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CENTRAL LANDFILL HEALTH AND SAFETY PLAN

Prepared by:

Goldberg-Zoino & Associates, Inc. Providence, Rhode Island

> June 1987 File No. C-30027.8



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June 8, 1987 File No. C-30027.8

TO WHOM IT MAY CONCERN:

This document serves as a site specific health and safety plan for activities conducted by Goldberg-Zoino & Associates, Inc. (GZA) associated with the Central Landfill Remedial Investigation/ Feasibility Study (RI/FS).

It is recommended that all personnel participating in the project including contractors of the RISWMC adhere to the procedures set forth in this plan. GZA, however, accepts no responsibility with regard to unsafe conditions and/or practices other than for its own personnel. If in the event GZA identifies unsafe conditions, the Site Safety Coordinator will immediately notify the responsible parties representing RISWMC. GZA will present their evaluation of the conditions/practices and will make recommendations to rectify such conditions (including job shutdown).

The reader is advised that since the preparation of this initial health and safety plan in 1984, GZA has expanded its corporate health and safety training program to include 40 hours of comprehensive health and safety training. This program involves both classroom and field training and meets the current OSHA Health and Safety Compliance requirements set forth in 29 CFR Part 1910.

Very truly yours,

GOLDBERG-ZOINO & ASSOCIATES, INC.

⊅ohn P. Hartley

Project Manager/Site Safety Officer

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APPENDIX D
HEALTH AND SAFETY PLAN
(REVISED 6/8/87)

HEALTH AND SAFETY PLAN

CENTRAL LANDFILL SITE JOHNSTON, RHODE ISLAND

A. PURPOSE

The purpose of this plan is to establish personnel safety/protection standards and mandatory safety operating procedures relative to physical and chemical hazards encountered on the site, to establish contamination zones and decontamination procedures, and to provide for contingencies which may arise during the course of the site operations.

B. APPLICABILITY

The provisions of this safety plan are mandatory for all personnel who are permitted access to the site during subsurface explorations and sampling operations. This plan is also applicable to drilling operations in areas downgradient of the site where contaminated groundwater or soil is suspected. All GZA personnel and drilling subcontractors are required to read and adhere to all aspects of this plan.

C. RESPONSIBILITIES

Safety Officer

In accordance with the draft Chapter 9 of EPA's Occupational Health and Safety Manual, as ordered by Executive Order 12196: "The Safety Officer is responsible for implementing the safety plan at the site."

At the Central Landfill site, the Safety Officer shall:

- a) Monitor compliance of workers relative to preestablished personnel protection levels (i.e. use of necessary clothing and equipment) to ensure the safety of personnel. This includes subcontractor personnel.
- b) Notify the project manager of discrepancies or violations of safety plan.
- c) Evaluate weather and chemical hazard information, and recommend any necessary modifications to work plans and

personnel protection levels to maintain personnel safety. Cancel operations if adverse weather conditions preclude safe completion of tasks.

- d) Monitor the total volatile organic concentration in the breathing zone of the site personnel via a photo-ionizing detector (Hnu or equivalent). Also monitor the total volatile organic concentration at the downwind air monitoring station at the limit of the exclusion zone. A daily log of all HNu readings will be maintained by the site Safety Officer.
- e) Monitor the workers for heat stress and fatigue.
- f) Conduct daily safety briefing for all on-site personnel.
- g) Report daily to the corporate Health and Safety Officer.

The Safety Officer for this site will be John P. Hartleyof Goldberg-Zoino & Associates, Inc. (GZA). The alternate site Safety Officer will be Edward Summerly (GZA).

D. SITE INFORMATION

1. Location

The Central Landfill Site is located in the southwestern corner of Johnston, Rhode Island. (An area locus plan for the site is shown on Figure 1.)

2. Site Background

The Central Landfill/Rhode Island Solid Waste Management Corporation (CL/RISWMC) main entrance is located on the northern side of Shun Pike approximately 800 feet northeast of the intersection of Greenville Avenue with Shun Pike in Johnston. Land presently belonging to RISWMC occupies approximately 613.5 acres with Central Pike as its northernmost border and Shun Pike as its extreme southern limit. (The site boundaries are shown on Figure 2.)

In 1955, Sylvestri Brothers established the privately owned Johnston Sanitary Landfill. Unlike most sanitary landfills in Rhode Island, Sylvestri Brothers accepted refuse from other communities which had disposal problems within their borders. Until the change of ownership in 1980 to the RISWMC, the Sylvestri Brothers had accepted approximately five million tons

of municipal, commercial, and industrial solid waste, sludge, and hazardous waste. Throughout its 25-year ownership period, Sylvestri Brothers spread and compacted refuse, utilizing the area method. During the final 3 years (1976 - May 1979) of management, Sylvestri Brothers disposed of municipal sludge and hazardous waste materials within certain designated areas of the landfill.

The RISWMC now operates two separate areas at the Central Landfill: one area receives between 1500 and 2000 tons per day of solid waste, while the second area receives 225 tons per day of wastewater treatment plant (WWTP) sludge. This refuse is currently codisposed over a 134-acre site, and it is anticipated that future expansion will increase the total to 264 acres. At present, 27 of Rhode Island's 39 municipalities use the Johnston Landfill.

On the basis of recent inspections, the RI Department of Environmental Management (RI DEM) and the United States Environmental Protection Agency (US EPA) notified RISWMC of alleged violations of: 1) the rules and regulations for solid waste management facilities (RI DEM) and, 2) the rules and regulations for hazardous waste generation, transportation, treatment, storage, and disposal (US EPA).

This Health and Safety Plan is part of a proposal requirement designed to address the above mentioned alleged violations.

3. Site Control - Work Zones

In recognition of the level of activity currently underway in the active portion of the landfill, no attempt will be made to induce complete site security measures or restrict access to the site as a whole during the proposed subsurface operations at this site.

The restriction of unauthorized personnel and the control of contaminated materials generated during this phase of operations will be accomplished through the use of a dynamic exclusion zone. This exclusion zone is established as a circular area around the drilling rig with a radius of at least 50 feet from the location of the boring.

This dynamic exclusion zone shall move with the rig to each new boring location and be defined with high visibility barrier tape supported by grade stakes. Figure HS-3 illustrates the arrangement of this exclusion zone and the relative location of

the personnel decontamination area and the ambient air monitoring station.

4. Personnel Decontamination Area

Personnel decontamination shall occur in the area immediately outside of the access gates of the exclusion zone. Decontamination activities in this zone are described in Section F of this plan.

The decontamination area will feature a plastic lined open head (17H) drum for the containment of expendable materials such as Tyvek, spent respirator cartriages, and gloves. Two wash tubs will be located in this area for the washing and rinsing of boots and outer gloves.

A first aid kit, emergency eyewash, and a supply of drinking water will be located just outside (upwind) of the personnel decontamination area.

Water for washing and rinsing of gloves and boots will be drawn from the supply of water on the drilling truck. A stock of disposable coveralls, gloves, and other items will also be located in the personnel decontamination area.

All personnel entering or leaving the exclusion zone will be required to pass through the personnel decontamination area and either don or doff the appropriate level of personnel protection and effect the required decontamination procedures.

E. PERSONNEL PROTECTION

Personnel protective equipment and safety requirements must be appropriate to protect against the known or worst potential hazards on the site. Protective equipment should be selected based on the concentrations and possible routes of exposure to known or potential worst case substances. All GZA and subcontractor personnel engaged in work on-site will be participants in the GZA medical monitoring program (see Appendix B).

In recognition of the potential for encountering worst-case unknown material in the hazardous waste or sludge disposal areas, GZA has selected Level B Personnel protection for drilling to be performed in the zones of former landfill activities, i.e. borings WE 85-1, 2, 3, 4, and test pit excavations. The specific respiratory protection device for the level B protection shall be

the MSA Supplied Airline Respirator with Ultravue facemask. All other items of Level B protection are outlined in Appendix HS-A.

In areas outside the known disposal areas but contiguous to the landfill, i.e. borings WE 85-16, 17, and 16, level C protection will be employed. Whenever level C is in use, constant monitoring of the breathing zone of the workers utilizing a photoionizer will be effected. If the total volatile organic concentration (as indicated by the PID) in the breathing zone of the workers approaches 50 ppm, work shall cease and the crew will exit the exclusion zone to don level B protection.

At all remaining boring locations, level D protection will be employed. Whenever level D is in use, constant monitoring of the breathing zone of the workers utilizing a photoionizer will be effected. If the total volatile organic concentration (as indicated by the PID) in the breathing zone of the workers exceeds predetermined background, work shall cease and the crew will exit the exclusion zone to don level C protection.

It shall be the responsibility of the Site Safety Officer to continuously monitor the ambient air quality in the breathing zone of the workers. The Site Safety Officer is responsible for upgrading the level of personnel protection.

The specific respiratory protective device selected by GZA to be utilized for Level C protection is the MSA Ultratwin with GMC-H (464027) combination cartridges. The GMC-H cartridge is approved for Organic Vapors, Formaldehyde, HCL, SO2, Dusts, Fumes, Mists, Radionuclides, and asbestos. TC Approval Code #23C-154.

F. COMMUNICATIONS AND TRAINING

Primary communications between the drilling party and the landfill office shall be via two-way VHF radio. Backup warning signals will be relayed from either party by use of freon air horns. Four blasts of these horns shall signify emergency conditions.

In addition to conducting fit-testing of all members of the on-site working party on the initial day of operations, the Site Safety Office shall conduct a briefing of all personnel covering the following topics.

Nature of the hazards suspected to be present.

- 2. A description of the levels of personnel protection selected for this operation and the procedures for donning and decontamination from these levels.
- Emergency procedures in the event of fire, explosion and medical emergency.
- 4. Proper equipment decontamination procedures.
- 5. Description of and delineation of the site control procedures and the established work zones.
- 6. Forbidden practices in the exclusion and decontamination zones.

A daily briefing shall be conducted by the Site Safety Officer prior to the commencement of each day of operations. This briefing shall serve to reinforce the standard safety plan and operating procedures of the work party. Any deficiencies will be discussed and corrected during these briefings as well as an agenda of the anticipated events of the day.

A daily report by the Site Safety Officer shall be made to the Corporate Health and Safety Officer for the purposes of reviewing the events of the day, problems encountered and the agenda for the next day.

G. DECONTAMINATION PROCEDURES

1. Personnel Decontamination

Before exiting the former hazardous waste and sludge areas, all personnel are required to decon within the personnel decontamination area by means of the following procedure:

- a) Wash boots thoroughly with clean water to remove gross contaminants.
- b) Scrub down outer boots in decon solution and rinse with water.
- c) Remove boots.
- d) If wearing reusable raingear, it should be cleaned in a similar manner as the boots.

- e) Disposable Tyveks should be removed and placed in trash barrel located within the decontamination area.
- f) Spent cartridges can also be discarded in the trash barrel.
- g) Remove duter gloves and wash in same manner as boots while wearing disposable gloves.
- h) Use a new set of disposable gloves to clean additional equipment including hard hat, safety glasses, etc.
- i) Decontamination wash and rinse water will be allowed to percolate into the landfill.

2. Equipment Decontamination

- a) Decontamination of drilling equipment including drill rigs, backhoes, drill rods, augers, etc. will take place at the site of each boring/test pit prior to moving to subsequent locations. Decontamination of such equipment will entail a thorough washing and rinsing of the equipment with high pressure water followed by air drying. In addition, the tires and undercarriages of vehicles exiting the former hazardous waste and sludge areas will be sprayed with high pressure water and allowed to dry before leaving the former hazardous waste and sludge areas. Care will be taken to minimize the risk of decontamination runoff leaving the exclusion zone.
- b) High pressure wash water will be generated by a gas driven cold pressure wash pump.
- c) Sampling equipment such as bailers, pump intake hoses, etc. may be decontaminated within the personnel decontamination area provided that the equipment is thoroughly rinsed with clean water and allowed to air dry before leaving the hot zone.
- d) The rinse water from this operation will be allowed to percolate into the landfill.
- e) Contaminated soil brought to the surface during well installation activities with a TOV greater than 100 ppm as registered by the field Hnu will be contained in 55-gallon drums for removal to a secure landfill following completion of the project.

EMERGENCY PHONE NUMBERS

Rhode Island Hospital	277-4006
Roger Williams General Hospital	456-2002
St. Joseph Hospital	456-3000
Police	231-8100
Fire Department	274-1111
Rhode Island DEM	401/277- 2797
Ambulance	274-2279
USEPA	617 /565-5637

DIRECTIONS TO RHODE ISLAND HOSPITAL (SEE FIGURE HS-1):

From the Central Landfill Office (off Shun Pike), travel approximately 0.6 miles (east) to Scituate Avenue, then approximately 1.2 miles (east) to Simmonsville Road, Left turn (Northeast) approximately 0.2 miles to Route #5 (Atwood Avenue), then left turn (north) approximately 0.7 miles on Route #195 (east) for approximately 6 miles to the end of Route #195 and a set of lights. Turn left onto Pleasant Valley Parkway (north) and within 50 yards turn right onto West Exchange Street (east) and follow the signs to Route #95 (south), then right turn onto Route #95 for approximately 1.4 miles to the Allens Avenue Exit, right turn off the exit to Rhode Island Hospital.

Site Safety Officer

Alternate Site Safety Officer

John P. Hartley Goldberg-Zoino 140 Broadway Providence, R. I. 02903

Edward Summerly
Goldberg-Zoino
140 Broadway
Providence, R. I. 02903

tel.: 401 421-4140

Date of Plan Preparation

February 1, 1985

REVIEW OF PLAN

June 8, 1987

Health and Safety Officer: John P. Hartley

Associate in Charge: Michael A. Powers

Project Manager: John P. Hartley

EMERGENCY PROCEDURES

INHALATION

- 1. If these warning signals are apparent (dizziness, nausea, headache, shortness of breath, burning sensation in mouth, throat, or lung), the victim should leave the contaminated air space immediately.
- 2. If unconscious, the victim should be pulled out of the contaminated area immediately. Rescuers should make sure they are wearing proper respiratory and protective equipment before attempting the rescue.
- 3. If the victim is no longer breathing, mouth-to-mouth resuscitation or some other form of artificial respiration should begin immediately away from the contaminated area.

Medical attention should be obtained as soon as possible.

SKIN EXPOSURE

The skin should be washed with copious amounts of soap and water. If clothing is contaminated, it should be removed immediately and the skin washed thoroughly with running water. If a shower is available, it should be used immediately and clothes should be removed while showering. This procedure may be life-saving as certain highly toxic chemicals are rapidly absorbed through the skin.

All contaminated parts of the body, including the hair, should be thoroughly decontaminated. It may be necessary to wash repeatedly.

INGESTION

Vomiting should be induced except when the substance presents an aspiration hazard, such as from a petroleum product; or when the substance is a strong acid or alkali. To induce vomiting, a

tablespoon of salt or powdered mustard in a glass of warm water or syrup of ipecac from the First Aid kit can be taken as an emetic.

Drinking plenty of water and placing a finger down the throat may also be effective in inducing vomiting. The treatment should be repeated until vomitus is clear.

Medical attention should be obtained immediately.

EYES

If a toxicant should get into the eyes, they should be washed with plenty of water. The eye itself should be held open, rotated, and flooded with water so that all surfaces are washed thoroughly. Washing should be continued for at least 15 minutes.

Medical attention should be obtained immediately.

APPENDIX HS-B

MEDICAL MONITORING

APPENDIX HS-B MEDICAL MONITORING

All GZA personnel and subcontractors engaged in on-site activities shall be participants in the GZA Medical Monitoring Program. As participants in this program, these individuals will have had recent physical examinations. The GZA Medical Monitoring program is outlined below.

The primary goal of GZA's Medical Monitoring Program is to provide evaluation and ongoing surveillance of the health status of employees potentially exposed to toxic substances as a result of their work-related activities. GZA recognizes that an active health monitoring program for those employees potentially at risk is an important tool in evaluating the effects of chronic low-level exposures or acute exposures related to operations at hazardous waste sites. The effects of low-level exposures may not become apparent until years after the initial exposure.

The GZA Medical Monitoring Program is a comprehensive blend of laboratory testing, personnel medical history evaluation, physical examination, and specific systemic testing.

Each participant in the GZA Medical Monitoring program undergoes a complete occupational history evaluation, physical examination including the following parameters:

- Pulmonary Function Studies
- Complete Blood Count
- SMA 25 (Multiphasic Blood Chemistries)
- Urinalysis
- Chest X-Ray
- Electrocardiogram
- Vision Test
- Audiogram

Following the establishment of each participant's baseline values for the above parameters, an annual re-evaluation is conducted to monitor potential changes due to work with hazardous materials.

In addition to this annual re-examination, provisions are made for specific post-exposure examinations in the event of a suspected exposure during a particular field event.

This program meets and exceeds the minimum requirements established in OSHA standard 20 CFR 1910.1000.

APPENDIX HS-A
LEVELS OF PROTECTION

LEVELS OF PROTECTION

Level A

Level A protection should be worn when the highest available level of respiratory, skin, and eye contact protection is needed. While level A provides the maximum available protection, it does not protect against all possible airborne or splash hazards. For example, suit material may be rapidly permeable to certain chemicals in high air concentrations or heavy splashes.

Level B (Emergency)

Level B protection should be selected when the highest level of respiratory protection is needed, but exposure to the small unprotected areas of the body (i.e., neck and back of head) is unlikely, or where concentrations are known to be within acceptable exposure standards.

Level C (Normal)

Level C protection should be selected when the types and concentrations of respirable materials are known, have adequate warning properties, or are reasonably assumed to be not greater than the protection factors associated with air-purifying respirators; and exposure to the few unprotected areas of the body (i.e., neck and back of head) is unlikely to cause harm. Continuous monitoring of site and/or individuals should be established. Level C will be the minimum protection employed during drilling activities.

Level D

Level D is the basic work uniform and should be worn for all site operations. Level D protection should only be selected when working off-site, or when subsurface explorations and sampling operations are not being conducted.

I. Level A

- A. Personnel Protection Equipment
 - Positive pressure SCBA (OSHA/NIOSH approved) operated in the positive pressure mode.

- Totally encapsulating suit (boots and gloves attached).
- Gloves inner (tight-fitting and chemical-resistant).
- Boots chemical-protective, steel toe and snank.
 Depending on suit boot construction, worn over suit boot.
- Gloves outer, chemical-resistant. Depending on suit construction, worn over suit gloves. May be replaced with tight-fitting, chemical-resistant gloves worn inside suit gloves.
- Underwear cotton, "long-john" type (optional).
- Hard hat (under suit).
- Disposable protective suit, gloves, and boots. (Worn under or over encapsulating suit.)
- Coveralls (under suit).
- 2-way radio communications.

B. Criteria for Use

Use Level A:

- 1. When the type(s) and concentration(s) of toxic substances are known to require the highest level of combined protection to the respiratory tract, skin, and eyes. These conditions would be:
 - a. Atmospheres which are "immediately dangerous for life and health" (IDLH). IDLH's are detailed in the NIOSH/OSHA's "Pocket Guide to Chemical Hazards" and/or other references.
 - b. Known atmosphere or potential situations that would affect the skin or eyes, or could be absorbed into the body through these surfaces in toxic quantities.
 - Potential situations are those where vapors may be generated or splashing may occur through site activities.

- Standard reference books should be consulted to obtain concentrations hazardous to skin, eyes, or mucous membranes.
- Oxygen deficient atmospheres with above conditions.
- 2. At sites where the type(s) and/or potential concentration(s) of toxic substances are unknown.
 - a. Unless there is information available to strongly indicate otherwise, the site should be presumed to present hazards to the respiratory system, skin, and eyes. Level A protection would provide the highest level of protection for the initial entry team.
 - b. Enclosed areas such as building, railroad cars, ship holds, etc.
- When total vapor readings of 500 ppm to 1,000 ppm are obtained on instruments such as the photoionizer (HNU) or organic vapor analyzer (OVA).

It is not anticipated that work will be done under conditions requiring Level A protection. If such conditions are encountered, operations will cease immediately and all personnel will immediately leave the area until conditions improve.

II. Level B

- A. Personnel Protective Equipment
 - Positive pressure SCBA (OSHA/NIOSH approved), operated in the positive pressure mode.
 - Hooded, two-piece chemical-resistant suit.
 - Gloves outer, chemical-protective.
 - Gloves inner, tight-fitting, chemical-resistant.
 - Boots outer (chemical-protective, steel toe and shank).
 - 2-way radio communications.
 - Hard hat.

- Face shield (optional).
- B. Criteria for Use

Use Level B:

- When the type(s) and concentration(s) of hazardous substances are known and require the highest degree of respiratory protection; but a lower level of skin protection, i.e. in
 - a. Atmospheres which are "immediately dangerous to life and health" (IDLH). Type(s) and concentration(s) of vapors in air do not present a hazard to the small, unprotected areas of the body.
 - b. Atmospheres with concentrations of known substances greater than protection factors associated with full-face, "air purifying" respirators with appropriate cartridges.
 - c. Atmospheres with less than 19.5 percent oxygen.
- 2. When a determination is made that potential exposure to the body parts not protected by a fully encapsulated suit (primarily neck, ears, etc.) is highly unlikely.
- 3. Total vapor levels range from 50 ppm 500 ppm on instruments such as the photoionizer or organic vapor analyzer and the atmosphere does not contain suspected high levels of toxic substances affecting skin or eyes.
- Normal drilling and sampling operations will cease if conditions are such that level B protection would be required.

III. Level C

- A. Personnel Protective Equipment
 - Half-face, air-purifying respirator (OSHA/NIOSH approved).
 - Chemical-resistant clothing.

- Gloves outer (chemical protective).
- Gloves inner (tight-fitting, chemical-resistant type (or woven liners).
- Hard hat (face shield, optional).
- Boots outer (chemical-protective, steel toe and shank).
- Safety glasses.

B. Criteria for Use

- Site known to contain potentially hazardous materials resulting in air concentrations requiring a protection factor afforded by a full-face, air-purifying respirator (OSHA/NIOSH approved).
- Well-documented, reliable history of site and patterns of prior entry.
- 3. No evidence to suspect acute or chronic toxicity to exposed skin.
- 4. Total vapor reading between 0 ppm and 50 ppm on instruments such as the photoionizer and portable GC.

Continuous air or personnel monitoring should occur while wearing Level C protection.

IV. Level D

- A. Personnel Protective Equipment
 - Chemical-resistant clothing.
 - Boots/Shoes safety or chemical-resistant steel-toed boots.
 - Boots outer (chemical protective heavy rubber throw-away).
 - Half-face respirators immediately available.
 - Safety glasses or safety goggles.
 - Gloves.

B. Criteria for Use

- 1. No indication of airporne health hazards present.
- 2. No gross indication above background on the photoionizer and/or organic vapor analyzer.
- 3. Continuous air or personnel monitoring should occur while wearing Level D protection.

5. <u>Criteria for Establishing Levels of Protection in Unknown Environments</u>

When responding to an incident where the type(s) and concentration(s) of substances in the ambient atmosphere which are injurious to human health are unknown, a determination must first be made if it is necessary to have personnel enter the site (close proximity to the potential source of exposure). A requirement for on-site operations necessitates personnel to initially enter the site to characterize and define the hazardous environment that potentially exists.

The procedure for evaluating the toxic atmosphere that may be encountered includes the use of a decision logic for selecting respiratory protection equipment based on evaluating concentrations of known toxicants against safety factors associated with various types of personnel protective equipment. Until quantities and quantitative information are available for assessing the ambient atmosphere at a site, levels of protection based on gross measurements from portable instruments, i.e. organic vapor analysis (photoionizer, organic vapor analyzer, etc.) will be used.

If carcinogens or other highly toxic materials are suspected to be present, levels of protection should be determined on a case-by-case basis and not solely dependent on the preceding criteria.

RESPIRATORY FIT TESTING

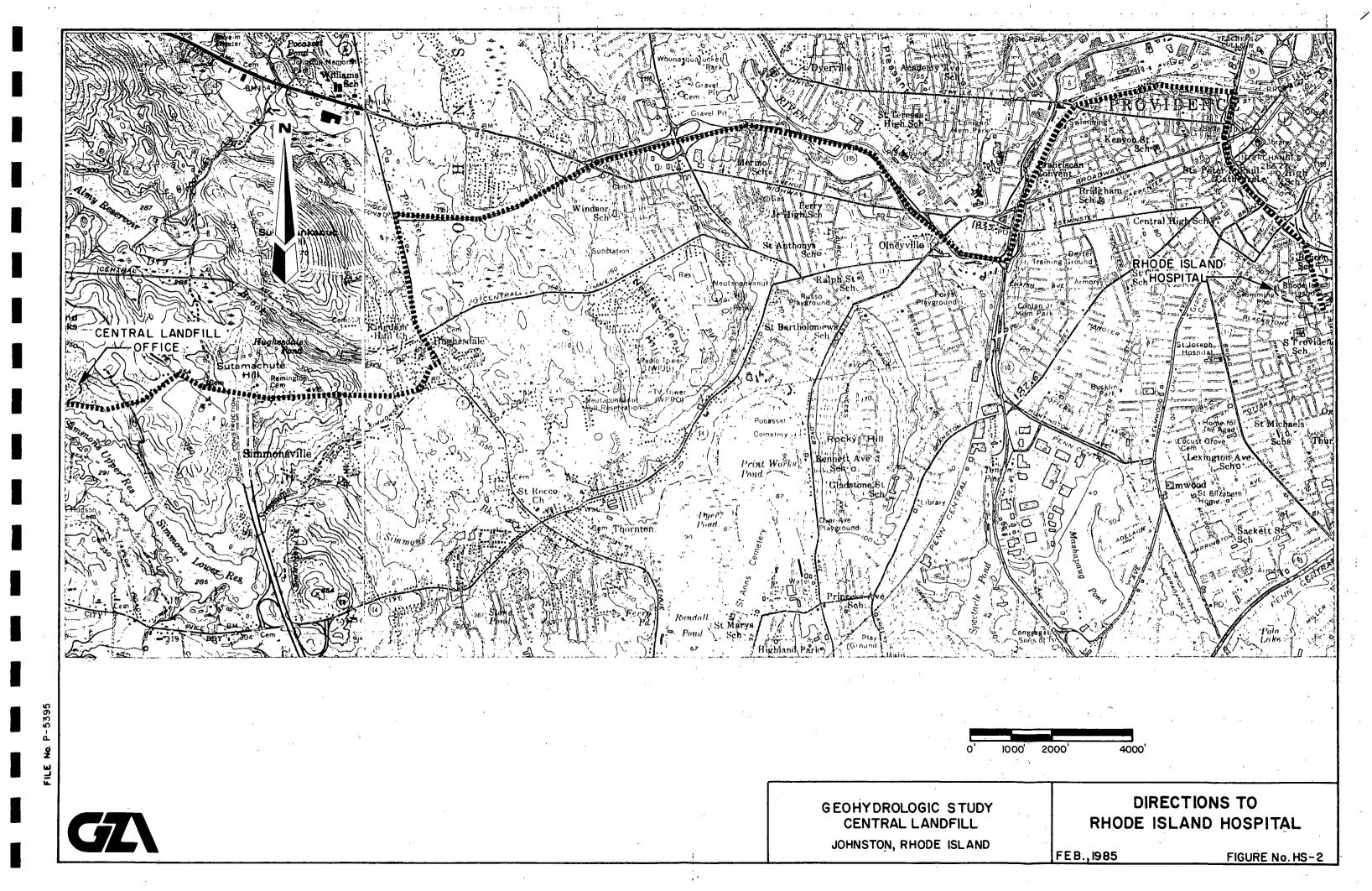
All personnel who will be entering the former hazardous waste and sludge areas during drilling or sampling operations will be required to have recently completed the respiratory fit test as outlined below. Retesting will be conducted as deemed necessary by the Safety Officer.

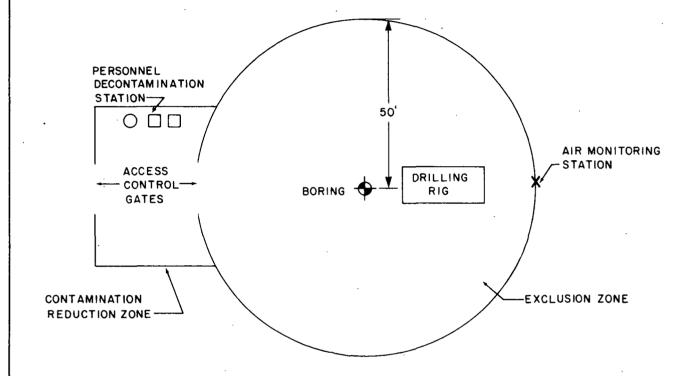
I. Suspend a plastic bag (open at bottom) and position personnel so the plastic bag fits over the head and shoulders of each individual.

NOTE: Prior to entering the test area each individual should don a respirator with proper cartriages.

- II. Once the individual is positioned inside the plastic bag, stannic chloride mist will be released within the plastic bag.
- III. Each individual will be asked to do the following:
 - A. To move the head from side to side.
 - B. To move the head back and forth.
 - C. To recite some of the alphabet.
 - D. To jog in place.
 - IV. If an individual can complete the above tasks without detecting the stannic chloride, a proper fit is indicated.

FIGURES





FILE No. P-5395

DRAWING NOT TO SCALE



GEOHYDROLOGIC STUDY CENTRAL LANDFILL JOHNSTON, RHODE ISLAND DYNAMIC EXCLUSION ZONE

FEB., 1985

FIGURE No. HS-3