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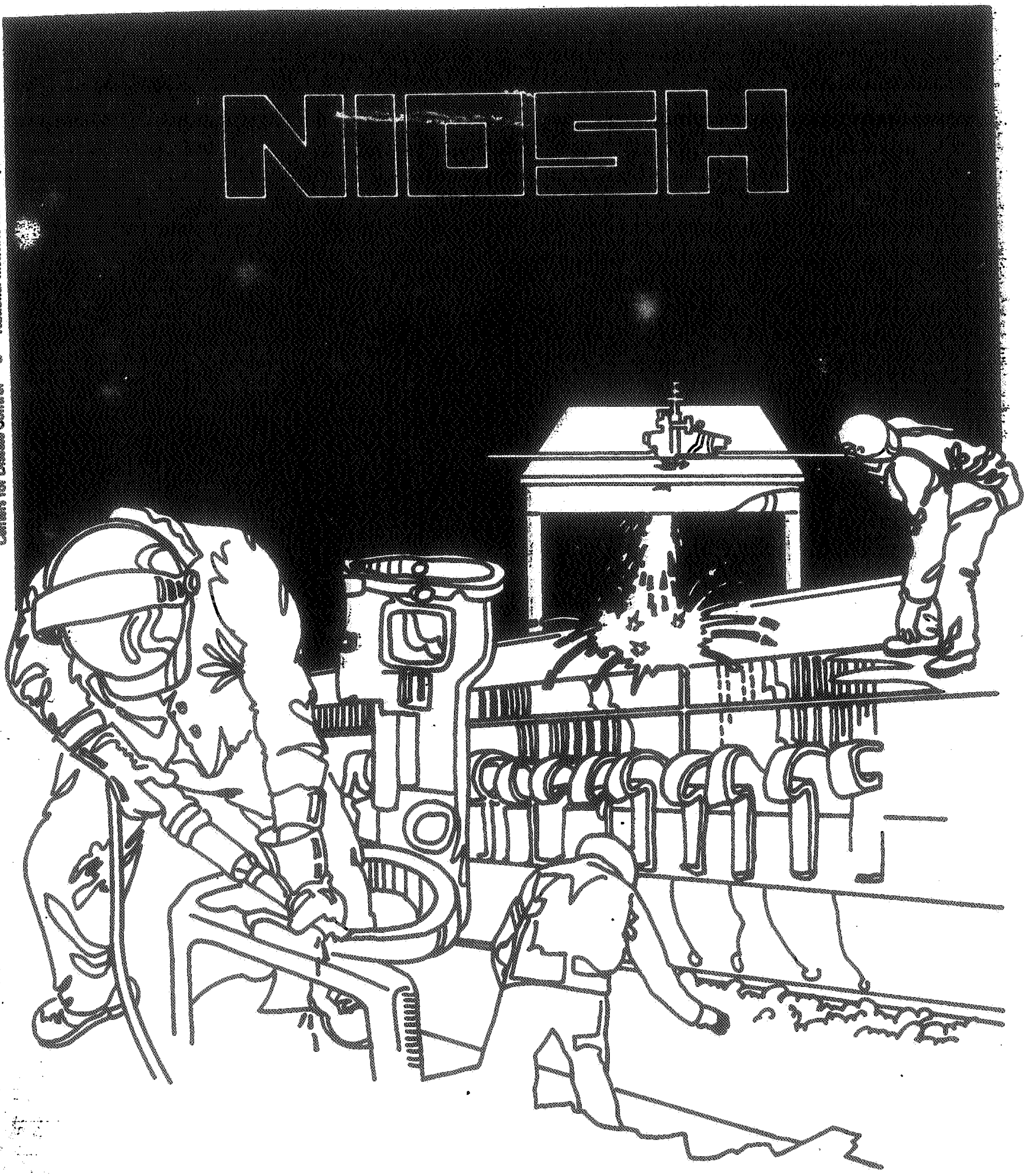

Health Hazard Evaluation Report

TA 80-77-853
CHEMICAL CONTROL CORPORATION
ELIZABETH, NEW JERSEY

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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CHEMICAL CONTROL CORPORATION
ELIZABETH, NEW JERSEY

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I. SUMMARY

On April 22, 1980, the National Insititute for Occupational Safety and Health (NIOSH) received a request from the State of New Jersey Department of Health to provide on-site industrial hygiene consultations during hazardous waste removal from the Chemical Control Corporation facility in Elizabeth, New Jersey. On April 21st an explosion and fire among the 40,000 drums of unlabeled chemical wastes had attracted national attention and raised serious concern about the health and safety of workers who had to cleanup the disaster site. To evaluate environmental conditions, NIOSH participated in the planning activites for the cleanup, in the conducting of air monitoring, in the providing of on-site and laboratory testing of respiratory protective equipment and in the evaluation of heat stress among workers at the site.

Two site visits were conducted, 107 environmental samples analyzed, and 4 respirator units tested. No overexposures to chemical substances were found. Aluminum, calcium, iron, phosphorus, toluene, and xylene were measured in more than 50% of the 47 personal and 60 area samples. More than half of the personnel monitored had additional exposures to chromium, mercury, magnesium, and sodium compounds. Comparison of personal and area samples showed a decrease in both the concentration and number of substances detected as the site boundary was approached.

Five incidents of suspected respiratory protective equipment failure were investigated. Failure was confirmed in at least two of the three incidents reported in June.

The results also suggest that heat stress was a factor in the multiple hospitalizations experienced during June. Site heat stress policies were reviewed. No formal heat stress control program was in effect.

A continuing program of personal monitoring was necessary to adequately document exposure while clean-up was under way.

Based on the environmental assessments of this investigation, NIOSH noted no airborne chemical overexposures. Inadequate worker protection programs including respiratory protection, heat stress abatement, and air monitoring were noted. Specific recommendations to correct those deficiencies are provided in this report.

KEYWORDS: SIC 4783, (Packing Goods for Shipping), Hazardous Waste Sites, Heat Stress, Respiratory Protection, Air Sampling.

II. INTRODUCTION AND BACKGROUND

On April 22, 1980, the State of New Jersey Department of Health requested that NIOSH provide on-site industrial hygiene consultations during hazardous waste removal at the Chemical Control facility in Elizabeth, New Jersey.

The 2 acre site formerly owned by the Chemical Control Corporation was placed under state jurisdiction in 1978 pursuant to a court supervised plan to remove approximately 50,000 drums of unknown chemicals from the site. Chemical Control Corporation was located on the western half of a peninsula formed by the confluence of the Elizabeth River and the Arthur Kill (Figure 1). The kill was a busy ship channel which separated northern New Jersey from Staten Island. The eastern half of the peninsula was occupied by a ready mix concrete company. A variety of light industries including petroleum distribution and speciality chemical manufacture operated on the nearby mainland. To the west, within a quarter mile of the Chemical Control site, was residential housing.

On April 21, 1980, an explosion and fire among the 40,000 drums remaining at the site attracted national attention, and raised serious concerns about the health and safety of workers exposed. NIOSH medical investigators responded immediately. Industrial hygiene studies began on April 25th. The medical investigation focused on acute health effects among firemen and security policemen involved in fire containment operations. The findings of this study have been reported elsewhere.[1] Industrial hygiene efforts were directed towards hazard evaluation, and selection and use of personal protective equipment.

From the beginning, all available scientific information about the site conditions was channeled to a scientific steering committee chaired by the U.S. Environmental Protection Agency (EPA).[2] This committee reported to the U.S. Coast Guard which had primary jurisdiction at the site under the Oil and Hazardous Substance Contingency Plan. Studies of air, soil, and water data were conducted by contractors to the U.S. Environmental Protection Agency, the State of New Jersey, and private groups. These were reviewed by the committee and initial personal protective equipment requirements and site safety and contamination control procedures developed.

Self-contained breathing apparatus and acid suits were required where there was the possibility of direct skin contact with liquids from ruptured drums. Air purifying respirators and disposable coveralls were required in other areas. The area west of the Elizabeth River was considered uncontaminated. Specific procedures for the initial post-fire cleanup operation, involving clearing waste drums from the bank of the Elizabeth River, were suggested by the EPA.[3]

Between June 9th and June 16th, 1980, NIOSH conducted air sampling at the site to investigate potential worker exposure to inhalation hazards. NIOSH also provided emergency on-site and laboratory evaluation of respiratory protective equipment.

On June 27th, 1980, a second site visit was requested. Three cleanup workers had been hospitalized following suspected "cyanide poisoning" and "chemical exposure" during the preceding week. Industrial hygiene and respirator specialists conducted additional air sampling and evaluated repiratory protection programs.

A request to review heat stress control programs was received in August 1980. Interim recommendations were furnished and laboratory development of a heat stress monitor for use under impermeable protective clothing was initiated.

III. PROCESS DESCRIPTION

The cleanup of Chemical Control lasted until late 1980. The cleanup operation involved restaging, pretreating, and transporting identified hazardous wastes remaining after the fire and ultimatly their safe disposal. Site cleanup also included demolishing unsafe structures, clearing navigable waterways, and restoring of adjacent property to private control.

Table 1 lists job titles, job descriptions, and potential exposures for personnel involved in the cleanup.

IV. METHODS

A. Air Sampling Strategy

1. May 9, 1980, to May 16, 1980

The objectives of NIOSH's air sampling strategy were to measure potential inhalation hazards to workers involved in cleanup operations and to evaluate the site as a potential source of "over the fence" occupational exposure to adjacent worksites. This was assessed by placing sampling pumps in the north, south, east, and west quadrants of the site and analyzing the collection media for organic vapors and metals on each of the 6 sampling days (Figure 1).

Personal air samples were obtained on volunteers performing any task which required respiratory protection. Solid collection media were positioned outside the respirator facepiece in the breathing zone of the workers.

Samples requiring liquid media were collected in fixed locations. This was because the glass impingers could break or lose their content during vigorous physical work.

No record of materials stored at Chemical Control prior to the fire were available and the substances measured were selected pragmatically.

Post-fire air sampling by EPA contractors indicated low ambient levels of organic vapors. There was concern that ash from the fire that fell on Statan Island contained heavy metals. Pesticides and PCBs were known to have been stored on site. Mercury and arsenic contamination of soil substantially above background levels had been reported. Cyanides were reported to be present by personnel familiar with the site. Elevated mercury levels in soil were identified during the cleanup. All of these substances were considered as potential exposure hazards and were evaluated by air sampling.

The number of samples collected was constrained by the available laboratory capacity at NIOSH and the willingness of cleanup personnel to wear sampling pumps. The sampling time was determined by the battery life of the pumps which, in general, was 8 hours.

2. June 27, 1980, to June 29, 1980

It was suspected that hydrogen cyanide may have been generated during the mixing of solid waste and fly ash by a heavy equipment operator, so long-term direct-reading hydrogen cyanide indicator tubes were attached to nine pieces of heavy equipment near the operator's position. Collection media for laboratory quantification of particulate and gaseous cyanide compounds were placed beside the indicator tubes and on three additional pieces of heavy equipment. Thus it was possible to obtain immediate exposure information with later laboratory confirmation. This procedure was used because color development in the direct-reading indicator tubes by non-cyanide acid gases was suspected. Available direct-reading indicator tubes for known interferences to hydrogen cyanide detector tubes were also exposed near the solid waste mixing area.

B. Air Sampling Techniques

Multiple screening media were utilized because the nature of the waste materials on the site was unknown and worker exposure from leaking drums and drum ruptures varied from day to day. These media included glass fiber filters followed by silica gel tubes analyzed by sequential desorption to identify pesticides, herbicides, and many of their precursor compounds and degradation products. Multi-channel analysis of AA filters was carried out by inductively coupled plasma atomic emission spectrometry for a variety of elements including the metals. Gas chromatographic and mass spectrometric (GC/MS) analysis of charcoal tubes for organic vapors was used. Additional media utilized for specific substances are outlined in Appendix A. Interactions and interferences (e.g. the interference of PCBs with pesticide analysis) were taken into account in the analytical scheme. Since workers engaged in vigorous activities were unable to wear more than one monitoring device at a time, it required several days to obtain a complete set of screening samples. This meant that exposure to pesticides, for example, was unknown when metals were determined.

The intrinsic safety of sampling pumps was considered and pumps certified for use in methane atmospheres were used. Measurement of explosive vapor levels were made before electronic equipment not certified for use in explosive atmospheres was used. Sampling pumps were enclosed in small plastic bags during use to prevent contamination and to insure their survival during decontamination procedures which involved vigorous wash-downs with a firehose.

C. Evaluation of Respiratory Protective Equipment

Written programs for respiratory protection were reviewed and the use and maintenance of equipment was studied. Suspect equipment was tested in the laboratories of the NIOSH Division of Safety Research, Testing and Certification Branch. Reports dated May 5, 1980[4], and July 24, 1980[5], were distributed to interested parties. Written comments from a contractor concerning respiratory protection practices at Chemical Control were reviewed.[6]

D. Heat Stress

Assessment of heat stress included a review of programs with state agencies and site contractors, on-site heat stress measurements, review of temperature data compiled by the Elizabeth Health Department,[2] a literature review of heat stress induced by impermeable protective clothing, and research laboratory development of a physiological heat stress monitor for use under impermeable protective clothing.

V. EVALUATION CRITERIA

A. Inhalation Hazards

Worker health protection based on air sampling implicitly assumes industrial environments with repetitive exposure to more or less constant levels of known contaminants, or mixtures of contaminants, and predictable exposure events during the job cycle. Evaluation of exposure using a Threshold Limit Value (TLV) criterion is difficult for jobs which involve intermittent exposures that vary significantly from day to day and novel work schedules. It is also difficult to measure intermittent high level exposures addressed by the Short-Term Exposure Limits (STELs), even when the identity of the substance is known. This problem is common when evaluating the exposures of maintenance and janitorial workers, and firefighters.[7,8]

Most chronic health effects caused by toxic substances are dose-dependent. Single or infrequent exposures to substances, as a rule, are less likely to result in chronic disease. There is no good way to evaluate chronic low-level exposure to a variety of substances even when they can be measured. A recent study by the National Research Council[9] suggests that the present "state of the art" is to assume additivity and follow the guidelines recommended by the American Conference of Governmental Industrial Hygienists.[10] When considered in this fashion, the exposures may be significant. The health effects of the wide variety of substances typically present at hazardous waste sites are poorly documented.[11] Occupational health standards for substances identified at Chemical Control are presented in Appendix B.

B. Skin Protection

There is no validated technique for monitoring skin exposure by personal dosimetry. Biological monitoring is the most accurate method of assessing actual individual exposure through the skin. However, it is only useful if there is one predominant exposure and a good biological monitoring technique available. Skin protection must prevent contact with liquids capable of entering the body through the intact skin and chemicals capable of permeating protective clothing materials.

C. Respiratory Protective Equipment

A written program detailing the selection, use, and maintenance of respirators must be developed for every use situation. OSHA, in 29 CFR 1910.134(b)(1), requires such a program. However, not every respiratory protection situation will require an extensive work-up. As a minimum, program responsibility must be clearly stated, and the basis for evaluation of program effectiveness must be established.

Training in the use, care, and limitations of respirators is essential for all employees assigned respiratory protection. To cite a parallel case, avaitors routinely use positive pressure respirators and work in stressful and physically demanding environments. In the Air Force, flight crew members are required to undergo respirator refamiliarization at regular intervals. This training includes the possible adverse consequences of respirator wear under stress, such as hyperventilation. Workers at hazardous waste cleanup sites require similar protection.

Respirator selection requires knowledge of the physical state, approximate concentration, and the toxicological properties of the gases and vapors encountered. Lacking this information, the worst case must be assumed and positive pressure self-contained breathing apparatus (SCBA) used.

Individualized fitting of facepieces is required to assure adequate worker protection (29 CFR 1910.134(e)(5)).

Personal protective equipment is a barrier between a contaminated, potentially dangerous outside environment and the worker. The protective barrier of the equipment can be breached. The use of protective equipment, as opposed to elimination of exposure hazards by engineering control or substitution of less toxic materials, is the last choice of health professionals for protecting workers from their job environment.

There is a trade off when personal protective equipment is used. Exposure is reduced at the price of decreased productivity, the risk of equipment malfunction, the need for specialized maintenance, and the need for training in proper equipment use. Personal protective equipment improperly used and maintained can easily be more dangerous than the harm it is intended to mitigate. The more personal protective equipment required on the job, the greater the risk of operator error and equipment malfunction.

D. Heat Stress

The normal resting body temperature is 37°C, and individual variations of up to plus or minus 1°C during the day are normal. Deviations of body temperature beyond this range can result in serious health consequences.

During work, the body temperature rises. When the deep body temperature exceeds 38°C, the cause should be controlled. Deep body temperatures above 38°C are not acceptable. Acute heat disorders occur when the deep body temperature reaches 39°C. Temperatures above 41°C are rapidly fatal.

The NIOSH criteria document for heat stress recommends that environmental monitoring and other preventive measures be adopted in hot work environments.[12] However, the provisions are not applicable to employees who are required to wear impermeable protective clothing. The reason for this exception is that impermeable clothing prevents the evaporation of sweat, which is one of the most important cooling mechanisms of the body. There is no recognized health protection standard for workers wearing impermeable protective clothing and respirators in hot environments.

VI. RESULTS AND DISCUSSION

A. Air Sampling

1. May 9, 1980, to May 16, 1980

Air sampling results are presented in Appendices C-E. No substance was measured in either personal or area air samples in concentrations exceeding its occupational health inhalation standard.

Aluminum, calcium, iron, phosphorus, toluene, and xylene were found in more than 50% of the 47 personal and 60 area samples analyzed in the laboratory (Table 2-3). More than 50% of the personal monitored had additional exposures to chromium, mercury, magnesium, or sodium compounds. The concentration of substances in personnel and area samples analyzed for the same materials shows a decrease both in the magnitude and number detected as the site boundary was approached.

For analysis, the personal sample results were divided into Group A (N=10), which included the manual drum handlers and heavy equipment operators who worked in close proximity to unrestaged drums. They wore the self-contained or air-line respiratory protection and impermeable suits. Group B (N=21) was comprised of all other site personnel sampled. These personnel worked in less contaminated areas and wore air purifying respirators and disposable coveralls. Of 14 substances named in Table 3 for which comparison is possible, Group A members had exposures in excess of other site personnel in 10 cases. The ratio of Group A to Group B substance-specific group mean exposure measurements varied from 1.4 for magnesium to 8.5 for chromium (Table 3).

Comparison of six substances (aluminum, calcium, iron, phosphorus, toluene, and xylene) found in all area samples shows that the southern portion of the site was the most contaminated and the northern portion the least. Four of the six indicator substances (aluminum, phosphorus, toluene, and xylene) measured at the Area S location have a mean concentration greater than the mean of all area sample results for the same substance. None of the six measured at the area N location has a mean concentration greater than the mean of all area samples results for the same substance (Table 4).

2. June 29, 1980

The sampling results are presented in Appendices F-G. No particulate or gaseous cyanide compounds were detected at 12 heavy equipment operator's positions. One long-term direct-reading indicator tube showed a slight color change, but the corresponding laboratory sample was negative.

Direct-reading indicator tubes, selected because their analytes had known interferences to the kind of long-term direct-reading hydrogen cyanide detector used for the personnel samples, were exposed at locations adjacent to the solid waste mixing pit. No interfering substances were detected.

The airborne exposures measured at the site were well below recognized occupational health standards. The probable reason is that a large and persistent source is needed to produce significant airborne concentrations in an outdoor environment. The fire at the site consumed many of the volatile substances, and there was a low rate of contaminant generation by the cleanup operation. The mechanisms of diffusion, transport, and dilution of contaminants by prevailing winds prevented the build-up of high levels of contaminants. Aluminum, calcium, iron, phosphorus, toluene, and xylene were detected at the site, and cleanup personnel as well as employees of neighboring factories were exposed chronically to low levels of these substances. The health effects of such exposures are unknown.

Evaluation of exposure to dusts entrained by wind or disturbed by active site operations was difficult. Exposures related to contaminated soil could have varied with time due to changes in soil moisture levels. There was also variable exposure from leaking drums when they were handled. A continuing program of personal exposure monitoring would have been necessary to adequately document exposure while cleanup was under way. Such a program would be costly and demanding of laboratory time. For major operations, the ideal situation would be a well equipped mobile analytical laboratory located on site and staffed by chemists experienced in hazardous waste operations.

There was no way to categorize site exposures for health protection purposes using a single number such as the "total vapor reading" of a photoionization detector or an organic vapor analyzer. Such measurements are valuable for finding organic vapor "hot spots" where quantative measurements should be made. However, health protection is predicated on the knowledge of the identity and concentration of contaminant substances. Such quantification requires knowledge of pertinent interferences, specific calibration of the portable sampling device used, and oftentimes the services of an experienced analyst. These conditions can seldom be met under acute exposure conditions.

Inhalation hazards were somewhat overshadowed by acute physical hazards such as exploding barrels, spontaneous ignition of unconfined materials, unstable overhead objects, and unsafe structures.

B. Respiratory Protective Equipment

1. Visit of April 29, 1980

The Division of Safety Research investigated an April 27, 1980, incident in which two users of BioMarine 60P SCBAs alleged short air supply duration and failure of the low air supply warning alarm. Four BioMarine units were secured in the Elizabeth Police Station pending arrival of NIOSH and manufacturer representatives. The units were examined to determine condition prior to transportation and were moved to the Appalachian Laboratory for Occupational Safety and Health. Bench tests failed to verify the malfunctions reported by the users. Laboratory investigation disclosed unapproved modifications to the units. All four devices failed the breathing resistance and bag relief value pressure tests. The units had been purchased and purveyed for use at Chemical Control with the NIOSH certification label removed.

2. Visit of June 28-30, 1980

The Division of Safety Research investigated three additional cases of alleged respiratory protective equipment failure in late June 1980. In one incident, a user smelled something like propane inside his respirator facepiece while working near a drum of chemical waste. He was hospitalized for treatment. The pressure demand SCBA worn was examined and no apparent failure was found. The drum contained no substance likely to produce severe effects under the conditions reported.

In the second incident, a supervisory employee complained of feeling unwell while wearing protective equipment and was hospitalized. The exhalation valve of the pressure demand SCBA worn was found to be blocked open by a burned paper match. Leakage of contaminated air into the respirator facepiece through the open valve with loss of protection could have occured if this unit was operated in the demand mode. Leakage of uncontaminated air from the supply tank with loss of air supply duration would be anticipated if the respirator was operated in the positive pressure mode. The unit was said to have been operated in the positive pressure mode. There was no unusual air consumption, suggesting that the wearer used the demand mode, and experienced loss of protection.

In the third incident, an employee operating a front-end loader complained of odor in his supplied-air demand/continuous flow respirator. The employer had instructed the heavy equipment operators to open the continuous flow valve to a subjectively comfortable level to maintain a positive facepiece pressure in the demand unit. Air use records indicated air consumption insufficient to maintain an adequate positive pressure inside the facepiece in the continuous flow mode. Cylinder regulators were set at a delivery pressure so low that the minimum airflow requirements for either demand or continuous flow operation could not have been achieved. It was reported that a direct-reading indicator tube showed a 5 ppm hydrogen cyanide concentration in the ambient air immediately after this incident.

The level of competence in using respiratory protection at the site varied widely from good to non-existent. There were no formal, written respiratory protection programs on the site. Two months after the April 21st fire, one contractor was said to have some respiratory protection guidance material in an operation's manual, another was said to be working on a draft, and a third was establishing a respirator program with the assistance of a respirator manufacturer. The state agencies that had been working much longer at the site had no formal respirator program, although one of them intended to request NIOSH assistance.

There was no formal facepiece fit testing. One contractor performed qualitative fitting with irritant smoke tubes (protocol unknown) and furnished a respirator that would fit. Another used a positive/negative pressure test to fit one of 3 sizes. A third was establishing a program.

The contractors and state agencies had informally designated site areas that required different degrees of respiratory and skin protection. The same degree of respiratory and skin protection was not always utilized in the same physical location, even when members of two different groups were present at the same time. Virtually every type and configuration of respirator and protective clothing was being used. No two parties seemed to agree on what should be used where. One contractor's office and rest areas, in which respirators and protective clothing were not required, was within another contractor's zone which required both. Feedback from accumulated field experience was not used to modify the initial choice of respiratory protective equipment.

The quality of respiratory protective equipment maintenance varied. One contractor had spare parts for issue and factory trained maintenance personnel on site. One used only air purifying respirators and performed no maintenance. A third sent units off site for servicing. Defects were identified by the user. Field checks of more than 20 of this contractor's SCBAs suggested that the pressure demand valve settings (inhalation resistance and airflow) and exhalation resistance were misadjusted. One alarm failure and one demand valve leak were observed. Additional instances of alarm failures, demand valve leakage, and two high pressure hose ruptures were reported.

One contractor was developing a medical surveillance program. The others provided medical surveillance to full-time permanent employees. No one provided health surveillance to subcontractors and casual subcontractors (deliverymen, etc.) although all were required to use respirators.

One contractor had a respiratory protection training program. A second was establishing a training program, and a third had requested training assistance from a respirator manufacturer. Several workers wearing respiratory protection were seen coughing and suffering from facial skin lesions.

C. Heat Stress

Heat stress monitoring using Wet Bulb Globe Temperature apparatus, Reuter-Stokes WIBGET monitors, and Botsballs was conducted during both site surveys. These on-site measurements generally agreed with the Elizabeth Health Department temperature readings.

The mean of weekday morning and afternoon ambient air temperature measurements rose from 63° F to 70° F during the two weeks preceeding the incidents and reached 79° F during the week of the hospitalizations.

A review of site heat stress policies with state agencies and contractors indicated that no formal program was in effect. Water and salt tablets were available in rest areas and some contractors referred to such practices as "hiring people who were used to it" and "letting them take it easy for the first few days." One group prepared and issued two meals a day to its employees and conducted daily body weight measurements to assess fluid balance. Its managers also encouraged fluid consumption. Most were not aware that heat stress could be induced by respiratory protective equipment and the relatively impermeable clothing worn at low temperatures. There was no evidence of acclimatization or reacclimatization procedures. Two of the three cases of illness were employees of a contrator who had been on site less than 2 weeks.

The results of the site visit suggest, but do not prove, that heat stress was a factor in the multiple hospitalizations experienced during late June 1980. In hot environments, heat stress is greatly exacerbated by impermeable protective clothing and respiratory protective equipment. In unacclimatized individuals, heat injury can occur rapidly and within the 30 minutes of air supplied by a self-contained breathing apparatus.[13] Environmental measurements such as the Wet Bulb Globe Temperature (WBGT) do not predict the consequences of heat exposure when clothing impermeable to sweat is worn.[12] Because of this, biological indices of the effects of heat stress on the human body, such as body temperature measurement and quantification of diurnal change in body weight, must be employed to control exposure. Real-time monitoring of this kind is difficult. We have suggested interim procedures for heat stress surveillance of workers wearing impermeable clothing which are reproduced in the Recommendations Section. Air cooled suits may not eliminate the heat stress problem.[14]

VII. CONCLUSIONS AND RECOMMENDATIONS

A. Protective Equipment

The relatively good respiratory protection safety record among cleanup personnel at the site (five reported incidents in several thousand man-days of SCBA usage) cannot be attributed to an adequate respirator program because no inhalation exposure likely to induce acute effects was demonstrated. However, respiratory protective equipment failure in at least two of the three incidents reported in June can be demonstrated.

The hospitalizations following equipment failures strongly support the need for thorough and repetitive training in the use of respiratory protective equipment and heat stress procedures.

The concentrations of toxic vapors and gases found at the site would probably not give rise to significant skin absorption in those exposed. Missile fuel handlers and personnel handling known chemical warfare agents require encapsulating suits covering the entire body. These kinds of materials were not found at Love Canal, Hyde Park, or Chemical Control.[11,16] Thus, because of the heat stress hazard induced by the use of impermeable suits in hot environments, we do not recommend their use except where there is a risk of frequent direct contact with either skin-absorbable substances of high or unknown toxicity or with severe irritants.

B. Medical Monitoring

A medical program should be part of the occupational health and safety program for site entry personnel. It should include:[16]

1. Provision for emergency medical treatment, if needed, and for appropriate evaluation of ill or symptomatic workers. This evaluation should be made by medical personnel familiar with the possible toxic effects of chemical exposures at the waste site.

2. Medical evaluation of the ability to use personal protective equipment.

3. Limited periodic medical screening. Screening is most appropriate for specific exposures with known health effects where an effective screening test for the effects is available. At most hazardous waste dumps, exposures are usually multiple and unknown. The medical screening at a particular site will depend on the specific hazards at that site.

4. Biological monitoring may be appropriate for situations where exposure to an agent which may be biologically monitored (e.g., lead) is either predominant or is a good indicator of overall exposure. The utility of this approach will vary from site to site.

C. Heat Stress Monitoring

NIOSH is developing a physiological monitor for use underneath impermeable protective clothing. Current recommended preventative measures for workers in hot environments using impermeable protective clothing are as as follows:

1. The rest and cool-off periods should be a minimum of 30 minutes per working hour and heart rate and body temperature should be monitored as early as possible in every rest period (as soon as shedding of protective clothing permits) to ensure that excessive heat stress is prevented. Body weight should be measured in the morning and the evening to evaluate fluid balance.

2. Heart rate (HR) should be measured by the radial pulse during 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is in excess of the above value, the next work period should be shortened by 10 minutes (or 33%) while the length of the rest period stays the same. However, if the heart rate is in excess of 110 beats per minute at the next rest period, the following work cycle should be further shortened by 33%.

3. Body temperature (BT) should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 37.6° C (corresponding to 38° C BT). If OT exceeds 37.6° C, the next work period should be shortened by 10 minutes (or 33%) while the length of the rest period stays the same. However, if the oral temperature is in excess of 37.6° C at the beginning of the next rest period, the following work cycle should be further shortened by 33%. OT should be measured again at the end of the rest period to make sure that OT has decreased below 37.6° C.

4. Body water loss (BWL) due to sweating during the work day should be measured by the difference between body weight in the morning before work and body weight in the evening after finishing work. The clothing worn should be similar at both weighings; however, preferably the workers should be nude. The balance should be accurate to ± 1/4 lb. BWL should not exceed 1.5% of total body weight. If BWL exceeds 1.5%, the worker should be instructed to increase his daily intake of fluids by the amount of total deficit (morning body weight minus evening body weight). The ideal condition is to maintain the body fluids at a constant level during the whole work day. This requires the replacement of the salt lost in the sweat as well. This can be achieved by eating salted meals during the day and/or drinking fluids containing 0.1% salt.

5. Surveillance by monitoring according to the above recommendations should take place on all days when the outside temperature at any time during the day exceeds 75° F.

6. It is essential that good hygienic standards be maintained by frequent change of clothing (as often as possible and at least daily) and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin eruptions should immediately consult a nurse or physician.[17]

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report have been sent to:

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   P.O. Box 1540, Trenton, New Jersey 15012

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8. State of New Jersey, Department of Environmental Protection
   Office of Hazardous Substance Control
   120 Route 156, Yardville, New Jersey 08620

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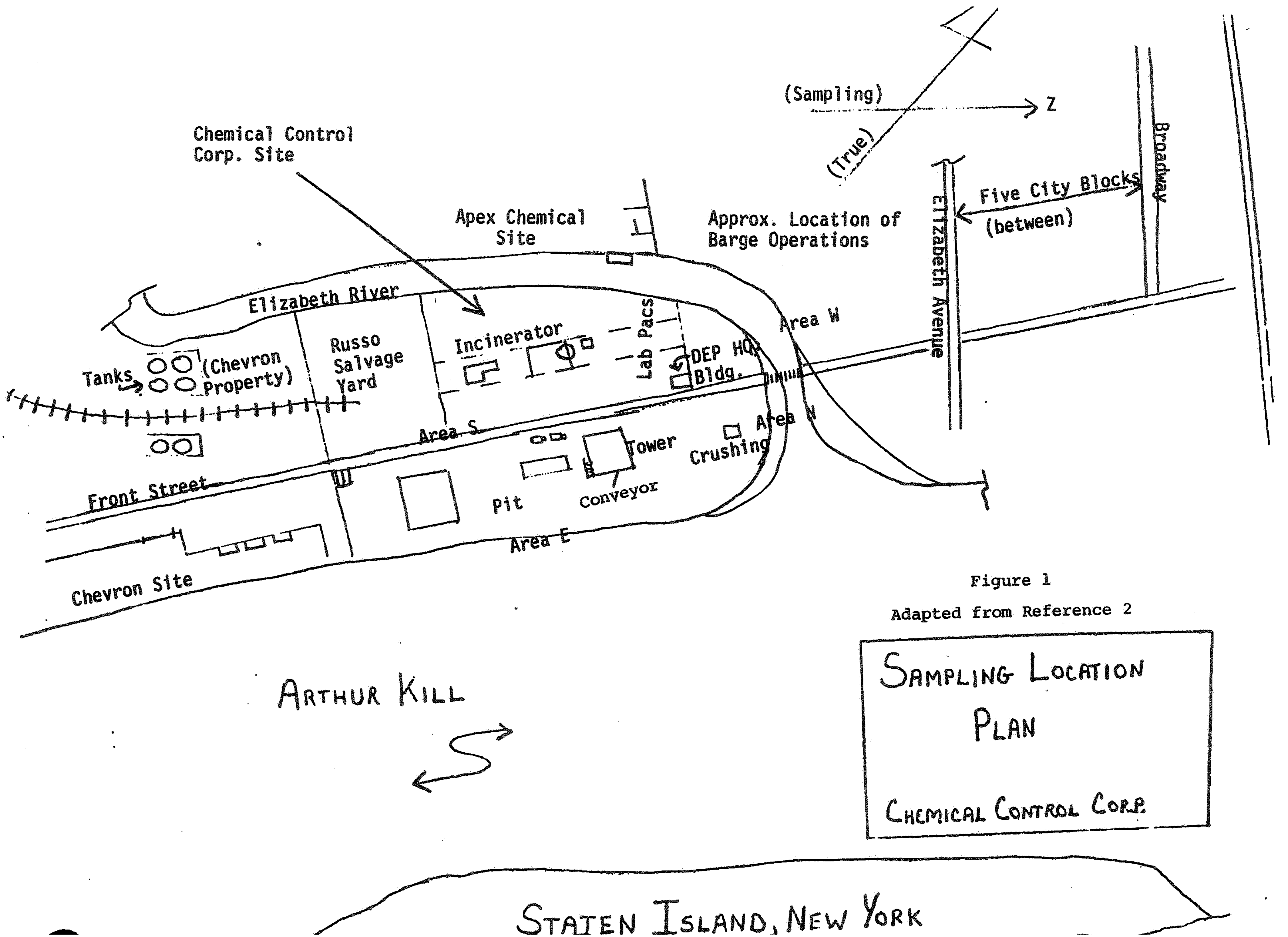

Figure 1

Adapted from Reference 2

TABLE 1

TA 80-77
JOB DESCRIPTIONS
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

Job Title	Job Description	Potential Exposures
Fire Protection Workers	These personnel maintained 24-hour on-site fire surveillance in the weeks after the fire and supressed a number of outbreaks. Firemen also hosed down the buildings and equipment of the adjacent ready-mix concrete company before it was returned to private ownership.	Thermal decomposition products, oxygen deficiency, heat stress, explosion, falling objects, and chemical permeation of glove materials.
Marine Salvage (Barge) Operators	These personnel hoisted barrels by crane from the shore of the Elizabeth River onto barges in order to clear the waterway. A Coast Guard vessel was positioned downstream to provide emergency egress for the barge and barrel handling crews.	Unconfined chemicals from drum ruptures, drowning, and heat stress.
Manual Drum Handlers	These personnel unstacked and loaded burned and intact barrels into the bucket of a front-end loader.	Unconfined chemicals from drum rupture, chemical permeation of protective clothing, heat stress, explosion, spontaneous chemical reactions, and falling objects.
Heavy Equipment Operators	These personnel operated bulldozers, front-end loaders, etc., transported intact and leaking barrels to restaging areas, and transported smoking barrels to safe areas. Other activities included building dikes and earthworks for spill containment, opening barrels, mixing solid hazardous waste with fly ash, and loading the mixture into trucks, etc.	Explosion, by-product generation in mixing operations, unsafe structures, heat stress, and chemical permeation of protective clothing during equipment cleanup.
Equipment Operators	These personnel crushed empty barrels and loaded them into trucks, siphoned pooled water into vacuum trucks, and transferred the liquid into holding tanks.	Unconfined chemical residues in barrels, and spontaneous chemical reactions during siphoning liquids into vacuum trucks.

TABLE 1 (cont.)

TA 80-77
JOB DESCRIPTIONS
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

Job Title	Job Description	Potential Exposures
Personnel Protective Equipment Technicians	These individuals assisted personnel in donning and doffing protective equipment, maintained respiratory protective equipment, and maintained first aid equipment, etc., in crew rest areas.	Potential inhalation and skin exposure from contact with contaminated equipment.
Chemists	These personnel sampled drums and performed laboratory tests to classify wastes for purposes of transportation and ultimate disposal. They operated portable and direct-reading instruments to measure contaminants in the air.	Chemical permeation of protective clothing during drum sampling; inhalation of volatile drum contents; inhalation, skin, and safety hazards during laboratory analyses.
Truckers	These personnel transported bulk materials to the site and carried solid and liquid hazardous waste for disposal.	Inhalation and skin exposure during loading and unloading operations, possible acute exposure in the event of a roadway accident or catastrophic failure of confinement vessels.
Waste Disposal Operators	These personnel prepared liquid hazardous wastes for shipment to the site of ultimate disposal. Operations included limited pretreatment and overpacking or redrumming, if necessary.	Potential inhalation and skin exposure especially during maintenance operations
Support Personnel	These personnel provided food service, shower and sanitary facilities, and similar services to site workers.	Minimal exposure.
Federal and State Government Employees	Personnel from various agencies provided site supervision and management. EPA personnel operated a mobile waste water treatment facility.	Minimal exposure except during initial reconnaissance and emergency response operations.

TABLE 2

TA 80-77
INCIDENCE OF DETECTION OF SUBSTANCES
MAY 9, 1980, TO MAY 16, 1980, AND JUNE 29, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

	Al	As	Ca	CN	Cr	Fe	HC	Hg	MC	Mg	Mn	Na	P	Pb	PCB	Pest	Sn	TCDD	T	X
LOD ng/Sample	500	25	500	3000	500	500	10^5	10	$3X10^4$	500	500	500	500	500	30	%	500	%%%	2000	2000
Personal Samples	6/6 100%	1/6 17%	6/6 100%	0/12 0%	4/6 67%	6/6 100%	2/12 17%	2/2 100%	4/12 33%	6/6 100%	1/6 17%	4/6 67%	5/6 83%	4/6 67%	1/5 20%	0/4 0%	2/6 33%	0/0 0%	12/12 100	12/12 100%
Area Samples	11/13 85%	0/12 0%	11/13 85%	0/5 0%	1/13 8%	13/13 100%	4/21 19%	0/2 0%	4/21 19%	3/13 23%	0/13 0%	5/13 38%	8/13 62%	2/13 15%	0/1 0%	--- ---	3/13 23%	0/6 0%	14/21 67%	14/21 67%
OVERALL	17/19 89%	1/18 6%	17/19 89%	0/17 0%	5/19 26%	19/19 100%	6/33 18%	2/4 50%	8/33 24%	9/19 47%	1/19 5%	9/19 47%	13/19 68%	6/19 32%	1/6 17%	0/4 0%	5/19 26%	0/6 0%	26/33 79%	26/33 79%

NOTES:
1. "T" means toluene. "X" means xylene. "HC" means total C_4-C_7 hydrocarbons. "MC" means methyl chloroform.
2. LOD means limit of detection.
3. % See Note 3 of Appendix E
4. %% includes personal samples collected June 29, 1980.
5. %%% See Appendix E for the Limits of Detection.

TABLE 3

TA 80-77
MEAN CONCENTRATIONS OF MEASURED SUBSTANCES
BY EXPOSURE GROUP
MAY 9, 1980, TO MAY 16, 1980, AND JUNE 29, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

	Al	As	Ca	CN	Cr	Fe	HC	Hg	MC	Mg	Mn	Na	P	Pb	PCB	Pest	Sn	T	TCDD	X
LOD ng/Sample	500	25 ng/M^3	500	3000 %%	500	500	10^5 mg/M^3	10 ng/M^3	$3X10^6$ mg/M^3	500	500	500	500	500	30	%	500	2000 mg/M^3	%%%	2000 mg/M^3
All Samples No. Detected Total No.	3.6 6/6	---- 1/6	11.0 6/6	---- 0/12	0.4 4/6	15.8 6/6	0.9 2/12	602 2/2	0.42 4/12	1.6 6/6	0.3 1/6	1.0 4/6	1.0 5/6	0.5 4/6	---- 1/5	---- 0/4	0.2 2/6	1.1 12/12	---- 0/0	0.8 12/12
Group A	3.6	----	9.6	----	1.1	25.9	3.0	545	1.2	2.0	----	2.5	2.4	0.3	0.27	----	0.2	3.0	----	1.4
Group B	3.5	0.01	11.7	----	0.13	10.8	0.5	659	0.3	1.4	0.4	0.3	0.3	0.6	----	----	0.1	0.7	----	0.7
A/B	1.0	----	0.8	----	8.5	2.4	6.0	0.8	4.0	1.4	----	8.3	8.0	0.5	----	----	2.0	4.3	----	2.0

NOTES:

1. Concentrations are given in units of ug/M^3 unless otherwise noted.
2. "T" means toluene. "X" means xylene. "HC" means total C_4-C_7 hydrocarbons. "MC" means methyl chloroform.
3. LOD means limit of detection.
4. Arithmetic means were used. The value 0.0 was entered into the calculation of the mean when a substance was analyzed, but not detected.
5. % See note 3 of Appendix E.
6. %% indicates samples collected June 29, 1980.
7. %%% See Appendix E for the Limits of Detection.
8. Group A includes barrel handlers and H.E. equipment operators.
9. Group B includes all other personnel (See Appendix C).

TABLE 4

TA 80-77
MEAN CONCENTRATIONS OF MEASURED SUBSTANCES
BY AREA
MAY 9, 1980 TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

	Al	As	Ca	CN	Cr	Fe	HC	Hg	MC	Mg	Mn	Na	P	Pb	PCB	Pest	Sn	T	TCDD	X
LOD ng/Sample	500	25	500	3000	500	500	10^5	10	$3X10^6$	500	500	500	500	500	30		500	2000	%%	2000
		ng/M^3					mg/M^3	ng/M^3	mg/M^3									mg/M^3	%%	
Overall	2.1	----	1.1	----	0.01	1.8	1.0	----	0.23	0.11	----	1.4	0.2	0.1	----	----	0.1	0.7	----	0.2
<u>No. Detected</u> Total No.	11/13	0/12	11/13	0/5	1/13	13/13	4/21	0/2	4/21	3/13	0/13	5/13	8/13	2/13	0/1	0/0	3/13	14/21	0/6	14/21
Area N	0.3	----	0.5	----	----	1.6	----	----	----	----	----	3.0	0.03	----	----	----	0.2	0.1	----	0.08
Area E	3.2	----	2.7	----	----	1.8	----	----	0.12	0.03	----	----	0.1	----	----	----	0.2	0.4	----	0.2
Area S	3.0	----	0.3	----	----	1.6	4.2	----	0.8	0.2	----	1.9	0.3	----	----	----	----	2.4	----	0.4
Area W	0.77	----	0.3	----	----	2.5	----	----	----	0.2	----	0.5	0.07	0.2	----	----	0.2	0.06	----	0.04
N/O	0.1	----	0.4	----	----	0.9	----	----	----	----	---	----	0.2	----	----	----	----	0.1	----	0.4
E/O	1.5	----	2.4	-----	----	1.0	----	----	----	----	----	----	0.5	----	----	----	----	0.1	----	0.4
S/O	1.4	----	0.3	----	----	0.9	----	----	----	----	----	----	1.5	----	----	----	----	3.4	----	2.0
W/O	0.4	----	0.3	----	----	1.4	----	----	----	----	----	----	0.4	----	----	----	----	0.1	----	0.2

NOTES:

1. Concentrations are given in units of ug/M^3 unless otherwise noted.
2. "T" means toluene. "X" means xylene. "HC" means total C_4-C_7 hydrocarbons. "MC" means methyl chloroform.
3. LOD means limit of detection.
4. Arithmetic means were used. The value 0.0 was entered when a substance was analyzed, but not detected.
5. The category "overall" (O)includes Area N (N), Area E (E), Area S (S), Area W (W), Conveyor, Crusher, DEP, Tower, and Inciner.
6. %% See Appendix E for the Limits of Detection.

APPENDIX A

ANALYTICAL METHODS
TA 80-77
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

ANALYTE	COLLECTION MEDIA	ANAYLTICAL METHOD	REFERENCE
Arsenic	AA filter	Hydride Generation Graphite Furnace Atomic Absorption	18
Cyanides(Total)	AA filters 0.1 NaOH	Ion-Specific Electrodes	S-250[19]
Dioxins	Xylene	Gas Chromotography High Resolution Mass Spectrometry	20
Mercury	Silvered Chromosorb P Carbosieve B Membrane Filter	Flameless Atomic Absorption	P&CAM 175[19]
Metals (Except As and Hg)	AA filter	Inductively Coupled Plasma Atomic Emission Spectrometry	21
Organic Vapors	225-mg Charcoal Tube	Gas Chromatography Mass Spectrometry	23
PCBs	Florisil	Gas Chromatography Electron Capture	19
Pesticides	Glass Fiber Filters Silica Gel Tubes	Sequential Desorption with Solvents of Increasing Polarity Gas Chromatography with Multiple Detectors	22
Phenol	Glass Fiber Filters Silica Gel Tubes	Liquid Chromatography UV-Visible Detector	22

APPENDIX B

OCCUPATIONAL EXPOSURE EVALUATION CRITERIA
TA 80-77
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SUBSTANCE	ACGIH			NIOSH RECOMMENDED		OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	
	TWA	STEL	CODE	TWA	CEILING	TWA	NOTE
Alkanes C_5-C_8				350 mg/M^3			
Arsenic and its Compounds	0.2 mg/M^3						
Arsenic (Inorganic)				2 ug/M^3 15 Minutes		10 ug/M^3	
Cyanide as CN	5 mg/M^3		Skin			5 mg/M^3	Skin
Cyanide (HCN)	10 mg/M^3 Ceiling		Skin		5 mg/M^3	11 mg/M^3	
Lead (Inorganic Fumes and Dust)	15 mg/M^3	45 mg/M^3		0.1 mg/M^3		0.05 mg/M^3	
Mercury (Alkyl)	0.01 mg/M^3	0.03 mg/M^3	Skin		1 mg/M^3		
Mercury (Except Alkyl)	0.05 mg/M^3	0.15 mg/M^3			1 mg/M^3	1 mg/10M^3	
Mercury (Inorganic)				0.05 mg/M^3	1 mg/M^3		
Phenol	19 mg/M^3	38 mg/M^3	Skin	20 mg/M^3	60 mg/M^3 15 Minutes	19 mg/M^3	Skin
Polychlorobiphenyls				1 ug/M^3			
42% Chlorine	1 mg/M^3	2 mg/M^3	Skin			1 mg/M^3	Skin
54% Chlorine	0.5 mg/M^3	1 mg/M^3	Skin			5 mg/M^3	Skin
Toluene	375 mg/M^3	560 mg/M^3	Skin	375 mg/M^3		750 mg/M^3*	
Xylene	435 mg/M^3	655 mg/M^3	Skin			435 mg/M^3	

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

	ACCEPTABLE CEILING	ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTABLE CEILING	
		Concentration	Maximum Duration
Toluene	1125 mg/M^3	1875 mg/M^3	10 Minutes

APPENDIX C

TA 80-77
PERSONAL SAMPLES
MAY 9, 1980, TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	VOLUME (M^3)	LOD (Sample)	Al	As ng/M^3	Ca	CN TOTAL	Cr	Fe	HC mg/M^3	Hg ng/M^3	MC mg/M^3	Mg	Mn	Na	P	Pb	PCB mg/M^3	Sn	TOLUENE mg/M^3	XYLENE mg/M^3
Barrels	5/09	0.51	0.5ug	3.3		9.2		1.2	33.6				2.3		4.5	3.9					
Barrels	5/12	0.28	30ng															N.D.			
Barrels	5/13	0.05	**							6.0		1.2								3.6	1.5
Barrels	5/14	0.72	25ng		N.D.																
Barrels	5/14	0.04	**							N.D.		1.1								2.5	1.2
Barrels	5/15	0.71	0.5ug	4.0		10.1		1.0	18.2				1.6		0.5	1.0	0.6		0.5		

APPENDIX D

TA 80-77
AREA SAMPLES
MAY 9, 1980, TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	VOLUME (M^3)	LOD (Sample)	Al	As ng/M^3	Ca	CN TOTAL	Cr	Fe	HC mg/M^3	Hg ng/M^3	MC mg/M^3	Mg	Mn	Na	P	Pb	PCB mg/M^3	Sn	TOLUENE mg/M^3	XYLENE mg/M^3
Area N	5/09	0.70	0.5ug	0.4		0.7			2.4						8.9						
Area N	5/09	0.05	**							N.D.		N.D.								N.D.	N.D.
Area N	5/12	0.69	25ng		N.D.																
Area N	5/12	0.05	**							N.D.		N.D.								0.4	0.2
Area N	5/13	0.72	0.5ug			0.1			0.3												
Area N	5/14	0.71	25ng		N.D.																
Area N	5/14	0.05	**							N.D.		N.D.								N.D.	N.D.
Area N	5/15	0.80	0.5ug	0.5		0.8			2.0							0.1			0.5		
Area N	5/15	0.05	**							N.D.		N.D.								0.1	0.2
Area N	5/16	0.70	25ng		N.D.																
Area N	5/16	0.05	**							N.D.		N.D.								N.D.	N.D.
Area E	5/09	0.74	0.5ug	0.8		1.6			2.1												
Area E	5/09	0.05	**							N.D.		N.D.								0.3	0.2
Area E	5/12	0.65	25ng		N.D.																
Area E	5/12	0.04	**							N.D.		N.D.								0.2	0.1
Area E	5/13	0.72	0.5ug			0.1			0.3										0.6		
Area E	5/13	0.05	**							N.D.		N.D.								0.1	0.1
Area E	5/14	0.73	25ng		N.D.																
Area E	5/15	0.81	0.5ug	1.6		6.4			3.1				0.1			0.4					
Area E	5/15	0.05	**							N.D.		0.6								0.8	0.5
Area E	5/16	0.69	25ng		N.D.																
Area E	5/16	0.04	**							N.D.		N.D.								0.4	0.2
Area S	5/09	0.80	0.5ug	6.9		0.8			1.8				0.6		4.8	0.4					
Area S	5/12	0.04	**							5.8		N.D.								3.3	0.3
Area S	5/13	0.78	0.5ug	0.6					0.4						1.0	0.3					
Area S	5/13	0.04	**							7.4		0.8								3.7	0.3
Area S	5/14	0.68	25ng		N.D.																
Area S	5/14	0.05	**							5.7		1.4								3.2	0.3
Area S	5/15	0.76	0.5ug	1.6					2.5							0.1					
Area S	5/15	0.05	**							N.D.		N.D.								0.4	0.2
Area S	5/16	0.70	25ng		N.D.																
Area S	5/16	0.09	3ng								N.D.(E)										
Area S	5/16	0.09	3ng								N.D.(O)										
Area S	5/16	0.09	10ng								N.D.(P)										
Area S	5/16	0.04	**							2.1		2.0								1.4	0.8
Area S	5/19	0.28	3ng				N.D.														

SEE "NOTES", PAGE 30.

NOTES FOR APPENDICES C AND D

1. All concentrations are expressed in units of ug/M^3 unless otherwise noted.
2. * The value represents the mean of the range of values reported by the laboratory.
3. ** N.D. (Not Detected) is reported for values less than 100 ug/sample for the C_4-C_7 hydrocarbons (HC), less than 30 ug/sample for methyl chloroform (MC), and less than 2ug/sample for toluene and xylene. Other organic compounds were identified. These included chloroform, perchloroethylene, trichloroethylene, and benzene. Concentrations of these compounds were very small; less than 30ug of either trichloroethylene or perchloroethylene, and less than 8ug of benzene.[23]
4. ***Aroclor 1254 was identified.
5. Total CN means the total of measured particulate and gaseous cyanides.
6. (E) means elemental mercury, (O) means organic mercury, and (P) means particulate mercury.
7. LOD means limit of detection in units of weight per sample.

CORRELATION OF RESULTS WITH JOB DESCRIPTIONS
(See Page 3 of Text)

1. Samples from the location "barrels" estimate the exposures of manual drum handlers.
2. Samples from the location "bottles" estimate the exposures of personal protective equipment technicians who worked east of the DEP Building. They directly supported the manual drum handlers.
3. Samples from the location "decon" estimate exposures of equipment operators who mixed and applied decontamination solutions.
4. The sample from the location "F.E. Loader" estimates exposure to heavy equipment operators.
5. The samples from the location "Fork L" estimate exposure to equipment operators restaging barrels onto pallets.
6. The samples from the location "Vacuum T" estimate exposures to equipment operators siphoning pooled water into vacuum trucks and transferring the liquid into holding tanks.

CORRELATION OF AREA SAMPLES WITH SITE LOCATIONS
(See Figure 1)

1. The positions of locations "Area N," "Area E," "Area S," and "Area W" are shown in Figure 1.
2. The sample from the position marked "Conveyor" was collected under the bulk materials conveyor leading to the "tower" of the ready mix plant.
3. The samples from the position marked "Crusher" were collected on the barrel crusher.
4. The samples from the location "DEP" were collected inside the DEP administration building on site.
5. The samples from the location "Tower" were collected near the "tower" of the ready mix-plant.
6. The sample from the location "Inciner." was collected near the now demolished incinerator.

APPENDIX D (cont.)

TA 80-77
AREA SAMPLES
MAY 9, 1980, TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	VOLUME (M^3)	LOD (Sample)	Al	As ng/M^3	Ca	CN TOTAL	Cr	Fe	HC mg/M^3	Hg ng/M^3	MC mg/M^3	Mg	Mn	Na	P	Pb	PCB mg/M^3	Sn	TOLUENE mg/M^3	XYLENE mg/M^3
Area W	5/09	0.67	0.5ug	0.4		0.4			2.4						1.5						
Area W	5/09	0.04	**							N.D.		N.D.								N.D.	N.D.
Area W	5/12	0.05	**							N.D.		N.D.								0.3	0.2
Area W	5/13	0.72	0.5ug	0.6		0.3			0.6				0.7			0.1	0.7		0.6		
Area W	5/14	0.68	25ng		N.D.																
Area W	5/14	0.04	**							N.D.		N.D.								N.D.	N.D.
Area W	5/15	0.77	0.5ug	1.3		0.1			4.4							0.1					
Area W	5/15	0.05	**							N.D.		N.D.								N.D.	N.D.
Area W	5/16	0.68	25ng		N.D.																
Area W	5/16	0.04	**							N.D.		N.D.								N.D.	N.D.
Conveyor	5/15	0.40	3ng				N.D.														
Crusher	5/09	0.52	3ng				N.D.														
Crusher	5/12	0.75	25ng		N.D.																
Crusher	5/14	0.26	30ng															N.D.			
DEP	5/12	0.86	25ng		N.D.																
DEP	5/12	0.06	**							N.D.		N.D.								0.6	0.4
DEP	5/13	0.74	0.5ug	1.1		0.4		0.1	0.7						1.6	0.4	0.9				
DEP	5/13	0.50	3ng				N.D.														
Tower	5/16	0.09	50ng								N.D.(E)										
Tower	5/16	0.09	3ng								N.D.(O)										
Tower	5/16	0.09	10ng								N.D.(P)										
Inciner.	5/15	0.37	3ng				N.D.														

SEE "NOTES", PAGE 30.

APPENDIX E

TA 80-77
ADDITIONAL SAMPLES
MAY 9, 1980, TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	VOLUME (M^3)	LOD	Organochlorine Pesticides	Organosulfur Pesticides	Organophosphorus Pesticides	Organinitrogen Pesticides	Acid Herbicides	Phenol ug/M^3	Dioxin # ##
Barrels	5/09	0.37	****	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Barrels	5/15	0.51	****	N.D.	N.D.	N.D.	N.D.	N.D.	97.5	
Bottles	5/09	0.39	****	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Bottles	5/16	0.41	****	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Crusher	5/12	0.50	90pg							N.D.
Barrels	5/12	0.42	240pg							N.D.
DEP	5/13	0.51	70pg							N.D.
Inciner.	5/13	0.32	80pg							N.D.
Area S	5/14	0.36	160pg							N.D.
Conveyor	5/15	0.41	100pg							N.D.

NOTES:
1. # 2,3,7,8-TCDD
2. ## Because the collection media were cooled in an ice bath, only area samples were collected.

LIMITS OF DETECTION
FOR PESTICIDE ANALYSES
MAY 9, 1980, TO MAY 16, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

Collection Medium	Organochlorine Pesticides	Organosulfur Pesticides	Organophosphorus Pesticides	Organinitrogen Pesticides	Acid Herbicides	Phenol
Glass Fiber Filter	0.1 ug	20 ug	10 ug	2 ug	40 ug	5.4 ug
Silica Gel Tube	0.05 ug	10 ug	5 ug	1 ug	20 ug	5.4 ug

MERCURY VAPOR SCREENING
READY-MIX PLANT
MAY 11, 1980

Thirty recorded observations were made with a direct-reading mercury vapor meter at 20 foot north-south intervals along a line 25 feet east of the fence separating the ready-mix plant from Front Street. Twenty-six were negative. Four displayed slight meter movement. No quantative readings were obtained. Additional unrecorded observations were taken at 20 foot north-south intervals in lines parallel to the fence at successive 25 foot easterly intervals until the Arthur Kill was reached. All were negative.

APPENDIX F

TA 80-77
HEAVY EQUIPMENT OPERATOR SAMPLES
FOR CYANIDE
JUNE 29, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	SAMPLE VOLUME ¢	LOD	TOTAL CYANIDES	HYDROGEN CYANIDE ¢¢
Backhoe	6/29	0.59	3ug	N.D.	Trace
Dozer	6/29	0.55	3ug	N.D.	N.D.
Dozer	6/29	0.51	3ug	N.D.	N.D.
Dozer	6/29	0.54	3ug	N.D.	N.D.
Dozer	6/29	0.52	3ug	N.D.	N.S.
F.E.Loader	6/29	0.58	3ug	N.D.	N.D.
F.E.Loader	6/29	0.58	3ug	N.D.	N.D.
F.E.Loader	6/29	0.58	3ug	N.D.	N.D.
F.E.Loader	6/29	0.51	3ug	N.D.	N.D.
F.E.Loader	6/29	0.58	3ug	N.D.	N.S.
H.E.	6/29	0.58	3ug	N.D.	N.D.
H.E.	6/29	0.55	3ug	N.D.	N.S.

NOTES:
1. ¢ The sample volume given is for the AA filter/impinger train.
2. ¢¢ A long term direct reading indicator tube was used.
3. N.S. means not sampled with a direct reading indicator tube.
4. H.E. means unspecified pieces of heavy equipment.
5. The limit of detection for the long-term direct reading indicator tube was 1ppm.

APPENDIX G

TA 80-77
DIRECT READING INDICATOR TUBE
AREA SAMPLES
JUNE 29, 1980
CHEMICAL CONTROL
ELIZABETH, NEW JERSEY

SAMPLE LOCATION	DATE 1980	VOLUME (M^3)	LOD (Sample)	ACETIC ACID	AMMONIA	BENZENE	CHLORINE	HYDROCYANIC ACID	HYDROGEN CHLORIDE	HYDROGEN FLUROIDE	HYDROGEN SULFIDE	NITRIC ACID	PHOSGENE
Lab Pacs	6/29	#	5ppm	N.D.									
	6/29	#	5ppm		N.D.								
	6/29	#	0.5ppm			N.D.							
	6/29	#	0.2ppm				N.D.						
	6/29	#	2ppm					N.D.					
	6/29	#	1ppm						N.D.				
	6/29	#	1.5ppm							N.D.			
	6/29	#	1ppm								N.D.		
	6/29	#	1ppm									N.D.	
	6/29	#	0.04ppm										N.D.
Conveyor	6/29	#	5ppm	N.D.									
	6/29	#	5ppm		N.D.								
	6/29	#	0.5ppm			N.D.							
	6/29	#	0.2ppm				N.D.						
	6/29	#	2ppm					N.D.					
	6/29	#	1ppm						N.D.				
	6/29	#	1.5ppm							N.D.			
	6/29	#	1ppm								N.D.		
	6/29	#	1ppm									N.D.	
	6/29	#	0.04ppm										N.D.
Pit	6/29	#	5ppm	N.D.									
	6/29	#	5ppm		N.D.								
	6/29	#	0.5ppm			N.D.							
	6/29	#	0.2ppm				N.D.						
	6/29	#	2ppm					N.D.					
	6/29	#	1ppm						N.D.				
	6/29	#	1.5ppm							N.D.			
	6/29	#	1ppm								N.D.		
	6/29	#	1ppm									N.D.	
	6/29	#	0.04ppm										N.D.

NOTES:
1. #The number of pump strokes needed to obtain the maximum sensitivity for each tube was used.
2. The samples from the location "Lab Pacs" were collected directly south of the DEP Building.
3. The samples from the location "Conveyor" were collected under the bulk materials conveyor leading to the "tower" of the ready mix plant.
4. The samples from the location "Pit" were collected south and east of the "tower" of the ready mix plant.

ERRATA
TA 80-77-853
June 2, 1981

1. Page 7, Results and Discussion, Paragraph 3: Change "Group A (N=10)" to Group A (N=24). Change "Group B (N=21)" to Group B (N=23).

2. Page 12, Paragraph 2. Change references (11,16) to (11, 15).

3. Page 15. Change "X. AUTHORSHIP AND ACKNOWLEDGEMENTS" to IX. AUTHORSHIP AND ACKNOWLEDGEMENTS.

4. Page 17. Change "XI. DISTRIBUTION AND AVAILABILIY OF REPORT" to X. DISTRIBUTION AND AVAILABILITY OF REPORT.

5. Table 3. Change the LOD for MC from "$3X10^6$" to $3X10^4$.

   Enter the value 0.1 in the line "All Samples" under the column "PCB".

6. Table. 4. Underlined values have been changed.

	Al	Ca	MC	T	X
LOD ng/Sample			$3X10^4$		mg/M^3
Overall	1.2	0.9			
Area E	0.8				
E/O	0.6			0.6	1.0
S/O	2.5				
W/O	0.6				

7. Appendix F. The units for the column labeled sample volume are in M^3.