = .860$

****

d) MEAN SGOT BY SEX

SEX	MEAN SGOT
Males	21.48
Females	12.40

STUDENT'S $t = -3.65$ $p < .001$

MORTURE

SGPT

TABLE 3.18

a) MEAN SGPT BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	20.50
Controls	21.58

STUDENT'S t = -.24 p = .814

****

b) MEAN SGPT IN MALES BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	[illegible]
Controls	[illegible]

STUDENT'S t = -2.12 p = .043

TEACHERS

TABLE 2.14 MEAN SGOT

2.14a MEAN SGOT BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	15.259
Controls	18.148

STUDENT'S t = -1.16 p = .255

****

2.14b MEAN SGOT BY SEX

SEX	MEAN SGOT
Male	26.500
Female	16.319

STUDENT'S t = 1.19 p = .440

****

2.14c MEAN SGOT BY EXPOSURE (FEMALES)

EXPOSURE	MEAN SGOT
Exposed	13.76
Controls	18.148

STUDENT'S t = -1.96 p = .059

WORKERS

TABLE 3.[illegible] HEMOGLOBIN (HB)

a) MEAN HEMOGLOBIN BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	13.96
Controls	12.63

STUDENT'S t = 3.96 P < .001

****

b) MEAN HEMOGLOBIN IN MALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	[illegible]
Controls	[illegible]

STUDENT'S t = .03 p = .98[illegible]

TABLE 3.19 HEMOGLOBIN (HB) (CONT'D)

c) MEAN HEMOGLOBIN IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	11.82
Controls	12.19

STUDENT'S t = -.31 p = .772

****

d) MEAN HEMOGLOBIN BY SEX

SEX	MEAN HB
Males	14.23
Females	12.13

STUDENT'S t = -7.05 p = $< .001$

EXPOSURE

TABLE 7.20 HEMATOCRIT (HCT)

a) MEAN HEMATOCRIT BY EXPOSURE

EXPOSURE	MEAN HCT
Exposed	41.06
Controls	[illegible]

STUDENT'S t = 2.15 P = .035

****

b) MEAN HEMATOCRIT IN MALES BY EXPOSURE

EXPOSURE	MEAN HCT
Exposed	41.69
Controls	42.66

STUDENT'S t = -.57 P = .572

WORKERS

TABLE 9.20 HEMATOCRIT (HCT) (CONT'D)

c) MEAN HEMATOCRIT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HCT
Exposed	36.14
Controls	36.15

STUDENT'S t = -.01 P = .996

****

d) MEAN HEMATOCRIT BY SEX

SEX	MEAN HCT
Males	36.15
Females	41.92

STUDENT'S t = -4.91 P = $<$ .001

[illegible]

TABLE 3.21 WHITE BLOOD COUNT (WBC)

a) MEAN WBC BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	61[illegible]
Controls	6596.5

STUDENT'S t = -1.2[illegible]

p = .[illegible]0

b) MEAN WBC IN MALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	5933.5
Controls	6738.8

STUDENT'S t = -1.52

P = .176

WORKERS

TABLE 3.21 WHITE BLOOD COUNT (WBC) (CONT'D)

c) MEAN WBC IN FEMALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	7560.0
Controls	6707.7

STUDENT'S t = 1.10 p = .319

****

d) MEAN WBC BY SEX

SEX	MEAN WBC
Males	6134.6
Females	6677.4

STUDENT'S t = 1.36 p = .180

COMMUNITY

TABLE 4.1 **STUDY SAMPLE BY EXPOSURE**

STUDY AREA	SAMPLE SIZE	% EXPOSURE	% TOTAL
Exposed			
Pinder's Point	34	46.6	21.7
Lewis Yard	19	26.0	12.0
Hunter's	20	27.4	12.7
TOTAL EXPOSED	73	100.0	46.5
Controls			
Freeport	24	100.0	33.5
G R A N D T O T A L	137		100.0

COMMUNITY

TABLE 4.2 SEX BY EXPOSURE BY AREA

EXPOSURE	SEX				TOTAL
	MALES		FEMALES		
	No.	%	No.	%	
Exposed					
Pinder's Point	13	21.3	21	21.9	34
Lewis Yard	8	13.1	11	11.4	19
Hunter's	6	9.9	14	14.6	20
TOTAL EXPOSED	27	44.3	46	47.9	73
Controls	34	55.7	50	52.1	84
GRAND TOTAL	61	100.0	96	100.0	157

FISHER'S EXACT P = .777

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TABLE 4.3 MEAN AGE BY EXPOSURE

EXPOSURE	MEAN AGE
Exposed	[illegible]
Controls	[illegible]

STUDENT'S t = 2.49

RANGE = 16 - 23

****

TABLE 4.4 MEAN YEARS OF RESIDENCE BY EXPOSURE

EXPOSURE	MEAN # OF YEARS OF RESIDENCE
Exposed	21.3
Controls	12.6

STUDENT'S t = 4.33

P = [illegible] .00[illegible]

[illegible]

TABLE 4.5 SMOKING STATUS BY EXPOSURE

EXPOSURE	SMOKING YES	SMOKING NO	TOTAL
Exposed	26	53	79
Controls	10	75	84

FISHER'S EXACT P = [illegible]

TABLE 4.6 DRINKING STATUS BY EXPOSURE

EXPOSURE	DRINKING YES	DRINKING NO	TOTAL
Exposed	40	39	79
Controls	42	42	84

FISHER'S EXACT P = [illegible]

TABLE 4.7 MEAN NUMBER OF CHECK-UPS BY EXPOSURE

EXPOSURE	MEAN # CHECK-UPS
Exposed	.6438
Controls	.6429

STUDENT'S t = .09 P = .924

COMMUNITY

TABLE 4.4 PAST DIAGNOSES BY EXPOSURE

a) HYPERTENSION

EXPOSURE	HYPERTENSION YES	HYPERTENSION NO	TOTAL
Exposed	[illegible]	56	73
Controls	7	[illegible]	84
TOTAL	[illegible]	[illegible]	[illegible]

PE = 19.1

PC = 8.3

PR = 2.3

95% CI = 0.985 - 5.362

X^2 = 3.436

p = 0.052

* *

b) GASTRO-INTESTINAL DISORDERS

EXPOSURE	GASTRO-INTESTINAL DISORDERS YES	GASTRO-INTESTINAL DISORDERS NO	TOTAL
Exposed	4	69	73
Controls	2	82	84
TOTAL	6	151	157

PE = .055

PC = .022

PR = 2.3

95% CI = 0.453 - 11.46

X^2 = .562

p = 0.162

APPENDIX

TABLE 6.8 PAST DISEASES BY EXPOSURE (CONT'D)

c) OTHER CARDIOVASCULAR DISORDERS

EXPOSURE	CARDIOVASCULAR DISORDERS		TOTAL
	YES	NO	
Exposed	3	70	73
Controls	1	83	84
TOTAL	4	153	157

PE^{+} = .041 [illegible]

PE^{-} = .012 95% CI = (.367 – [illegible])

RR = 3.452

χ^2 = 1.506 p = 0.220

****

d) COLD, COUGHS, FEVER

EXPOSURE	[illegible]	NOT [illegible]	TOTAL
Exposed	4	[illegible]	[illegible]
Controls	[illegible]	[illegible]	[illegible]
TOTAL	4	[illegible]	[illegible]

PE^{+} = .055 PE^{-} = 0

COMMUNITY

TABLE 4.[illegible] CHRONIC CONJUNCTIVITIS

a) CHRONIC CONJUNCTIVITIS BY EXPOSURE AND SETTLEMENT

EXPOSURE	CHRONIC CONJUNCTIVITIS YES	CHRONIC CONJUNCTIVITIS NO	TOTAL
Exposed			
Pinder's Point	9	25	34
Lewis Yard	1	18	19
Hunter's	4	16	20
TOTAL EXPOSED	14	[illegible]	[illegible]
Controls	4	[illegible]	[illegible]
GRAND TOTAL	18	[illegible]	[illegible]

RE* = .192

PR = 1.22

95% CI = 1.227 - 6.458

X^2 = 5.645

P = .009

COMMUNITY

CORNEA OPACITY

TABLE 4.12

a) CORNEA OPACITY BY EXPOSURE AND SETTLEMENT

EXPOSURE	CORNEA OPACITY YES	NO	TOTAL
Exposed			
Pinder's Point	12	22	34
Lewis Yard	5	14	19
Hunter's	5	15	20
TOTAL EXPOSED	22	51	73
Controls	9	85	94
GRAND TOTAL	31	126	167

[illegible] 167

$PR^{+} = .501$

95% C.I. = 1.17 — 3.08

$PR = 2.81$

$p = 0.003$

$X^2 = 7.404$

COMMUNITY

TABLE [illegible] CATARACTS

a) CATARACT CASES BY EXPOSURE AND SETTLEMENT

EXPOSURE	CATARACTS YES	CATARACTS NO	TOTAL
Exposed			
Pinder's Point	4	30	34
Lewis Yard	4	15	[illegible]
Hunter's	5	[illegible]	20
TOTAL EXPOSED	13	52	[illegible]
Controls	[illegible]	9	[illegible]
GRAND TOTAL	16	41	57

PR* = .151 [illegible] = .160

PR = 2.59 95% CI = 2.15 - 2.95

χ^2 = 3.186 P = .037

COMMUNITY

TABLE 4.12 MEAN AGE IN PERSONS WITH DISORDERS OF THE EYE COMPARED TO PERSONS WITHOUT

a) CHRONIC CONJUNCTIVITIS

DISEASE STATUS	MEAN AGE
Yes	45.37
No	35.72

STUDENT'S t = 3.48 p = .002

****

b) CORNEAL OPACITY

DISEASE STATUS	MEAN AGE
Yes	50.47
No	32.80

STUDENT'S t = 7.40 p = $<$ .001

****

c) CATARACTS

DISEASE STATUS	MEAN AGE
Yes	61.31
No	34.11

STUDENT'S t = 7.05 p = $<$ .001

COMMUNITY

TABLE 4.[illegible] ACUTE ECZEMA

a) ACUTE ECZEMA OF THE HANDS BY EXPOSURE AND [illegible]

EXPOSURE	ACUTE ECZEMA OF HANDS YES	ACUTE ECZEMA OF HANDS NO	TOTAL
Exposed			
Fisher's Point	4	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]
Hunter's	1	[illegible]	[illegible]
TOTAL EXPOSED	6	[illegible]	[illegible]
Controls	[illegible]	84	[illegible]
GRAND TOTAL	6	[illegible]	[illegible]

FE* = .092

****

b) ACUTE ECZEMA OF THE LEGS BY EXPOSURE

EXPOSURE	ACUTE ECZEMA OF LEGS YES	ACUTE ECZEMA OF LEGS NO	TOTAL
Exposed	2	[illegible]	[illegible]
Controls		84	84
TOTAL	2	[illegible]	157

FE* = .[illegible]

****

c) ACUTE ECZEMA OF THE FACE BY EXPOSURE

EXPOSURE	ACUTE ECZEMA OF FACE YES	ACUTE ECZEMA OF FACE NO	TOTAL
Exposed	3	70	73
Controls		84	84
TOTAL	3	154	157

COMMUNITY

ULCERATIVE LESIONS

TABLE 4.14

a) ULCERATIVE LESIONS OF THE HANDS BY EXPOSURE

EXPOSURE	HAND LESIONS YES	HAND LESIONS NO	TOTAL
Exposed	2	71	73
Controls	-	84	84
TOTAL	2	155	157

$PE^{+} = .027$

****

b) ULCERATIVE LESIONS OF THE LEGS BY EXPOSURE

EXPOSURE	LEG LESIONS YES	LEG LESIONS NO	TOTAL
Exposed	3	70	73
Controls	-	84	84
TOTAL	3	154	157

$PE^{+} = .041$

COMMUNITY

TABLE 4.15 REPRODUCTIVE DISORDERS

a) OLIGOMENORRHOEA BY EXPOSURE

EXPOSURE	OLIGOMENORRHOEA		TOTAL FEMALES
	YES	NO	
Exposed	4	42	46
Controls	1	49	50
TOTAL	5	91	96

****

b) AMENORRHOEA BY EXPOSURE

EXPOSURE	AMENORRHOEA		TOTAL FEMALES
	YES	NO	
Exposed	[illegible]	35	46
Controls	4	[illegible]	50
TOTAL	15	81	96

COMMUNITY

TABLE 4.16 ABORTIONS AND STILLBIRTHS

a) TOTAL NUMBER OF ABORTIONS AND STILLBIRTHS BY EXPOSURE

EXPOSURE	TOTAL ABORTIONS	TOTAL STILLBIRTHS
Exposed	14	4
Controls	16	6
TOTAL	30	10

****

b) TOTAL NUMBER OF FEMALES WITH AT LEAST ONE ABORTION AND/OR STILLBIRTH BY EXPOSURE

EXPOSURE	# OF FEMALES WITH AT LEAST ONE	
	ABORTIONS	STILLBIRTHS
Exposed	10	2
Controls	12	4
TOTAL	22	6

****

c) YEAR OF FIRST ABORTION AND STILLBIRTH BY EXPOSURE

EXPOSURE	ABORTIONS		STILLBIRTHS	
	AFTER 1973	BEFORE 1973	AFTER 1973	BEFORE 1973
Exposed	8	[illegible]	[illegible]	2
Controls	6	[illegible]	3	[illegible]
TOTAL	14	6	3	3

COMMUNITY

TABLE 4.17 MALE REPRODUCTIVE SYSTEM DISORDERS

a) FUNCTIONAL DISORDERS BY EXPOSURE

EXPOSURE	FUNCTIONAL DISORDER		TOTAL MALES
	YES	NO	
Exposed	2	25	27
Controls	1	33	[illegible]
TOTAL	3	58	[illegible]

---

b) DECREASED LIBIDO BY EXPOSURE

EXPOSURE	DECREASED LIBIDO		TOTAL MALES
	YES	NO	
Exposed	2	25	27
Controls	1	33	34
TOTAL	3	58	61

COMMUNITY

TABLE 4.18 SPECIFIC GRAVITY OF URINE

a) MEAN SPECIFIC GRAVITY BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.020
Controls	1.023

STUDENT'S t = -1.70 P = .091

****

b) MEAN SPECIFIC GRAVITY IN MALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	1.02
Controls	1.02

STUDENT'S t = -1.42 P = .162

APPENDIX

TABLE 4.30 SPECIFIC GRAVITY OF URINE (CONT'D)

C) MEAN SPECIFIC GRAVITY IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SPECIFIC GRAVITY
Exposed	[illegible]
Controls	1.02

STUDENT'S t = -.69 P = [illegible]

****

D) MEAN SPECIFIC GRAVITY BY SEX

SEX	MEAN SPECIFIC GRAVITY
Male	1.023
Female	[illegible]

STUDENT'S t = -.07 P = .93

COMMUNITY

SGOT

TABLE 4.19

a) MEAN SGOT BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	20.82
Controls	18.95

STUDENT'S t = .85 P = .397

****

b) MEAN SGOT IN MALES BY EXPOSURE

EXPOSURE	MEAN SGOT
Exposed	27.59
Controls	24.49

STUDENT'S t = .65 P = .521

COMMUNITY

TABLE 4.16 [illegible] (CONT'D)

c) MEAN [illegible] IN FEMALES BY EXPOSURE

EXPOSURE	MEAN [illegible]
Exposed	16.95
Controls	15.17

STUDENT'S t = 1.12 p = .267

****

d) MEAN [illegible] BY SEX

SEX	MEAN [illegible]
Males	25.06
Females	15.92

STUDENT'S t = 3.90 P < .001

COMMUNITY

SGPT

TABLE 4.20

a) MEAN SGPT BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	15.65
Controls	19.61

STUDENT'S t = -1.04 p = .299

****

b) MEAN SGPT IN MALES BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	23.26
Controls	26.19

STUDENT'S t = -.33 p = .743

APPENDIX

TABLE 6.20 SGPT : (CONT'D)

c) MEAN SGPT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN SGPT
Exposed	11.19
Controls	15.14

STUDENT'S t = -2.10 P = .039

****

d) MEAN SGPT BY SEX

SEX	MEAN SGPT
Males	14.83
Females	13.25

STUDENT'S t = -2.40 P = .019

COMMUNITY

TABLE 4.21 HAEMOGLOBIN (HB)

a) MEAN HAEMOGLOBIN BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	13.05
Controls	13.15

STUDENT'S t = -.40 p = .690

****

b) MEAN HAEMOGLOBIN IN MALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	14.22
Controls	14.28

STUDENT'S t = -.15 p = .885

CONTINUED

TABLE 6.23 HAEMOGLOBIN (HB) (CONT'D)

c) MEAN HAEMOGLOBIN IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HB
Exposed	12.26
Controls	12.30

STUDENT'S t = -.12

P = .906

****

d) MEAN HAEMOGLOBIN BY SEX

SEX	MEAN HB
Males	14.26
Females	12.37

STUDENT'S t = -7.75

$P < .001$

COMMUNITY

TABLE 4.77 HEMATOCRIT (HCT)

a) MEAN HEMATOCRIT BY EXPOSURE

EXPOSURE	MEAN HCT
exposed	39.93
controls	39.[illegible]

p = .996

STUDENT'S t = .19

****

b) MEAN HEMATOCRIT IN MALES BY EXPOSURE

EXPOSURE	MEAN HCT
exposed	[illegible].06
controls	42.39

p = .939

STUDENT'S t = .20

COMMUNITY

TABLE 6.22 HEMATOCRIT (HCT) (CONT'D)

(c) MEAN HEMATOCRIT IN FEMALES BY EXPOSURE

EXPOSURE	MEAN HCT
Exposed	38.10
Controls	37.95

STUDENT'S t = .46 P = .646

****

(d) MEAN HEMATOCRIT BY SEX

EXPOSURE	MEAN HCT
Exposed	42.91
Controls	37.90

STUDENT'S t = -6.51 $P < .001$

COMMUNITY

TABLE 4.23 WHITE BLOOD COUNT (WBC)

a) MEAN WBC BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	6578.5
Controls	6995.5

STUDENT'S t = .65 p = .657

****

b) MEAN WBC IN MALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	[illegible]
Controls	6152.94

STUDENT'S t = .70 p = .434

COMMUNITY

TABLE 4.33 WHITE BLOOD COUNT (WBC) - (CONT'D)

c) MEAN WBC IN FEMALES BY EXPOSURE

EXPOSURE	MEAN WBC
Exposed	[illegible]
Controls	[illegible]

STUDENT'S t = .81 P = .422

****

d) MEAN WBC BY SEX

SEX	MEAN WBC
Males	6230.51
Females	7202.03

STUDENT'S t = 2.36 P = .001

APPENDIX A

Rand Memorial Hospital
P.O. Box F71
Freeport, Grand Bahama

Telephone: (809) 352-6735
Telex: Ranhosp. 30-037

Ministry of Health
Commonwealth
Of The Bahamas

EPIDEMIOLOGICAL STUDY ON
WORKERS/TEACHERS/SCHOOL CHILDREN AND RESIDENTS
IN GRAND BAHAMA.

1. Study to begin on 23rd of February 1987.

2. Study to be conducted by a specially selected team of Ministry of Health Officials who will be based at the Rand Memorial Hospital.

3. Examinations will be confidential and will include: Chest Xray, Blood & Urine Tests, Physical Examination and testing of Eyes, Ears and Skin.

4. A total of 600 persons will be be tested and the study is expected to last 10 - 12 weeks.

5. Participants will spend one day at the Rand Memorial Hospital where they will be interviewed and examined. Free transportation and meals will be provided.

6. Persons are selected for the study by the process of random sampling, but only persons who agree to participate will be accepted.

APPENDIX 3

Rand Memorial Hospital
P.O. Box F-[illegible]
Freeport, Grand Bahama

Ministry of Health
Commonwealth
of the Bahamas

Telephone: (809) 352-6735
Telex: [illegible] 30-037

Dear Parents:

RE: EPIDEMIOLOGY STUDY

Your child has been selected (through the process of random sampling) from a list of school children to participate in a Ministry of Health Community Epidemiology Study which will commence on 23rd February 1987.

As you are no doubt aware, the Ministry has been trying to determine scientifically whether persons living, working or attending school near [illegible] Park are subjected to any [illegible] and this study will answer this particular question.

Whilst your child is not compelled to participate we hope that you will agree to his/her inclusion in the study and we ask that you sign the attached consent form and send it with your child to his/her teacher as soon as possible.

A short description of the tests and study procedures is enclosed for your information.

You will have an opportunity to meet with the doctors, nurses and other officials at a special meeting at the school on February at [illegible] p.m. or at another time indicated by you.

Please feel free to call Dr. Brown at the Epidemiologist Office at Rand Hospital for further information.

MINISTRY OF HEALTH

CONSENT FORM

TO: Medical Staff and

The Ministry of Health

I...of......................................

consent to the Medical Examination of Epidemiological study being

performed on..

the nature of which has been explained to me.

Signed...

Witness.......................................

Dated the.....................day of...................................

I certify that the nature of the medical examination has been fully

explained to ....

....

Signed.......................................

Dated.......................................

In case of an adult please sign.

In case of a child [illegible] name of children/patients who is signing

this form a parent or guardian.

Rand Memorial Hospital
P.O. Box [illegible]
Freeport, Grand Bahama

Ministry of Health
Commonwealth
Of The Bahamas

Telephone: [illegible]
Telex: [illegible]

27th February, 1987.

Dear

RE: Epidemiology Study

You have been selected, through the process of random sampling from a list of [illegible] teachers to participate in a Ministry of Health conducted Epidemiology Study which will [illegible] February 1987.

Whilst you are not compelled to participate [illegible] you will agree to join [illegible] the study [illegible] sign the attached consent form and return it to this office as soon as possible.

A short description of the study and study background is attached for your information.

Please feel free to call Dr. Eric Brown at the Epidemiology Office, Rand Memorial Hospital for further information.

PLEASE PRINT

APPENDIX C

CLASSIFICATION

S / T / R / C

STUDY NUMBER

NAME

FIRST

MIDDLE

LAST

SEX

M / F

DATE OF BIRTH

JOB TITLE

OCCUPATION

RESIDENTIAL ADDRESS

WORK/SCHOOL ADDRESS

RESIDENCE SINCE

DAY MONTH YEAR

WORKING SINCE

DAY MONTH YEAR

WEEKLY INCOME

$

MONTHLY INCOME

$

ANNUAL INCOME

$

NO. OF PERSONS USUALLY LIVING

SMOKING

CONSULTATIONS

YEAR

1985

1984

1983

1982

1981

ANY ESTABLISHED DISEASES

USE OF MEDICINES IF YES

SMOKING (IF YES) NUMBER OF CIGARETTES PER DAY..................

ALCOHOL (IF YES) 1-3 DAYS/WEEK /__/ /__/ 4-7 DAYS/WEEK

/ REPRODUCTION /

/ FEMALE / DYSMENORRHOEA (IF YES) DURATION...................

AMENORRHOEA (IF YES) DURATION...................

OLIGOMENORRHOEA (IF YES) DURATION...................

USE OF CONTRACEPTIVE (IF YES) DURATION...................

LAST PREGNANCY (DATE)...................OUTCOME: L.B./S.B./A.B.

PREVIOUS PREGNANCIES (DATE) 1.........OUTCOME: L.B./S.B./A.B.

2.........OUTCOME: L.B./S.B./A.B.

3.........OUTCOME: L.B./S.B./A.B.

4.........OUTCOME: L.B./S.B./A.B.

/ MALES / LAST CHILD'S AGE /__/ YEAR...................

EARLIER CHILDREN AGE 1 YEAR...................

2 YEAR

3 YEAR...................

4 YEAR...................

DECREASED LIBIDO (IF YES) DURATION...................

FUNCTIONAL DISORDER (IF YES) DURATION...................

USE OF CONTRACEPTIVE (IF YES) DURATION...................

/ EYES / / RIGHT EYE / / LEFT EYE /

CONJUNCTIVITIS - ACUTE /__/ /__/

- CHRONIC /__/ /__/

CORNEA - OPACITY /__/ /__/

LENS - CATARACT /__/ /__/

VISION - DISTANT ....

NEAR ....

EARS

	500HZ	1000HZ	2000HZ	4000HZ
25 db				
40 db				
60 db				
NO RESPONSE				

REMARKS

LT EAR (X) RT EAR (O)

SKIN

	HANDS RT	HANDS LT	FEET RT	FEET LT	SCALP
ECZEMA - ACUTE					
- CHRONIC					
PIGMENTATION - INCREASE					
- DECREASE					
ULCERATIVE LESIONS					
NEOPLASMS					
GRANULOMATA					
CHLORACNE					

LABORATORY TESTS

URINE

SP. GRAVITY ....

U. SEDIMENTS ....

PROTEIN ....

LIVER

S.G.O.T. ....

S.G.P.T. ....

BILIRUBIN (DIRECT) ....

(INDIRECT) ....

C.B.C.

HB ....

HCT ....

W.B.C. ....

DIFFERENTIAL - NEUTROPHILS

- EOSINOPHILS

- BASOPHILES

- LYMPHOCYTES

- MONOCYTES

RADIOLOGICAL EXAMINATION

OPACITY		RIGHT LUNG			LEFT LUNG		
		UPPER	MIDDLE	LOWER	UPPER	MIDDLE	LOWER
SMALL/1 cm.							
Rounded	p < 1.5 m.m.						
	q = 1.5 - 3.0 m.m.						
	r = 3.0 - 10.0 m.m.						
Irregular	s = fine/linear						
	t = medium						
	u = coarse/blotchy						
LARGE / 1 cm.							

REMARKS ....

....

....

....

....

Signed ....

Date ....

Rand Memorial Hospital
BLOOD CHEMISTRY REQUEST
Printed values are adult references

ROUTINE ___ STAT ___ PAC-?? ___ DIAGNOSIS ___

NAME ___ HOSPITAL NUMBER ___ AGE ___ SEX ___ ADDRESS ___ ROOM & BED ___ DATE ___

TEST	RESULT	NORMALS
GLUCOSE FAS	MG/DL	(70-110)
2Hr PP	MG/DL	(<120)
RBS	MG/DL	
2Hr PP		
BUN	MG/DL	(7-18)
CREATININE	MG/DL	(M: 0.7-1.4)
URIC ACID		(F: 0.6-1.1)
	MG/DL	(M: 3.5-7.5)
CO2		(F: 2.0-6.7)
CHLORIDE	MMOL/L	(23-30)
SODIUM	MMOL/L	(98-111)
POTASSIUM	MMOL/L	(135-150)
Tot. PROTEIN	MMOL/L	(3.5-5.3)
ALBUMIN	GM/DL	(6.3-8.2)
GLOBULIN	GM/DL	(2.3-3.2)
A/G RATIO	GM/DL	(1.0-1.9)
CALCIUM		(1.1-2.5)
PHOSPHORUS	MG/DL	(8.5-10.4)
IRON	MG/DL	(2.5-4.4)
TIBC	UG/DL	(35-150)
	UG/DL	(245-400)
AMYLASE	U/DL	(20-131)
ALK PHOS	U/L	(M: 32-92)
		(F: 19-83)
GAMMA GT	U/L	(M: 8-38)
		(F: 5-27)
SGOT	U/L	(UP TO 35)
SGPT	U/L	(UP TO 40)
LDH	U/L	(M: 50-166)
		(F: 50-132)
CPK	U/L	(M: 38-55)
		(F: 0-50)
ACID PHOS, prost.	U/L	(0.05-0.15)
ACID PHOS, tot.	U/L	(M: 0.13-0.63)
		(F: 0.01-0.50)
BILIRUBIN, tot.	MG/DL	(0.2-1.2)
BILIRUBIN, dir.	MG/DL	(0-0.3)
CHOLESTEROL, tot.	MG/DL	(150-300)
CHOLESTEROL, HDL	MG/DL	(M: 29-72)
		(F: 35-80)
CHOLINESTERASE		
LIPASE	U/ML	(40-80)

CHARGES: PUBLIC ___ PRIVATE ___

TECH ___ DATE ___

RAND MEMORIAL HOSPITAL

HAEMATOLOGY REQUISITION