HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

SECTION 1.0

1.0 INTRODUCTION

The personal health and safety of its employees, including any Quadrex contractors or subcontractors, is of particular concern to Quadrex management. Therefore, all prudent and reasonable measures will be taken to establish and maintain a working environment which is free from recognized hazards that are likely to cause illness or injury to any person.

This Health and Safety Plan (H&SP) identifies potential hazards associated with PCB projects, and the actions which will be taken to minimize these hazards (i.e., emergency controls, use of personal protective equipment, training, etc.).

Although every effort has been made to develop a Plan that is as comprehensive and detailed as possible, conditions may change once the project is initiated, and the Plan may require modifications. Modification of the Plan will be the responsibility of the Quadrex Project Manager. Substantial changes will be reviewed and approved by the Quadrex Health and Safety Officer.

This Health and Safety Plan identifies potential concerns that could affect the safety and well being of individuals and surroundings associated with PCB decontamination tasks. It is the responsibility of all personnel involved in these activities to understand and comply with the provisions of this Plan. Furthermore, each individual must observe safe working practices in order to protect all persons involved. The safety and well being of all project personnel and bystanders will be assured through a conscientious effort by everyone involved to observe this plan and to identify immediately to management any additional or unforeseen hazards which may need attention.

Polychlorinated biphenyls (PCBs) are a class of chemical substances which are non-polar chlorinated hydrocarbons in which chlorine atoms have replaced hydrogen atoms. This chlorine-for-hydrogen replacement may vary in both numbers and combinations. From 1957 to 1977 large quantities of PCBs were manufactured and widely distributed by Monsanto under the trade name Aroclor®. These products were named on the basis of their approximate percent by weights of chlorine in the compound. Numbers such as 1221, 1242, 1248, 1254 and 1260 were used to represent the various products. The physical and chemical properties of the individual compounds vary widely according to the degree and position of the chlorine atoms. The toxicity of the various individual compounds are similar, but their potencies increase with increasing chlorine substitution.

PCB compounds have low solubilities in water and extremely low vapor pressures, i.e., they do not dissolve or evaporate readily. Their thermal stability, nonflammability, and dielectric capabilities resulted in their use in electrical items and in mechanical equipment as a fire retardant lubricant. The trade name Askarel®

is used to refer to a broad class of these nonflammable, synthetic, chlorinated hydrocarbon insulating fluids.

In 1976, the Toxic Substance Control Act was enacted. This law gave the Environmental Protection Agency (EPA) authority to control the production and use of PCBs in the United States. As of January 1, 1978, the manufacture, processing, distribution, and the unauthorized use of PCBs were prohibited. In 1985, a final rule on the use of PCBs in electrical transformers was established. The law stated that after October 1, 1990, PCBs in certain transformers are prohibited.

PCB's once used as lubricating fluids in the compressors of air systems tended to migrate downstream, contaminating piping, tanks, and ancillary equipment. The EPA has indicated that such migration is considered a "spill" under 40CFR761. When the presence of PCBs above 50ppm is discovered, cleaning in accordance with EPA-approved spill cleanup policies is required in order that the use of these items is authorized by the PCB regulations. Quadrex has EPA-approved cleanup technology, and provides related services to its clients.

SECTION 2.0

2.0 PROJECT ORGANIZATION

The contract awarded Quadrex Environmental Company pursuant to its negotiations with Natural Gas Pipeline will be managed at the site by a Project Manager. Gerald Smith, Manager - Field Service Manager, will be responsible for administration of the contract.

Specific responsibilities of key members of the project organization are as follow:

2.0.1 Manager of Projects

The Field Service Manager, Gerald Smith, is responsible for the administrative and technical management of Quadrex pipeline decontamination projects. The Field Service Manager reports directly to the Corporate Director of Projects, Scott Kepler and the Vice President of Remediation, Mr. Robert Pitre. Mr. Smith will serve as the corporate contact throughout the project's duration. Mr. Smith has named Curtis Fort as Quadrex's Project Manager and The Health and Safety Officer, is Gerald Kolb and, in this capacity, Mr. Kolb will report to the Quadrex Health and Safety Officer.

2.0.2 Health and Safety Officer

The QEC Health and Safety Officer (HSO), Dennis Fleetwood, and his staff will be available to provide assistance to the Project Manager during the project. The HSO is responsible for monitoring all Quadrex projects to ensure compliance with applicable federal, state, and local health and safety regulations, techniques, procedures, and practices. The HSO and/or members of his staff will make periodic visits to the site during the project at the direction of the Field Service Manager or at his own discretion. Training and experience of the HSO are included in Appendix A.

2.0.3 Technicians

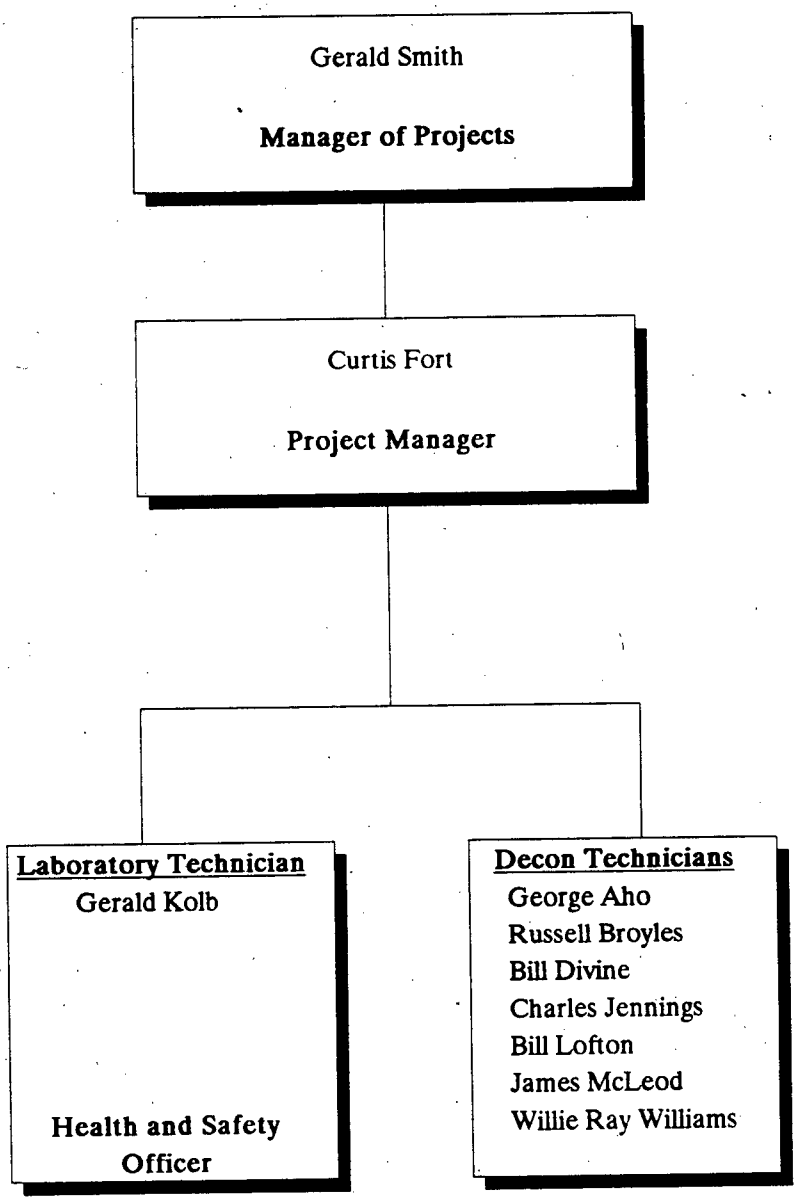
"Technician" includes decontamination technicians, pipefitters/welders, and lab technicians, who are responsible for performing decontamination activities. These people are experienced in air system decontamination techniques, and have been trained to follow safe work practices. Each is responsible for working in accordance with the project's Health and Safety Plan and the Project Plan, and each will take direction from the Project Manager.

2.0.4 Project Organization

An organization chart follows this section. Any changes to these assignments will be documented by a revised chart.

PROJECT ORGANIZATION

NATURAL GAS PIPELINE



SECTION 3.0

3.0 POTENTIAL HAZARDS

The most apparent hazards associated with PCB remediation projects include:

a. Electrical
b. Chemical
c. Standard Industrial

The safety and well being of all personnel are dependent on each individual's awareness of these respective hazards and his/her strict adherence to the related Health and Safety Practices or additional directions as specified by the Project Manager.

3.0.1 Electrical Hazards

A significant hazard associated with any field project is the potential for electrical shock. The decontamination vans and remote pump skids require line voltages as high as 480 vac, and the mobile laboratory 220 vac. Under routinely encountered conditions, these voltage levels can result in physical effects including painful or fatal shocks and burns, and arc flash eye damage. There are no biological effects associated with these electrical hazards. The Project Manager shall direct the connection of site power to the Quadrex equipment, and shall satisfy himself that temporary power feeds are properly insulated and/or barriered to prevent accidental personnel contact. No electrical work will be performed in terminal boxes or junction boxes without the Project Manager's cognizance and approval. The Project Manager will consult with the client's safety personnel during hookup of equipment; the Quadrex Health and Safety Officer will be contacted if questions exist as to electrical shock potentials on-site.

3.0.2 Chemical Hazards

Two chemicals will be present during PCB decontamination projects: polychlorinated biphenyls and 1,1,1 trichloroethane.

3.0.2.1 Effects of Exposure to PCBs

A. Physical Effects

PCBs present little or no physical hazard due to their thermally stable, non-reactive, non-flammable, and non-corrosive characteristics.

B. Biological Effects

PCBs are readily absorbed through the skin and lungs, and once absorbed remain in body tissues nearly indefinitely. PCBs may also cause chloracne (a skin rash), and some research has indicated that PCBs may cause liver damage, decreased fertility, and other reproductive problems. PCBs are also a suspected human carcinogen.

Biological incorporation or involvement with PCBs may cause definable effects, as described below.

1. Surface contact and/or absorption can occur on exposed areas including eyes, nasal and throat surfaces, and skin. Irritation may result to form reddening of the skin and chloracne type rash and eye irritation.

2. Ingestion and inhalation of PCB material can result in the distribution of varying quantities (percent) of the total amount ingested throughout the body. Both experimental and occupational exposure data show that PCBs predominantly incorporates in the liver and fatty tissue. Liver dysfunction or abnormalities could occur. Liver tumor development and fatty tissue degeneration have been identified as possible effects from overexposure to PCBs.

3.0.2.2 Effects of Exposure to 1,1,1 - Trichloroethane

The chemical 1,1,1-trichloroethane (also called methyl chloroform) is a versatile, all purpose solvent, popular with industry because of its powerful cleaning properties, low flammability, and low relative toxicity. It was introduced in the mid-1950's as a cold cleaning solvent substitute for carbon tetrachloride. Today, 1,1,1-trichloroethane is used primarily for vapor degreasing and cold cleaning of fabricated metal parts and other materials.

1,1,1-trichloroethane is a member of a family of saturated aliphatic halogenated hydrocarbons and has an odor threshold of approximately 100 ppm.

1,1,1 reacts violently with liquid and pure gaseous oxygen, sodium, and sodium hydroxide. 1,1,1 also reacts with and corrodes aluminum and aluminum alloys. The fluid is slightly flammable at very high temperatures. Inhibited (containing stabilizers) trichloroethanes have been found to have explosive limits, but ignition requires an extremely high energy source. Once the source is removed, the vapors will continue to burn.

A. Physical Effects

1,1,1 can cause severe eye irritation, and prolonged or repeated contact can cause moderate irritation, defatting, and dermatitis. Inhalation of 1,1,1 may cause the general sensation of dizziness, nausea, drowsiness, loss of consciousness, or even death. Excessive inhalation of vapors can cause nasal and respiratory irritation. Incoordination and impaired judgement may occur at vapor exposures of 500-1000 ppm. Acute inhalation may also cause changes to exposed tissue, but not permanent injury or cell death. 1,1,1 causes a proarrhythmic activity which sensitizes the heart to epinephrine induced arrhythmias. 1,1,1 may cause cardiac arrest when massively inhaled. Acute exposure produces a significant toxic effect in the form of a functional depression of the central nervous system leading to respiratory failure. Sensitive employees may experience anesthetic effects or drunkenness at 800-1000 ppm for short exposures. Exposure to concentrations of 2000 ppm and higher will readily produces anesthetic or narcotic effects. Ingestion can cause gastrointestinal irritation, nausea, vomiting, and diarrhea.

B. Biological Effects

Some research indicates that 1,1,1 chronic (long-term) exposures to 1000 ppm or greater results in fatty degeneration of the liver, kidney and lung damage, and growth depressions have been noted at 650 ppm. 1,1,1 is not presently classified as a carcinogen by OSHA.

3.0.2.3 Routes of Exposure

The most probable routes for biological incorporation of PCBs or either of the cleaning solvents arise from inhalation, eye or skin contact (absorption), and ingestion. In each instance, properly engineered techniques and procedures will be applied so as to minimize the possibility of exposure. When engineering and administrative controls are not feasible to achieve full compliance, protective equipment or other protective measures will be used to keep the exposure of employees to contaminants within the limits prescribed. Any equipment and technical measures used for this purpose must first be approved for each particular use by the Health and Safety Officer, Project Manager, or other technically qualified personnel.

3.0.3 Standard Industrial Hazards

Other hazards associated with the PCB Remediation projects can include trips and ankle twists, falls, head, eye and face injury hazards, the misuse of hand tools and ladders, back injuries, noise, fire, and explosion.

Quadrex will initiate and maintain a program of frequent and regular inspections of the job site materials and equipment to assure proper use and working order. The Project Manager will instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his/her work environment to control or minimize any hazards or other exposure to illness or injury. The use of any machinery, tool, material, or equipment which is not in compliance with any applicable requirement of 29 CFR Part 1926 is to be avoided.

3.0.4 Regulatory Guidelines

3.0.4.1 PCBs

The American Conference of Governmental Industrial Hygienists (ACGIH) has developed 8-hour time weighted average (TWA) concentrations on the basis of threshold limit values (TLVs). Based on the prevention of liver injury to exposed workers acceptable exposure concentration of 1 mg/m^3 for the 42% chlorine substitution and 0.5 mg/m^3 for the 54% chlorine

compound were recommended. The Occupational Safety and Health Administration (OSHA) issued permissible exposure limits (PEL) based on ACGIH recommendations. The Short Term Exposure Limits (STEL) for PCBs were set at 2 mg/m^3 and 1 mg/m^3 for the 42% and 54% products respectively. The OSHA PEL and ACGIH TLV and STEL values include a "skin" notation which refers to the potential contribution to overall exposure by the cutaneous route, i.e., through the mucous membranes, skin, and eyes by either airborne or direct skin contact with the PCBs.

The National Institution for Occupation Safety and Health (NIOSH) recommends that exposure to PCBs in the workplace be limited at or below a concentration of 1 $\mu g/m^3$ determined as a TWA for up to 10 hour workdays per 40 hour week. This recommendation was based on the findings of adverse reproductive and carcinogenic effects on laboratory animals, the potential of PCBs being a human carcinogen in the workplace, and on the conclusion that human and animal studies have not shown that human exposure to any level of PCBs would not subject the workers to possible liver injury. For the purpose of control by/and for Quadrex employees 0.5 mg/m^3 is to be considered the maximum permissible exposure limit. This limit is a TWA value, therefore the concentration in air, averaged over a work shift of up to 10 hours per day and up to 40 hours per week, cannot exceed 0.5 mg/m^3.

3.0.4.2 1,1,1 Trichloroethane

The American Conference of Governmental Industrial Hygienists (ACGIH) developed an 8-hour time weighted average (TWA) concentration on the basis of the threshold limit values (TLVs). Based on the prevention of injury to exposed workers, acceptable exposure concentration of 350 ppm is recommended. OSHA issued PEL's based on ACGIH recommendations. The STEL for 1,1,1 is 450 ppm. NIOSH has also published a vapor concentration which is immediately dangerous to life and health of 1000 ppm. For the purpose of control by/and for Quadrex employees, 350 ppm (TWA) is to be considered the maximum permissible exposure limit. As an administration guideline, the concentration in air

averaged over a work shift of up to 10 hours per day and up to 40 hours per week cannot exceed 250 ppm without respiratory protection for QHPS employees.

For the purpose of control by/and for Quadrex employees,both the published OSHA and ACGIH guidelines will be adhered to, provided no more stringent site specific requirements are promulgated by the Quadrex Health and Safety Officer.

SECTION 4.0

PREPARED BY: Ken Shamoda DATE: 3/25/92

APPROVED BY: Dennis L. Stewart DATE: 3/25/92

1.0 PURPOSE

In order to fulfill contract requirements, Quadrex Environmental Company requirements, or both, certain work efforts must be performed in accordance with formal, issued Health and Safety Plans (HSP). This Practice gives instructions for the applicability, generation, issue, and auditing of these plans.

2.0 SCOPE

- This Practice will be used whenever a responsible QEC party determines that a Health and Safety Plan is necessary for any work scope of any magnitude.

3.0 DEFINITIONS

HSP - Health and Safety Plan

4.0 RESPONSIBILITIES

Either the QEC Health and Safety Officer, the designated Project Manager, or any of their higher-tier management may specify that a Health and Safety Plan be prepared and issued for any project. The QEC Health and Safety Officer and the Corporate Quality Assurance Manager will determine audit requirements for Health and Safety Plans.

5.0 PROCEDURE

5.1 Contents

The Health and Safety Plan shall be issued in a three-ring tabbed binder, titled on its cover and spine, including appropriate Quadrex logos. A description of the HSP contents follows; sub-tabs may be used for ease of reference.

5.1.1 A *Title Sheet* shall be the cover page for each Health and Safety Plan; the sheet shall include "Health and Safety Plan" as the title, the project identification and

address, preparer identification, the month and year first issued, and the revision.

5.1.2 A *Table of Contents* shall follow the Title Sheet.

5.1.3 An *Introduction* section following the Title Sheet will present necessary background information. This section should briefly discuss reasons for the project and major health and safety issues to be addressed by the Plan. If appropriate, related customer health and safety concerns and procedures may also be *briefly* discussed. Note that repetition of parts of the Project Plan and its Procedures is unnecessary. Also, this section shall not include any mandatory requirements - these will be specified in the Health and Safety Practices section.

5.1.4 Next, a *Project Organization* section will include the current organization chart, together with a summary of the health and safety responsibilities of the key individuals. Key individuals will *always* include the technicians responsible for performing the work scope and their immediate supervisors. HSP responsibilities for technicians and supervisors are to follow safe work practices in accordance with the HSP and Project Plan.

5.1.5 A *Potential Hazards* section will discuss the most apparent hazards associated with the project. Each hazard will be reviewed separately to include description, physical effects, biological effects, routes of exposure, and regulatory guidelines.

5.1.6 *Health and Safety Practices* shall constitute the majority of the Plan. These Practices shall be chosen from QEC's library of documents, based on their applicability to the project.

5.1.7 *Appendices* may contain any useful information, such as reference procedures (*not* mandatory procedures), resumes, guidelines, excerpts from regulations or other published sources, Material Safety Data Sheets, addresses and telephone numbers, sample data sheets, etc.

5.2 Audits

The QEC Health and Safety Officer, or his designee, is responsible for determining the need for and auditing compliance with the Health and Safety Plan. At his option, Quadrex Corporation's Quality Assurance Manager or his designee is responsible for identical Corporate requirements.

6.0 REFERENCES

None

7.0 ATTACHMENTS

None

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Update to new format*	*3/24/92*

PREPARED BY: Ken Shoemaker DATE: 3/25/92
APPROVED BY: [signature] DATE: 3/25/92

1.0 PURPOSE

A major part of the implementation of Quadrex's Health and Safety Plan for any project consists of engineered controls. These engineering controls address work zone setup, hazard avoidance, personal protective equipment, material and equipment specifications, and work procedures, which, taken together, minimize risk of exposure. This Practice details those project engineered controls.

2.0 SCOPE

This Practice will be used whenever there are chemical or physical hazards present at the job site which must be controlled to prevent employee or environmental exposure.

3.0 DEFINITIONS

None

4.0 RESPONSIBILITIES

Each employee assigned to a project will be trained in the requirements of this procedure after which each employee is responsible for working in accordance with those requirements. The site manager is responsible for monitoring Quadrex employees under his direction for compliance with this Practice.

5.0 ENGINEERED CONTROLS

5.1 Controlled Area Access

Access to areas where decontamination is progressing or where work is being performed will be limited. Strict adherence to posted or oral supervisory instructions is necessary to help prevent injury and the spread of contaminants. Where spread of contamination is a possibility, three zones are established for controlling project access. The boundary of the first zone is the fenced boundary of the job site, and access will be restricted by the client. A Contamination Reduction Zone (CRZ) within the

first zone provides a transition area to the Work Area Exclusion Zone (WAEZ). These latter two zones will be clearly identified with Hazard and/or Warning tape and "Caution (material)" signs to restrict access. All remediation activities will occur inside the Exclusion and Contamination Reduction Zones. Each person is to observe zone entrance and egress provisions, and if any questions arise, the site manager is responsible for clarification.

5.1.1 Work Area Exclusion Zone

Only those persons actually dressed out in full protective clothing (Kit C, See HSP-004) and authorized by the organization chart or the Site Manager to be present will be allowed in the Work Area Exclusion Zone (WAEZ). This zone will be established to include protective floor or ground covering, where appropriate, and ropes and/or tape to delineate its boundaries. Associated with this WAEZ will be a control point and container (or bag) and open top drum to allow removal and packaging of grossly contaminated garments. Removal of outer garments is required to prevent contamination spread from the WAEZ. Clean replacement garments (coveralls, booties, etc.) will be available at the control point to allow movement into the WAEZ. The WAEZ will be the immediate work area. The WAEZ will have dimensions which will allow the placement of all supporting materials and equipment. Where berms are required (see HSP-005), they will be constructed of a 2'x4' wood or PVC frame covered with one or two layers of chemical resistant plastic, which are taped at the seams. The WAEZ will be separated from the CRZ by the use of a step-off pad. Ingress and egress will be through a control point in the CRZ delineated by this step-off pad and a roped-off corridor.

5.1.2 Contamination Reduction Zone

This zone consists of an area adjacent to the WAEZ which contains the WAEZ entrance control point. The CRZ will be marked with tapes, barricades, and rope at the site manager's discretion. The CRZ entrance control point will be established (step-off pad) to allow removal of contaminated garments. Bags or other containers in the CRZ will be provided to store materials and equipment designated for reuse or reclamation. Only those persons donned in the protective gear described in Kit B (see HSP-004) will be allowed to enter the CRZ.

5.1.3 Ingress / Egress

Specific entry and exit (control) points will be clearly identified at the perimeter of the CRZ and WAEZ. These control points will consist of a roped off area, a step-off pad, and an "Authorized Personnel Only" sign. No person shall be permitted to enter a controlled area (WAEZ or CRZ) without proper personnel protection commensurate with the type of hazard present. Protective clothing to be donned prior to entry into the controlled zones are described in HSP-004 of this Health and Safety Plan. Sufficient protective clothing will be available for all Quadrex Environmental Company workers. Protective clothing will be made available for others who require entrance to a controlled area for inspection purposes per contractual agreements.

Exit from a controlled zone shall only occur at the control points, except in emergency situations where such exit is not practical. Care must be taken to prevent spread of contaminants; additional containment or decontamination may be required. All contaminated protective clothing must be placed in the proper receptacles when exiting the controlled area prior to stepping on the step-off pad. Contaminated protective clothing will not be worn in an unrestricted area.

5.1.4 Visitor Access

Persons other than Quadrex employees or associated project personnel will be classified as visitors to the area. Since the full hazard conditions are not usually known by visitors, it is necessary for the safety and well being of all that any person visiting the Quadrex work site notify the site manager. Visitors may be required to don protective clothing prior to entry and be escorted to prevent unnecessary risks. Some areas adjacent to the controlled zone may be accessible with lesser protective criteria if the person is present for observation purposes only.

5.2 Electrical

To minimize or reduce exposure to potential electrical hazards associated with remediation projects, the following engineered controls will be reviewed with personnel and implemented by the site manager.

A. Extension cords used shall be the 3-wire type, shall be protected from damage, and shall not be fastened with staples, hung from nails, or suspended from wires. Splices shall have soldered wire connections with insulation equal to the cable. Worn or frayed cables shall not be used.

B. Except where deeply recessed in the reflector, bulbs on temporary lights will be equipped with guards. Temporary lights will not be suspended by their electric cords unless designed for suspension.

C. Where different voltages, frequencies, or types of current are supplied, receptacles shall be of such design that attachment plugs are not interchangeable.

D. Each disconnecting means for motors and appliances and each service feeder or branch circuit at the point where it originates shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident.

E. Cables passing through work areas will be covered or elevated to protect them from damage which would create a hazard to employees.

F. Boxes for disconnecting means will be securely and rigidly fastened to the surfaces upon which they are mounted and fitted with covers.

G. No employee is to perform work in the proximity of any part of an electric power circuit that he/she may contact in the course of his/her work, unless the employee is protected against electric shock by de-energizing the circuit and grounding it or by guarding it by effective insulation or other means.

H. For 15 and 20 ampere receptacle outlets on a single-phase, and/or 120 volt circuits for sites which are not a part of the permanent wiring of the building or structure, Quadrex will use either ground-fault circuit interrupters or institute an assured equipment grounding conductor program for employee protection which is outlined as follows:

- Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, will be inspected before use for external defects and possible internal damage.

- The noncurrent-carrying metal parts of fixed, portable and plug-connected equipment shall be grounded. Portable tools and appliances protected by an approved system of double insulation need not be grounded.

- The path from circuits, equipment, structures, and conduit or enclosures to ground shall be permanent and continuous and have ample carrying capacity for the purpose. Only qualified personnel will perform electrical connections to or from Quadrex owned equipment.

5.3 Chemical

To minimize or reduce exposure to potential chemical hazards associated with remediation projects, the following engineering controls will be reviewed with personnel and implemented by the site manager.

A. Employees will conduct work in a timely and efficient manner so as to reduce their exposure potentials;

B. Employees will not loiter in the WAEZ zone when work is complete;

C. Employees shall not be permitted to eat, drink, or smoke in the WAEZ, decon van, CRZ, or other areas designated by the site manager;

D. Drum closures will be replaced and securely fastened immediately upon completion of waste packaging;

E. Fluid storage containers will not be stacked unless on pallets constructed for stacking;

F. Employees shall be trained as to the hazards presented by chemicals present in the decontamination project. Such training shall be evidenced in accordance with HSP-003; and

G. Methods of moving, transporting, or transferring chemicals shall be in accordancwwith the requirements of HSP-005 and HSP-006.

5.4 Eye and Face Protection

Quadrex equipment is engineered to minimize potential eye or face injuries. In addition, any Quadrex employee working in the WAEZ or performing fluid transfer tasks will be required to wear chemical resistant, splash proof goggles.

5.5 Fire and Explosion

A. No burning of debris or open fires, including open drum or barrel fires, is permitted. The client's requirements for fire protection will be rigorously followed, particularly those associated with temporary area heating.

B. Fire fighting equipment shall be conspicuously located and readily accessible at all times, shall be periodically inspected, and shall be maintained in operating condition.

C. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.

D. At least one (1) dry chemical fire extinguisher, UL rated not less than 10ABC, will be provided at the exit of each mobile unit.

E. No explosive material will be stored by QEC at the remediation project site. Flammable liquids will be stored in appropriate safety cabinets or storage areas.

5.6 Hand Tools

A. All hand tools will be inspected prior to use. Tools found to be unsafe shall not be used.

B. Wrenches shall not be used when jaws are sprung to the point that slippage occurs. Impact tools shall be kept free of mushroomed heads. The wooden handles of tools shall be kept free of splinters or cracks and shall be attached tightly to the tool.

C. Electric power operated tools shall either be approved double-insulated, be properly grounded, or used with ground fault circuit interrupters.

5.7 Head Injury Prevention

Prior to initiating the project, the site manager will tour the work area and identify potential sources of head impact, flying or falling objects, and items which could produce overhead hazards. The site manager is responsible for identifying sources of potential head injuries to all personnel in the area and will identify those areas where personnel will be required to wear hard hats. In the absence of specific instructions, hard hats will always be worn inside the fenced boundaries of the job site except in the client's offices or QEC's office trailers.

5.8 Noise

Quadrex maintains a hearing conservation program which includes an annual audiometric testing for employees involved. The program is used to evaluate and document employee noise exposure and to assure compliance with OSHA noise regulations 29 CFR 1926.52 and 29 CFR 1910.95.

A. Noise sources will be located away from the immediate work area whenever possible.

B. Employees will conduct work in a timely and efficient manner so as to reduce their exposure duration.

C. Extremely loud equipment will be insulated where possible.

D. Devices emitting impulsive or impact noise exceeding 140 decibels (dB) peak sound pressure level will be labeled to communicate the potential hazard to employees.

F. The site manager will use what data the customer has on the site sound levels to determine the need for hearing protection. If no information is available, the site manager will consult with the Health and Safety Officer.

5.9 Ladders

A. Except where either permanent or temporary stairways, permanent or temporary scaffolding, or suitable ramps or runways are provided, ladders shall be used to give safe access to all elevations.

B. The use of ladders with broken or missing rungs or steps, broken or split side rails, or with other faulty or defective construction by Quadrex employees is prohibited. When ladders with such defects are discovered, they shall immediately be withdrawn from service.

C. Portable ladders shall be placed on a substantial base at a 4-1 pitch, have clear access at top and bottom, extend a minimum of 36 inches above the landing or otherwise be provided with grab rails and be secured against movement while in use.

D. Ladders shall be used only as intended by the manufacturer.

5.10 Material Hoists

A. Quadrex will comply with the manufacturer's specifications and limitations of all material hoists and handling devices.

B. Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be reviewed with project personnel.

C. All material hoists shall conform to the requirements of ANSI A10.5-1981, *"Safety Requirements for Material Hoists."*

D. Personnel hoists will be used by Quadrex employees only under the direction of the Quadrex Health and Safety Officer.

5.11 Power Transmission, Mechanical

Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains or other reciprocating, rotating, or moving parts of equipment shall be guarded if such parts are exposed to contact by employees or otherwise constitute a hazard. Guarding shall meet the requirements of ASME B15.1-1984, *"Safety Code for Mechanical Power Transmission Apparatus."*

5.12 Floor Openings, Elevated Floors, and Runways

A. Floor openings shall be guarded by a standard railing and toeboards or cover. In general, the railing shall be provided on all exposed sides, except at entrances to stairways.

B. Every open-sided floor or platform 6 feet or more above adjacent floor or ground level shall be guarded by a standard railing, or the equivalent, on all open sides except where there is entrance to a ramp, stairway, or fixed ladder.

C. Runways 4 feet or more high shall have standard railings on all open sides, except runways 18 inches or more wide used exclusively for special purposes may have railing on one side omitted where operating conditions necessitate.

5.13 Scaffolds (General)

A. Scaffolds will be erected on sound, rigid footing, capable of carrying the maximum intended load without settling or displacement.

B. Scaffolds and their components will be capable of supporting, without failure, at least 4 times the maximum intended load.

C. Guardrails and toeboards will be installed on all open sides and ends of platforms more than 10 feet above the ground or floor. Scaffolds 4 feet to 10 feet in height, having a minimum dimension in either direction of less than 45 inches, will have standard guardrails installed on all open sides and ends of the platform.

D. There will be a screen with maximum 1/2 inch openings between the toeboard and the guardrail where the persons are required to work or pass under the scaffold.

E. All planking shall be Scaffold Grade or equivalent as recognized by approved grading rules for the species of wood use. The maximum permissible spans for 2 x 10 inches or wider planks are shown in the following table:

MATERIAL

	Full Thickness Undress Lumber (2")			Nominal Thickness Lumber (1 1/2")	
Working Load (p.s.f.).....	25	50	75	25	50
Permissible Span (ft.).....	10	8	6	8	6

The maximum permissible span for 1-1/4 x 9 inch or wider plank of full thickness is 4 feet, with medium loading of 50 p.s.f.

F. Scaffold planking shall be overlapped a minimum of 12 inches or secured from movement.

5.14 Housekeeping

A. Form and scrap lumber with protruding nails and all other debris will be kept clear from all work areas.

B. Combustible scrap and debris must be removed at regular intervals.

5.15 Back Injury Protection

Three factors have been identified as contributors to the risk of a back injury and are thus potentially hazardous to a worker's lower back when lifting a load. These factors are:

1. Weight of the load;

2. The location (position of the load's center of gravity with respect to the worker); and

3. The frequency of the lift.

There is a great variability in the risk of injury and the lifting performance of an individual. Thus it is important for each individual to develop good work practices for manual lifting tasks. The following guidelines are established to guide employees on the correct procedure for manual lifting. All employees should include these practices in their daily work tasks which involve manual lifting.

5.15.1 Environmental Conditions to be Considered

1. Floor conditions
2. Static posture
3. Reaching
4. Side bending
5. Position of load and posture
6. Twisting
7. Hurrying

5.15.2 Factors to be Considered Prior to Making a Lift

1. The horizontal location of the load with respect to the body.
2. The vertical location of the load at the origin of the lift.
3. The vertical distance between the load origin and the destination of the lift.
4. The frequency of the lift.

5.15.3 Controls to Reduce the Risk of Back Injury

1. Warm up before performing a lift.
2. Minimize the frequency of lifting.
3. Adjust the horizontal and vertical load distance from the body.
4. Consider load location, start/end relationship, floor condition, and body posture.
5. Store heavy objects at waist height if possible.
6. Minimize the distance from the body.
7. Assure a good, comfortable grasp - use gloves if necessary to prevent slipping or injury.
8. Lift from the front - not the side.

9. Adjust visual environment - make sure sight is unimpaired.

10. Temperatures inside the 60°F - 70°F range decrease the risk of injury. Therefore, if practical, schedule lifts during moderate temperatures.

11. Use two (2) persons when lifting over 40 pounds.

12. Use mechanical lifting/material handling aids for large, bulky items particularly items weighing over 100 pounds.

5.15.4 Lifting Recommendations

1. Keep loads close to the body.

2. Avoid simultaneous lifting and twisting.

3. Avoid awkward lifts.

4. Avoid rapid, jerky motions during lifting.

5. Minimize lifting objects from the floor.

6. Minimize pushing or pulling loads during the lift.

7. Lift with a straight back.

5.16 Heat Stress

Nearly all acclimated fully clothed workers with adequate water and salt intake should be able to function effectively, without adverse health effects.

All breaks, including unscheduled pauses and administrative or operational waiting periods during work, may be counted as rest time when additional rest allowance must be given because of high environmental temperatures.

5.16.1 Water and Salt Supplementation

During the hot seasons or when the worker is exposed to artificially generated heat, drinking water should be made available to the workers in such a way that they are stimulated to frequently drink small amounts, i.e., one cup every 15-20 minutes

(about 150 ml or 1/4 pint). The water should be kept reasonably cool (10°-15°C or 50.0°-60.0°F).

Alternately, Gator Ade or an equivalent product may be substituted for drinking water.

5.16.2 Other Considerations

A. *Clothing:* If special clothing is required for performing a particular job, and this clothing is heavier than normal clothing, or it impedes sweat evaporation or has higher insulation value (Chemrel™), the worker's heat tolerance is reduced. For each job category where special clothing is required, the permissible heat exposure limit will be established by the individuals tolerance.

B. *Acclimatization and Fitness:* Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during his/her first week of exposure to hot environmental conditions. Extra caution must be employed when unacclimated or physically un-fit workers must be exposed to heat stress conditions.

5.17 Cold Stress

5.17.1 Introduction to Cold Stress

Fatal exposures to cold among workmen have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. Employees should be protected from exposure to cold so that the deep core temperature does not fall below 36°C (96.8°F); lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision making or loss of consciousness with the threat of fatal consequences.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 35°C (95°F). This must be taken as a sign of danger to the employee and

exposure to cold should be immediately terminated for any employee when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Since prolonged exposure to cold air or to immersion in cold water at temperatures well above freezing can lead to dangerous hypothermia, whole body protection will be provided by Quadrex.

Adequate insulating clothing to maintain core temperatures above 36°C will be provided to workers if work is performed in air temperatures below 4°C (40°F). Wind chill, or the cooling power of the air, is a critical factor. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

Unless there are unusual or extenuating circumstances cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions which should be considered. The precautionary actions to be taken will depend upon the physical condition of the worker and will be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

5.17.2 Evaluation and Control

For exposed skin, continuous exposure is not permitted when the wind speed and temperature results in an equivalent chill temperature of -32°C (-25°F). Superficial or deep local tissue freezing will occur only at temperatures below -1°C regardless of wind speed.

At air temperatures of 2°C (35.6°F) or less it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing and be treated for hypothermia.

Special protection for the hands is required to maintain manual dexterity for the prevention of accidents.

If fine work is to be performed with bare hands for more than 10-20 minutes in an environment below 16°C (60°F), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars will be covered by thermal insulating material at temperatures below -1°C (30°F).

If the air temperature falls below 16°C (60°F) for sedentary, 4°C (40 °F) for light, and -7°C (20°F) for moderate work and fine manual dexterity is not required, then gloves shall be used by the workers.

To prevent contact frostbite, workers should wear anti-contact gloves.

When cold surfaces below -7°C (20°F) are within reach, a warning should be given to each worker by his/her supervisor to prevent inadvertent contact by bare skin.

If the air temperature is -17.5°C (0°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection is required if work is performed in an environment at or below 4°C (40°F). The workers shall wear cold protective clothing appropriate for the level of cold and physical activity.

5.17.3 Workplace Monitoring

Thermometry will be arranged at any workplace where the environmental temperature is below 40°F.

Employees shall be excluded from work in cold at -1°C (30°F) or below if they are suffering from diseases or taking medication which interferes with normal body temperature regulation or reduces tolerance to work in cold environments.

5.17.4 Temporary Heating Devices

Quadrex will operate all temporary heating devices in accordance with the manufacturers' instructions and the client's safety practices. In addition, heaters will only be operated in areas where fresh air is in sufficient quantity to maintain the health and safety of Quadrex employees. Solid fuel salamander heaters will not be used by Quadrex in enclosed buildings or on scaffolds.

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Update to comply with changes in OSHA Regulations; Update ANSI standards.*	*3/24/92*

5.0 PROCEDURE

5.1 General Training

All Quadrex employees assigned to projects involving hazardous materials will complete the following training program:

- Respiratory protection;
- Hazard communication training specific for the hazardous materials involved;
- Hazardous materials handling, transport, and packaging;
- Emergency response;
- Spill prevention and control; and
- Hearing conversation.

If the project falls under the scope of 29CFR1910.120 (Hazardous Waste Operations & Emergency Response), all employees working on the project will receive 40 hours of training, which at a minimum will include:

- Names of personnel and alternates responsible for site safety & health;
- Use of Personal Protective Equipment (PPE);
- Work practices by which the employee can minimize risks from hazards;
- Safe use of engineering controls and equipment on the site;
- Medical surveillance requirements;
- Symptoms and signs of overexposure to hazards;
- Decontamination procedures;
- Emergency response plans;
- Confined space entry procedures; and
- Spill containment programs.

These employees will also receive 8 hours annual refresher training.

All topics mentioned in the top half of this section are covered in the 40 hour training.

5.2 Project Manager Training

All project managers responsible for projects involving hazardous materials will receive the same training prescribed in section 5.1. If the project falls under the scope of 29CFR1910.120, the manager will receive an additional 8 hours of training which will include but is not limited to:

- Site specific safety & health plans;
- Employee training program;
- Personal protective equipment program;
- Spill containment program; and
- Health hazard monitoring procedure and techniques.

5.3 Site Specific Training; - Pre-Project

Prior to commencement of on-site activities, the Quadrex project manager, or delegate, will provide site specific training to all individuals who will be involved in the project and subject to exposure to hazardous materials (i.e., Quadrex employees, contractors, or subcontractors). The program will cover all health and safety aspects of the project and will include:

- Review of the project's Health and Safety Plan;
- Basic operational safety, emphasizing the hazards expected on the site;
- Explanation of the designated work areas;
- A review of the MSDS's for the hazardous materials that will be encountered;
- Requirements for personal protective equipment;
- Explanation of the buddy system;
- The locations of all emergency equipment;
- Decontamination procedures for personnel and equipment and the importance of preventing migration of pollutants;
- Where and how to exit and enter from every area;
- Assembly area in case of emergency;
- Organization responsibilities and chain of command;
- Security procedures; this will include employee I.D. system and check-in and check-out procedures, if required; and
- Client safety requirements not included above.

5.4 Site Specific Training; Daily Training

Prior to the start-up of each on-site work day, the site manager will review any changes or modifications to the Health and Safety Plan, describe the assigned tasks for the day, and identify their potential hazards. This meeting shall also be used to obtain feedback on health and safety conditions.

5.5 Records

Quadrex will keep a record (date, subjects discussed, attendees, etc.) of all training sessions and document all training. Certificates of completion for the forty hour class, the additional 8 hour supervisor training, and any other training are on file for all Quadrex employees and are available for review in accordance with applicable regulations.

6.0 REFERENCES

None

7.0 ATTACHMENTS

None

TITLE: TRAINING

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Update to comply with 1910.120*	*3/24/92*

PREPARED BY: Ken Shoemake DATE: 3/25/92
APPROVED BY: Dave L. Thurwood DATE: 3/25/92

1.0 PURPOSE

Quadrex projects require various personal protective clothing and equipment; this Practice discusses types of protective devices and their applications.

2.0 SCOPE

This Practice applies to all Quadrex projects.

3.0 DEFINITIONS

HSO - Quadrex Health & Safety Officer
WAEZ - Work Area Exclusion Zone
CRZ - Contamination Reduction Zone

4.0 RESPONSIBILITIES

The Quadrex site manager is responsible for on-site instructions concerning protective clothing application and monitoring in accordance with this Practice. The Quadrex Health and Safety Officer is responsible for interpreting this Practice, and for providing revisions to reflect current regulatory and QEC requirements.

5.0 PROCEDURE

Protective clothing, including safety glasses, long pants, leather steel toed shoes or boots with non-conductive soles, and a comfortable shirt (short or long sleeved) will be worn at all job sites at a minimum. Additional recommended protective clothing will be worn when performing specific tasks as described below.

5.1 Head Protection

Head protective equipment (helmets) or hard hats shall be worn in areas where there is a possible danger of head injuries from impact, flying or falling objects, or electrical shock or burns. Helmets for protection against impact and penetration of falling and flying objects shall meet the

requirements of ANSI Z89.1-1986 and shall be constructed of non-conducting material.

5.2 Hearing Protection

Employees will be given a choice of hearing protectors which are selected based on the protector's sound attenuation. The hearing protector attenuation will be evaluated for the specific noise environment in which the protector is used. The evaluation method will comply with the guidelines outlined in Appendix B of 29 CFR 1910.95, *"Methods for Estimating the Adequacy of Hearing Protection Attenuation."* Whenever employee noise exposures increase to the extent that the hearing protector chosen no longer provides adequate attenuation, more effective hearing protectors will be issued and worn.

5.3 Eye and Face Protection

Eye and face protection will be provided and worn when machines or operations present potential eye or face injury. Eye and face protective equipment shall meet the requirements of ANSI Z87.1-1989, *"Practice for Occupational and Educational Eye and Face Protection."* In active working areas, safety glasses with side shields, chemical resistant, splash proof goggles, or face shields will be worn when operations present potential eye hazards. Eye and face protection will be provided by Quadrex. The final decision on additional eye protection in the work area will be at the discretion of the site manager based on the hazard present according to the following guidelines:

PERSONAL PROTECTIVE EQUIPMENT

OPERATION	HAZARDS	RECOMMENDED PROTECTION
ACETYLENE - BURNING ACETYLENE - CUTTING ACETYLENE - WELDING	SPARKS, HARMFUL RAYS, MOLTEN METAL, FLYING PARTICLES	7, 8, 9
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	2, 10 (FOR SEVERE EXPOSURE ADD 10 OVER 2)
CHIPPING	FLYING PARTICLES	1, 3, 4, 5, 6, 7A, 8A
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	9, 11 (11 IN COMBINATION WITH 4, 5, 6, IN TINTED LENSES, ADVISABLE)
FURNACE OPERATIONS	GLARE, HEAT, MOLTEN METAL	7, 8, 9 (FOR SEVERE EXPOSURE ADD 10)
GRINDING - LIGHT	FLYING PARTICLES	1, 3, 4, 5, 6, 10
GRINDING - HEAVY	FLYING PARTICLES	1, 3, 7A, 8A (FOR SEVERE EXPOSURE ADD 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	2 (10 WHEN IN COMBINATION WITH 4, 5, 6)
MACHINING	FLYING PARTICLES	1, 3, 4, 5, 6, 10
MOLTEN METALS	HEAT, GLARE, SPARKS SPLASH	7, 8 (10 IN COMBINATION WITH 4, 5, 6 IN TINTED LENSES)
SPOT WELDING	FLYING PARTICLES, SPARKS	1, 4, 5, 6, 10

1. GOGGLES, FLEXIBLE FITTING, REGULAR VENTILATION
2. GOGGLES, FLEXIBLE FITTING, HOODED VENTILATION
3. GOGGLES, CUSHIONED FITTING, RIGID BODY
4. SPECTACLES, METAL FRAME WITH SIDESHIELDS
5. SPECTACLES, PLASTIC FRAME WITH SIDESHIELDS
6. SPECTACLES, METAL FRAME WITH SIDESHIELDS
7. WELDING GOGGLES, EYECUP TYPE, TINTED LENSES
7A. CHIPPING GOGGLES, EYECUP TYPE, CLEAR SAFETY LENSES
8. WELDING GOGGLES, COVERSPEC TYPE, TINTED LENSES
8A. CHIPPING GOGGLES, COVERSPEC TYPE, CLEAR SAFETY LENSES
9. WELDING GOGGLES, COVERSPEC TYPE, TINTED PLATE LENS
10. FACE SHIELD (AVAILABLE WITH PLASTIC OR MESH WINDOW)
11. WELDING HELMET

Employees involved in any PCB remediation projects will be required to don safety spectacles during normal operations at a minimum. Client requirements *more* restrictive than the above will be adhered to.

5.4 Respiratory Protection

Respirators are only to be used by those persons properly trained and fit tested (certification records required). The use of respiratory protection equipment may be necessary when entering into the WAEZ and CRZ. Respirators are to be used whenever the levels of mists or airborne contaminants are suspected or anticipated to be greater than the limits described in Section 3.0.2. A suitable air purifying respirator type includes full or half face with organic vapor cartridge. If the environment and the protective capability of the cartridge type respirator are in doubt, an SCBA type unit is required in order to enter the area of concern. The Health and Safety Officer shall prescribe the correct cartridge for respirators for each project, and shall determine the requirement for SCBA gear application. Only NIOSH/MSHA approved respiratory equipment will be used.

5.5 Dermal Protection

Employees inside the Work Area Exclusion Zone and Contamination Reduction Zones will be required to wear at minimum:

- Chemrel™ coveralls, or equivalent (taped at ankles and wrists)
- Sol-vex or equivalent nitrile butyl rubber gloves with cotton liners
- Standard Industrial Gloves
- Chemical resistant shoe covers (preferably Chemrel™)

Gloves should be taped to the appropriate protective garments at the cuff to ensure that no liquid comes into contact with the skin. Due to the fragile nature of the sol-vex glove material, the gloves should be worn inside standard industrial gloves. Used gloves will be disposed of as PCB solid waste and replaced with new pairs as needed.

5.6 Zone Protective Equipment

The following outlines generic protective clothing to be used inside the Work Area Exclusion and Contamination Reduction Zones by field service personnel. Other devices may be prescribed for specific needs at the direction of the HSO. When a specific manufacturer or trade name of protective devices is specified by the HSO, it must be used. Each worker is advised that it is their responsibility to be aware of the working environment at all times. If conditions change so that a lesser or greater degree of protection is warranted, then they must bring those changed conditions to the attention of the site manager, and/or the Quadrex HSO

E: PERSONAL PROTECTIVE EQUIPMENT

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Update referenced ANSI standards*	*3/24/92*

TITLE: HAZARD COMMUNICATION

PREPARED BY: Ken Shoemake DATE: 3/25/92
APPROVED BY: Dennis L. Stutzman DATE: 3/25/92

1.0 PURPOSE

The purpose of this procedure is to establish a written hazard communication program in compliance with the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS) 29 CFR 1910.1200. This program is established to 1) ensure proper evaluation of chemical hazards present at Quadrex, 2) define the procedures used to transmit hazard information to Quadrex employees, and 3) ensure proper labeling of hazardous chemicals.

2.0 SCOPE AND APPLICATION

The hazard communication program applies to any chemical that is defined by OSHA as a hazardous chemical or is listed on the Florida Substance List and which is known to be present in the work place, to which employees may be exposed under normal conditions of use or in a foreseeable emergency. In accordance with the Florida Right to Know Law, this plan also applies to those substances presented in the Florida Substance List under Chapter 442, of the Florida Statutes. This program does not apply to consumer goods such as normal housekeeping items when used in normally limited quantities.

3.0 REFERENCES

3.1 Florida Right to Know Law

3.2 OSHA Hazard Communication Standard 29 CFR 1910.1200

3.3 RAD Material License

3.4 DOT Reg 49 CFR 100-199

3.5 Protection of Environment 40CFR 260-265

3.6 NFPA Fire Protection Handbook

4.0 RESPONSIBILITIES

4.1 Industrial Hygienist

The Industrial Hygienist is responsible for

- ensuring that the Hazard Communication Program complies with regulatory requirements;
- approval of all new hazardous materials brought on-site;
- ensuring proper training;
- annual Hazard Communication Program Review and (see attachment B); and
- notifying city/county officials of chemicals used/kept on site. (see attachment C).

4.2 Purchasing Agent

The Purchasing Agent is responsible for

- control and procurement of hazardous chemical's approved for use at Quadrex;
- verifying that a MSDS is on file for all chemicals being purchased; and
- requesting a MSDS from the vendor of a chemical if one is not on file.

4.3 Regulatory Compliance Assistant

The Regulatory Compliance Assistant is responsible for

- ensuring a physical inventory is completed every 6 months;
- ensuring MSDS's are on file and distributed;
- maintaining personnel "MSDS Request Log"; and
- data entry of the hazardous material inventory.

5.0 MATERIAL SAFETY DATA SHEETS

5.1 Obtaining Relevant MSDS

When a "MSDS Request Letter" (see attachment E) is sent to a chemical supplier, an entry will be made in a log, noting the

manufacturer/distributor of the product and the date requested. Once the MSDS is received, the Regulatory Compliance Assistant will be responsible for adding it to the Quadrex MSDS inventory and assuring that copies are properly distributed and placed.

5.2 MSDS Inventory, File Location and Employee Acquisition

The MSDS file will be arranged so that the proper MSDS can be found with minimal effort. The MSDS file will be reviewed whenever the chemical inventory is updated to ensure that every chemical in stock has a corresponding MSDS in the file. Old MSDS's for materials no longer in stock or used by Quadrex will be transferred to a permanent "inactive" MSDS file, and will be retained to address any future questions concerning those materials that may arise.

5.2.1 Quadrex will maintain three (3) sets of Materials Safety Data Sheets for the hazardous chemicals on site in order to provide easy access by employees. MSDS's are filed alphabetically by chemical name for quick reference. (located in the *Company library, laboratory,* and *regulatory compliance office).*

5.2.2 Any employee may request in writing a copy of the Material Safety Data Sheet for the hazardous chemical to which he/she is, has been, or may be exposed to in the work place. Written requests should be made to the Regulatory Compliance Assistant in the Gainesville office. The request should include the material for which a MSDS is requested, the date the request is made and the employee's signature.

5.3 Chemical Inventory/Purchases/MSDS

All hazardous chemicals in stock, regardless of when purchased, must have a MSDS on record in Quadrex files (maintained and distributed by the RCA).

No new chemical will be released by the warehouse without the supplier sending a MSDS to purchasing beforehand so that the Industrial Hygienist may note our in-house ability to handle this chemical before receipt of shipment. This stipulation should be made clear on the purchase order. If a new chemical is delivered without an MSDS, the

receiving department will put the chemical in a holding area and notify the Industrial Hygienist. The chemical will not be released for use until the MSDS is received. No "free" samples from a supplier's sales staff will be accepted without a MSDS.

6.0 LABELING SYSTEM

The labeling system of Quadrex will rely mostly on labels provided by the chemical manufacturer.

Quadrex will use and preserve the labels already on containers when purchased as provided by the chemical manufacturer or suppliers. Whenever any materials are transferred to other containers for later use, the new container will be labeled immediately with the chemical name as it appears on the manufacturer's label. The new container label will also include the appropriate hazard warning.

6.1 Labeling Requirements

All incoming chemical containers must have labels that include 1) The chemical identity, and 2) the appropriate hazard warning. If an incoming chemical container is inadequately labeled or not labeled at all, the following labeling system will be used by warehouse personnel to properly label the container.

The label will have on it a diamond shaped design which is divided into 4 sections. Each section is color coded as indicated below:

Hazard	Color
Health	Blue
Flammability	Red
Reactivity	Yellow
Special	White

Each section will be rated according to the following scale:

Rating 4: Extremely Hazardous
Rating 3: Highly Hazardous
Rating 2: Moderately Hazardous
Rating 1: Slightly Hazardous
Rating 0: no significant Hazard

Anyone having questions about how the label is to be completed should seek assistance from the Industrial Hygienist.

6.2 Trade Secrets

Quadrex respects a company's legal right to protect secret formulations, however, MSDS for substances which omit health hazard information because of trade secrets may not satisfy Quadrex's requirements and every attempt will be made to obtain the necessary information. If the supplier will not provide necessary health and hazard information (which is not part of the formula), then an alternate chemical supplier should be sought.

Chemicals formulated and distributed by Quadrex as trade secret formulas, will have an MSDS prepared so as to protect the formulation and still comply with the regulations.

6.3 When new or updated information is on received chemical hazards, the Industrial Hygienist will assure that revised labels are placed on all affected containers.

6.4 The Industrial Hygienist will review the chemical inventory and assure that all labels and MSDS's have the necessary carcinogen hazard warning if the material is known or suspected to cause cancer.

7.0 CHEMICAL INVENTORY

7.1 Quadrex Inventory Control Program

Quadrex will maintain a chemical inventory of all chemicals used in the Company. This inventory will be verified by a "physical" inventory every 6 months. New chemicals will be added on an ongoing basis. A sample of the chemical inventory is included in this program as attachment A.

8.0 EMPLOYEE INFORMATION AND TRAINING

8.1 Employee Information

Quadrex employees shall be given information regarding hazardous chemicals in their work place. This information will include:

- The regulatory requirements of the Hazard Communication Standard;
- Presence, identity, and location of hazardous chemicals in their work place;
- The location and availability of this (or other) Written Hazard Communication Program;
- The procedure for requesting information and Material Safety Data; and
- The location of the MSDS files.

8.2 Employee Training

All employees who have the potential of being exposed to a hazardous substance in the course of their work must be trained about the chemical hazards in their work area. The Industrial Hygienist will keep a file documenting who has been trained and when the training was completed. The training class will be a combination of audiovisuals and classroom instruction. An exam will be given at the end to verify that the employee learned the essentials of the class (see attachment D). The training will cover:

- The Hazard Communication Standard;
- Presence, identity and location of hazardous chemicals in their work place;
- Location and details of the facility's written hazard communication program and MSDS's;
- A description of the in-house labeling system;
- Chemical hazard evaluation procedures;
- Reading and interpreting MSDS;
- Physical and health hazards of hazardous substances in the work area;
- Methods and observations used to detect the presence of hazardous substances in the work area;
- Proper work practice and precautions when working with hazardous chemicals;
- Appropriate personal protective clothing, and protective measures, including ventilation;
- Emergency procedures and treatment in the event of an accident or exposure; and
- Spill prevention and clean up.

8.3 Employee Retraining

Retraining is required whenever new hazards are introduced into the work place or changes are made in process that will change the chemical exposure of the employee.

Whenever a new chemical is added to the chemical inventory, the Industrial Hygienist will evaluate it and the need for retraining.

8.4 Non-Routine Work Assignments

Occasionally some non-routine work assignment will be made that will require the employee to work with chemicals that they are not familiar with. These activities will be controlled through the Regulatory Compliance Office. Prior to initiating any non-routine work assignment, the employees will be informed of the possible existing hazards as well as the appropriate protective measures to be taken to prevent employee exposure. The department supervisor will be responsible for seeing that the Industrial Hygienist is notified before the work begins.

8.5 New Employees

Upon hiring a new employee, the personnel department should contact the Regulatory Compliance Office so that training may be arranged for the new employee. New employees must be trained prior to their initial assignment which requires work with a hazardous substance.

8.6 Outside Contractors

The Quadrex employee responsible for bringing contractual help on site should notify the Regulatory Compliance Office in advance of the contractor service date at Quadrex in order to arrange, if needed, the appropriate training session(s).

Outside contractors must comply with this program and shall not introduce hazardous materials into the facility without first notifying the Industrial Hygienist and providing MSDS's.

HAZARD COMMUNICATION

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
0	*Initial Review*	
1	*Change in format; update due to changes in responsibility.*	*3/24/92*

PREPARED BY: Ken Shoemaker DATE: 3/25/92
APPROVED BY: Dennis L. Stallard DATE: 3/25/92

1.0 PURPOSE

This procedure describes the methods to be used to quantify employee exposure to 1,1,1 trichloroethane during pipeline PCB decontamination projects.

2.0 SCOPE

This procedure applies to all Field Service projects involved in PCB decontamination using 1,1,1-trichloroethane.

3.0 DEFINITIONS

PEL - Permissible Exposure Limit
PCB's - Polychlorinated Biphenyls
WAEZ - Work Area Exclusion Zone
CRZ - Contamination Reduction Zone

4.0 RESPONSIBILITIES

The Project Manager will have overall responsibility for compliance with this program. The on-site Health and Safety Officer will be responsible for determining air concentrations of 1,1,1-trichloroethane in work areas.

5.0 PROCEDURE

1,1,1 trichloroethane is a low-toxicity solvent used in Compressed Air System PCB decontamination. Employee exposure to 1,1,1-trichloroethane is expected to be limited to the decontamination van and the bermed area(s) (i.e., WAEZ and CRZ). To determine employee exposures, the following monitoring program will be implemented.

5.1 Real Time Monitoring

The decontamination van will be equipped with a permanently-installed International Sensor Technology brand 1,1,1-trichloroethane monitor. The monitor will have a sensor mounted about 30" above the floor in the general area between the "dirty" solvent tanks and the distillation unit. When 1,1,1-trichloroethane levels reach 250 ppm (below the PEL of 350 ppm) a warning light comes on. At 350 ppm an exhaust fan comes on automatically. The fan will remain on until the 1,1,1-trichloroethane level falls below 300 ppm. The fan can also be activated manually.

5.2 Personnel Monitoring

Colorimetric detector tube technology will be the method used to determine employee exposure in areas outside the decontamination van. When the detector tubes indicate levels of 175 ppm, personal protection equipment will be upgraded to include respiratory protection (refer to HSP-011, Respiratory Protection). The following job activities will be monitored:

- Blow-back

wˆTˆDˆHˆS 2ˆ\ˆOˆ\ˆ10!Phˆ P$ of lines being decontaminated

- Any other work activities deemed necessary by the on-site Health and Safety Officer.

5.3 Perimeter Monitoring

Due to the "closed-loop" nature of the decontamination operation, it is unlikely that significant 1,1,1-trichloroethane vapors will migrate beyond the decontamination van and WAEZ. In the event that a significant vapor release is suspected (e.g., spill, pipe rupture, levels over 175 ppm from routine monitoring), detector tube monitoring will be conducted around the perimeter of the work site. If the 1,1,1-trichloroethane levels exceed 175 ppm, the Company will be notified and all employees entering the affected work area will be required to wear respiratory protection.

5.4 Technical Assistance

Any questions concerning monitoring methods or interpretation of monitoring results will be directed to the QEC Health and Safety Officer.

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
0	*Initial Review*	*3/24/92*

PREPARED BY: Ken Shoemake DATE: 3/25/92
APPROVED BY: Dennis L. Stuteville DATE: 3/25/92

1.0 PURPOSE

This Practice describes Quadrex Field Service Operations's (FSO) program for medical surveillance for its employees.

2.0 SCOPE

Personnel whose job duties create the potential for exposure to material identified as or suspected to be potentially hazardous to health, or who are otherwise required by Quadrex FSO, will participate in a medical surveillance program.

3.0 DEFINITIONS

Attending Physician - A licensed physician with knowledge of occupational medicine and a member of the American Occupational Medical Association.

Controlled Zone - Any work area which presents the potential for exposure to a hazardous material or to any other physical hazard

HSO - Health and Safety Officer

PCBs - Polychlorinated Biphenyls

RSO - Radiation Safety Officer; the person named within Quadrex's site Radiological License

4.0 RESPONSIBILITIES

The Quadrex HSO will provide advice and counsel to FSO management concerning its work related to medical issues.

The manager of FSO is responsible for having his respective employees 1) assigned to appropriate categories; 2) receive pre-employment physicals when hired in Category I or II; 3) receive periodic physical examinations as indicated by this Practice; and 4) receive exit examinations prior to issuance of final paycheck or severance pay. (**Note**: The employee's final paycheck will be issued whether or not the employee has had an exit exam.)

5.0 PROCEDURE

This medical surveillance program may include physical examination, blood analysis, feces or urine bioassays, or other biological tests as appropriate. The tests prescribed will be consistent with potential exposure levels as well as relative hazards. The content of the medical examinations and consultations shall be determined by the attending physician.

All results of physical examinations will be provided to the HSO for review and filing. Records of current or past examinations will be made available upon request to the employee or his/her authorized representative. All medical examinations will be provided by a physician in the practice of internal medicine belonging to the American Occupational Medical Association.

The Quadrex medical surveillance program establishes both baseline data and current medical condition for employees. This is accomplished through a pre-employment physical, an annual exam, periodic exams required by certain projects or exposure conditions and an exit physical. The annual and periodic exam portions of the surveillance program are included to provide an indication of the effectiveness of the safety measures used and to indicate areas where improvements can further minimize probable avenues of personnel uptake.

The HSO will regularly apprise the attending physician of each employee's anticipated or customary duties, actual or potential exposure levels and any other information useful in diagnosing work-related disorders.

5.1 Employment Categories

FSO categorizes its employees into three groups (Category I, II, or III) depending on their usual work environments and duties.

Category I employees are those who work with hazardous

materials on a regular basis (site managers, foremen, technicians, field engineers, and some support personnel).

Category II employees are those who come in contact with hazardous materials on a non-routine basis (office, business, and technical managers; technical support personnel; marketing representatives).

Category III employees are not exposed to hazardous materials in the normal course of their jobs (secretaries, administrative personnel).

Should an employee's category change due to a change in job responsibilities and such changes necessitate increased medical surveillance, the employee's supervisor shall be responsible for assuring that the medical surveillance for the temporarily re-Categorized employee meets the requirements of this Procedure. Should FSO employ a subcontractor whose personnel are used essentially as FSO employees, the hiring FSO Manager shall assure that this Procedure's requirements are applied as if the subcontracted employee were a FSO employee.

5.2 Program Components

5.2.1 Examination Frequency

Category I employees shall receive a pre-employment, annual, and exit physical examination, as well as periodic and incident exams when appropriate.

Category II employees shall receive a pre-employment physical examination and an exit exam.

Category III employees shall receive a physical exam only when reassigned to another job classification category.

5.2.2 Pre-Employment Physicals

Pre-employment physicals include a comprehensive examination focusing on all pertinent organ systems,

and a thorough history covering past employment and conditions as well as any special current health problems affecting the employee's ability to handle hazardous material. Any employee designated as a worker in a potentially hazardous environment must have a complete physical prior to entering a controlled work area. Components of the baseline, pre-employment examination will include at least the following:

5.2.2.1 Medical history; general physical; EKG; chest X-ray (PA and lateral); a basic panel of blood counts and chemistries to evaluate blood forming organs, kidney, liver, and endocrine/metabolic function (including white blood cell count and differential cell count, hemoglobin and/or hematocrit, albumin, globulin, and total protein, serum glutamic oxalacetic transaminase (SGOT), lactic dehydrogenase (LDH), alkaline phosphatase, calcium, phosphorus, uric acid, creatinine, urea nitrogen, cholesterol, glucose); and a routine urinalysis (including specific gravity, 9 component dipstick, and microscopic when appropriate)

5.2.2.2 PCB blood level analysis for those employees whose duties include PCB activities

5.2.2.3 Controlled substance (alcohol, marijuana, cocaine, opiates, amphetamines, and phencyclidine (PCP)) testing in accordance with the Quadrex Fitness For Duty Program

5.2.2.4 Audiogram administered and completed in compliance with 29CFR1910.95(g)

5.2.2.5 Visual acuity

5.2.2.6 Screening to determine that the employee is able physically to perform a particular task and use respiratory protection equipment, including a pulmonary function test in compliance with 29CFR1910.134. Female employees will be advised of any uptake possibilities and are requested to inform the HSO immediately upon indication of pregnancy so that potential effects to unborn children can be considered

5.2.3 Annual Physical

The annual physical is comprised of the components of the pre-employment exam.

5.2.4 Periodic Exams

Periodic or special exams are administered as needed, and are not scheduled on a regular basis. Instances in which a periodic exam may be required are:

1) when an employee changes occupations and moves from one category to another;

2) when an employee may be potentially exposed to unusually high concentrations of a particular contaminant or contaminants on a project;

3) when a contaminant will be handled that the regular physical does not evaluate;

4) if an employee feels he has been adversely affected during the course of his/her duties;

5) as required by Quadrex's Fitness for Duty Program; or

6) as required by contractual agreements.

5.2.5 Incident/EmergencyExams

Additional medical evaluations will be required as determined by the HSO or FSO management when indicated by an employee's substandard performance, or a particular stress or chemical exposure that is evidenced by an injury or lost time illness.

5.2.6 Exit Exams

For Category I or II employees, exit exams are identical to the annual exam, excluding item 5.2.2.3.

Category III employees do not receive exit exams. If employment is terminated for Quadrex employees before completion of the assignment, an exit exam will be given.

If an employee refuses the exit exam, the FSO manager will document this by having the employee sign a statement saying that they were provided with the opportunity to have an exit exam and that they refused. If the employee will not sign, the FSO manager should write this on the release form. The release form should be sent to the Regulatory Compliance Assistant for inclusion in the employee's medical record.

5.3 Contractors/Subcontractors

Medical exams for contractors/subcontractors will be defined on a case by case basis. The manager of FSO shall contact the Quadrex HSO for requirements.

5.4 Radiological Bioassay

Employees who participate in work activities which present a potential for radiological exposure may be required to undergo bioassay as required by the Radiation Safety Officer. Bioassay

requirements, including whole body counts where appropriate, will be determined based on occupational exposure history, the potential for biological uptake, half-life of the isotope(s), or other factors as determined by the Radiation Safety Officer.

5.5 Action Levels

The HSO will review results presented by the attending physician and confer with the physician on any findings of significance. The previous medical examinations and blood analyses will be reviewed to detect any trends or abnormalities. Any noted liver or skin related abnormalities will be cause for further evaluation by the physician and review by the HSO. Any increase in PCB blood level above previous levels will be cause for the HSO to further investigate. Any work-related abnormalities which are noted by the attending physician, will be cause for the HSO to review exposure history correlation and assist in determining necessary corrective measures. Until significant findings are resolved as to cause, origin, and corrective action, the affected person may be restricted from performing any additional contributing or aggravating tasks.

6.0 REFERENCES

29CFR1910 - Occupational Safety and Health Regulations

7.0 ATTACHMENTS

None

TITLE: MEDICAL SURVEILLANCE

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Update definitions*	*3/24/92*

PREPARED BY: Ken Shoemaker DATE: 3/25/92
APPROVED BY: Dennis L. Fleetwood DATE: 3/25/92

1.0 PURPOSE

The purpose of this practice is to ensure the protection of all Quadrex employees from respiratory hazards through proper use of respiratory equipment.

2.0 SCOPE

This procedure applies to all Quadrex employees whose job requires them to wear or be able to wear a respirator.

3.0 DEFINITIONS

OSHA - Occupational Safety Health Administration
NIOSH - National Institute for Occupational Safety & Health
MSHA - Mine Safety & Health Administration

4.0 RESPONSIBILITIES

The Health & Safety Officer (HSO) shall be responsible for 1) the training or arranging the training of all affected employees; 2) providing guidance for the selection of respirators to be used; and 3) provide guidance for determining when respiratory use is required.

Supervisors/Project Managers shall be responsible for assuring that their employees use and maintain their respirators in accordance with this procedure.

5.0 PROCEDURE

5.1 Medical Monitoring

Pre-employment physicals are given to all employees whose job may/will require them to wear a respirator. The Company physician will certify, based on spirometry and physical exam, that the employee is capable of wearing a respirator while performing their

normal job duties. Employees without this certification are prohibited from performing jobs that require the use or potential use of a respirator.

Depending on their potential exposure to hazardous materials, periodic physical exams will be performed to determine an employees continuing ability to wear a respirator.

In the event that biological monitoring shows excessive uptake of a chemical an employee is exposed to, that employee will be retrained on respirator use. Fit testing will also be repeated.

5.2 Work Area Monitoring

The supervisor/project manager will provide the HSO with information concerning the hazardous materials that will be encountered. Based on this, the HSO will establish air monitoring requirements for those materials.

5.3 Respirator Selection

The HSO, based on information supplied by the project manager or department supervisor, will determine what type of respirator will be needed to provide adequate employee protection. Only MSHA/NIOSH approved respiratory equipment will be used.

5.4 Employee Training/Fit Testing

Each employee, upon initial assignment to a job or project requiring respirator use, will be trained in the use of the proper respiratory equipment. That training will include but is not limited to:

- written procedures concerning respirator use;
- respirator selection;
- proper use;
- cleaning/storage;
- maintenance;
- limitations; and
- practice session featuring actual usage.

Part of the training will include fit testing which will assure that the employee is properly protected while wearing a respirator. The fit test procedure will use either amyl acetate or sodium saccharin as a challenge media and will include the following exercises:

- normal breathing;
- deep breathing;
- moving head side to side;
- moving head up & down; and
- reading a prepared text.

5.5 Respirator Maintenance, Inspection and Cleaning

Prior to each use, the employee will inspect their respirator to assure that it is in proper operating condition. This inspection should include:

- facepiece clean and free of tears;
- inhalation and exhalation valves present and in good condition (flat, free of holes/tears);
- straps present, still have some elasticity;
- proper cartridges for intended use; and
- if full face, is lens clean and free of scratches.

After each use, the respirator will be cleaned by either of the following methods:

- Remove cartridges and wash entire facepiece in warm, soapy water. Allow to dry, replace cartridges, and store in an airtight container (ziploc, tupperware, etc.); or

- Use a respirator wipe to disinfect/clean all surfaces. Allow to dry and store in an airtight container.

6.0 REFERENCES

None

7.0 ATTACHMENTS

None

E: RESPIRATORY PROTECTION

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Revise responsibilities and medical monitoring section.*	*3/5/92*

PREPARED BY: Ken Shoemaker DATE: 3/25/92

APPROVED BY: Dennis L. Thetford DATE: 3/25/92

1.0 PURPOSE

Contamination spreading during remediation projects poses a risk to personnel and the environment; this Practice provides guidance to minimize that risk.

2.0 SCOPE

This Practice applies to all Quadrex projects involving substances whose unintentional release or spread is undesirable.

3.0 DEFINITIONS

WAEZ	-	Work Area Exclusion Zone
CRZ	-	Contamination Reduction Zone
PCBs	-	Polychlorinated Biphenyls
ppm	-	Parts Per Million

4.0 SITE MANAGER RESPONSIBILITIES

Each worker is responsible for continuous awareness of the possibility of spreading contamination, and for performing his/her duties in such a manner to prevent this risk. The site manager will provide guidance and advice to the site workers.

5.0 PROCEDURE

5.1 Zone Practices

In order to minimize the spread of chemical contamination, where a Work Area Exclusion Zone (see HSP-002) has been established, a laydown area consisting of an absorbent material will be included. Any item, tool, part, shoes, etc. suspected of having come into contact with any PCB or solvent contamination will, after its completed use, be placed on the laydown area within the exclusion zone while awaiting packaging or decontamination.

At the closeout of the WAEZ the laydown material and any non-recoverable items will be disposed of as PCB contaminated waste.

5.2 Decontamination Procedures

5.2.1 Personnel and Personal Protective Equipment

At the start of the work day, workers will don protective clothing as required before entering the WAEZ. Upon completing cleanup activities, workers will stop at the WAEZ exit to the CRZ and remove boot covers, Chemrel suits, hard hats, eye protection, gloves, and respirators if applicable.

Damaged gloves will be discarded into receptacles provided. Disposable coveralls and shoe covers will also be discarded (if the work day is over, or if damaged) or temporarily stored (if on break, lunch, etc., and the clothing is still in good condition). All disposable clothing and respirator cartridges will be discarded into the receptacles provided at the end of each work day since these items are difficult to decontaminate. Boots, hard hats, gloves, eye protection will be decontaminated by wiping the surfaces with an appropriate cleanser and absorbent sheet and will be stored for reuse. At the end of each day, respirators will be cleaned, disinfected, and stored as described in the Respiratory Protection Program.

When the worker leaves the decontamination area, he will either wash his hands and face if taking a break period, or if leaving the site at the end of the work day, will shower upon his return to the hotel.

The utmost care should be taken to prevent contact with the skin and excessive exposure to vapors. In the event of skin contact with solvent, contaminated clothing should be removed and the area should be immediately flushed with water and promptly cleansed with soap and water. It will be the responsibility of the site manager to ensure that these procedures are strictly adhered to.

5.2.2 Equipment Decontamination Procedures

Without exception, all recoverable equipment and materials will be decontaminated prior to removal from the CRZ and prior to final removal from the site. All items for which decontamination is difficult, or uncertain, will be considered non-recoverable and disposed of as contaminated waste. Examples of such non-recoverable equipment are contaminated lumber, non-reusable personnel protective equipment and apparel, contaminated cleaning fluids and materials, etc. Decontamination will take place within the decon chamber inside a mobile unit or in the CRZ materials decontamination area as designated by the site manager and will consist of degreasing (if required) followed by high pressure, solvent cleaning as appropriate. A non-porous pad or bermed area of appropriate material will be placed under items being decontaminated to catch and hold any rinse fluids which may be generated. The pad, structural materials and the rinse fluids will be considered non-recoverable. All non-recoverable solid materials and equipment will be deposited in DOT/EPA approved drums at the site, disposed of in accordance with contract requirements.

All equipment and tools which have or are suspected to have come into contact with contaminated fluids, are to be considered contaminated. Prior to release of any item for reuse or redistribution, it shall be decontaminated utilizing the following methodology.

- Any PCB container shall be decontaminated by flushing internal surfaces of the container three (3) times with a suitable solvent containing not greater than 50 ppm PCB. The solubility of PCBs in the solvent must be five (5) percent or more by weight. Each rinse shall use a volume of the normal dilutant equal to approximately ten (10) percent of the PCB container capacity.

  The solvent may be reused for decontamination until it contains 50 ppm PCB. The solution shall then be disposed of as a PCB waste in accordance with 40CFR761. Non-liquid PCBs resulting from the decontamination procedures shall be disposed of in accordance 40CFR761.

- Any item decontaminated will be wipe tested and analyzed for residual PCBs. Prior to removal from site, all decontaminated equipment and materials shall meet EPA spill clean-up criteria, and shall be inspected and approved by the Quadrex's site manager. Certification of decontamination shall be attested to by Quadrex's site manager.

- Tools and small movable equipment used in the project which are suspected of being contaminated shall be cleaned either inside equipment on board the mobile unit or by wiping the surface area with a cloth treated with a suitable solvent.

6.0 REFERENCES

None

7.0 ATTACHMENTS

None

TITLE: CONTAMINATION CONTROL

RECORD OF REVISION

REVISION NUMBER	*PURPOSE OF REVISION*	*EFFECTIVE DATE*
1	*Change format*	*3/24/92*

Title: Quadrex Laboratory Chemical Hygiene Plan **Date:** 11/26/91

Prepared By: [signature] **SOP #:** S-02

Authorized By: [signature] **# Pages:** 24

INDEX

QUADREX STANDARD OPERATING PROCEDURE

Title:	**Quadrex Laboratory Chemical Hygiene Plan**	**Date:**	11/26/91
Prepared By:	[signature]	**SOP #:**	S-02
Authorized By:	[signature]	**# Pages:**	24

INDEX

1.0 PURPOSE

The OSHA Occupational Exposures to Hazardous Chemicals in Laboratories rule became effective May 1, 1990. This rule-making requires those who operate laboratories to develop and implement a Chemical Hygiene Plan by January 1, 1991. The laboratory standard was promulgated in order to allow employers more flexibility in addressing the unique situations of laboratories in terms of their needs for preventing chemical exposure to employees.

2.0 SCOPE

This Chemical Hygiene Plan (Plan) applies to the Quadrex analytical laboratory in Gainesville, FL and to all mobile labs.

3.0 RESPONSIBILITIES

3.1 *Company President* has the ultimate responsibility for chemical hygiene within the Company and must, with other administrators, provide continuing support for site-wide chemical hygiene.

3.2 *Department and Section Managers* are responsible for chemical hygiene within their department or section.

3.3 *Chemical Hygiene Officer(s)* must do the following:

3.3.1 Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.

3.3.2 Monitor procurement and use of chemicals used in the laboratory.

3.3.3 See that appropriate audits are maintained.

3.3.4 Help personnel directing specific operations to develop precautions and maintain adequate facilities.

3.3.5 Seek ways to improve the chemical hygiene program.

3.3.6 Ensure that employees are adequately informed of and trained in the hazards and proper disposal of the chemicals in their work area.

3.3.7 Check ventilation to ensure proper operation and check protective equipment for integrity prior to work with chemicals.

3.4 *Laboratory Manager:* The Lab Manager has overall responsibility for chemical hygiene in the laboratory including responsibility for the following:

3.4.1 Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided.

3.4.2 Ensure proper storage, handling, use, and disposal of chemicals to prevent possible exposure of employees.

3.4.3 Ensure proper hazard labeling of drums, cans, and other containers of chemicals used or stored in the work area.

3.4.4 Ensure that Material Safety Data Sheets (MSDS's) are available in the work area.

3.4.5 Obtain MSDS for any new chemical planned for use and contact the Regulatory Compliance Office for authorization to purchase all chemicals new to the laboratory.

3.4.6 Provide regular, formal inspections of housekeeping, chemical hygiene, safety, hazardous waste disposal and emergency equipment. Inspection sheets shall be filed, and corrective actions initiated.

3.4.7 Consult with Regulatory Compliance to determine the required levels of protective apparel and equipment.

3.4.8 Ensure that facilities and training for the use of any hazardous material in the laboratory are adequate.

3.4.9 Send injured or ill employees for medical treatment and complete the necessary reports.

3.5 *Job site supervisors* have the responsibility of chemical hygiene for that project.

3.6. *Laboratory Workers*: Technicians are responsible for planning and conducting each operation in accordance with the Company chemical

hygiene procedures and developing good personal chemical hygiene habits. Specifically, they shall:

3.6.1 Handle and use chemicals in a manner which minimizes the potential for absorption, inhalation, or ingestion to themselves and others.

3.6.2 Be aware of the hazards associated with the chemicals with which they are working, contact the lab manager when questions arise about hazards, proper controls, or when unlabeled chemicals are encountered.

3.6.3 Follow procedures and protective equipment requirements specified when handling chemicals.

3.7 *Manager of Regulatory Compliance* is responsible for determining whether a waste is hazardous and ensuring that the applicable government regulatory requirements are followed during chemical waste disposal. Manager of Regulatory Compliance provides guidance for the proper disposal of the selected chemicals per applicable regulatory requirements.

4.0 LABORATORY SAFETY RULES

4.1 Safety glasses (with side shields) that meet OSHA requirements, are to be worn in the laboratories at all times when working with chemicals. The need for additional eye protection shall be evaluated by the Chemical Hygiene Officer and implemented as necessary.

4.2 Laboratory employees shall wear apparel which minimizes the potential for contact with chemicals. When working with or around chemicals, personnel shall wear standard lab apparel: lab coat, smock, or other protective clothing, slacks/dress, and sturdy shoes, i.e., not sandals, perforated shoes, or cloth sneakers.

4.3 Gloves shall be used as appropriate and as specified for the task being performed, along with appropriate goggles, face shields, aprons, respirators, or hearing protection as necessary.

4.4 When transferring chemicals from one container to another, additional splash protection shall be worn. Also, the pouring shall be done in the fume hood or under other appropriate ventilation.

4.5 There shall be no eating, drinking, use of tobacco products, or application of cosmetics permitted in the laboratory rooms. Beakers or other laboratory glassware shall never be used for drinks. Drinks shall only be consumed outside the laboratory or in designated break areas. Food or drink shall not be stored in or near the same enclosure with chemicals; e.g., refrigerator.

4.6 Workers shall wash hands before leaving the laboratory to eat, drink, smoke, or to use the rest room.

4.7 Laboratory workers shall make themselves aware of hazards of the chemicals with which they are working. This information is available on MSDS's.

4.8 All chemical containers shall be labeled with the proper chemical name.

4.9 Combustible or flammable liquids shall be stored in approved flammable liquid storage cabinets. *NOTE: The quantity of flammable/combustible liquid to be used on one shift may be left outside of cabinets at the work station.*

4.10 Gas cylinders shall be transported within the lab using a gas cylinder dolly with a chain to secure it and should be secured in place with a chain or nylon strap.

4.11 Incompatible chemicals shall be kept separated during storage, transfer, use (if possible), and disposal to prevent incompatibles from mixing and the subsequent release or explosive reaction of hazardous chemicals.

4.12 Any pipeting of chemicals will be done using mechanical devices, and under no circumstances will pipeting be performed by mouth.

4.13 Concentrated acids or bases must be added to water, not vice-versa, to make dilute solutions.

5.0 CHEMICAL INVENTORY

The laboratory shall develop and maintain an inventory of hazardous chemicals which are present in the laboratory. The inventory information shall include: chemical name, quantity, and storage location. Newly purchased chemicals shall be added to the inventory upon receipt. A physical inventory shall be conducted on a quarterly basis. The updated inventory information shall become Appendix A of

this Plan.

6.0 CHEMICAL HAZARD INFORMATION

Material Safety Data Sheets shall be present in the laboratory area, and employees shall be informed that the MSDS's are available for their use. An MSDS must be obtained and added to the MSDS log before new chemicals are introduced into the laboratory. In the event that an MSDS is not available, the Chemical Hygiene Officer can provide, in writing, hazard information for a chemical to be used in the laboratory. An MSDS must be obtained from the manufacturer if the chemical is to remain in the inventory. The Chemical Hygiene Officer may be used as a resource for providing further health and safety guidance if requested.

The Chemical Hygiene Officer shall review the chemical inventory and develop a list of select carcinogens. This listing shall be incorporated as an addendum to the chemical inventory.

7.0 VENTILATION UNITS

Proper laboratory fume hood installation is essential for adequate personnel protection to be afforded. The exhaust stack should extend straight up to the roof with no traps or horizontal runs to collect dust or condensate. The exhaust stack should extend at least six feet straight above roof level, and provisions should be made for drainage of rain water. The exhaust fan should be located on the roof, never inside the building. The system should be installed so that an avg face velocity of 125 fpm across the face with the sash fully open can be maintained. The hood should be located on the opposite side of laboratories from exits, and away from frequently used walkways, doors, operable windows, all air conditioning and heating vents.

Effective Use of Laboratory Fume Hoods

In order to utilize a fume hood most effectively, the following rules should be followed by the users:

7.1 Work as deeply within the fume hood as possible. Arrange all equipment as far into the hood as practicable without blocking the rear baffle. If the unit has a work surface depression, work within this depression to retain spills within the hood.

7.2 The sliding sash should be held at the 10" opening (unless otherwise specified). This is the level which provides optimum capture efficiency of

hazardous fumes. The sash should be fully open only when placing large items in or removing them from the work zone.

7.3 Avoid creation of strong cross drafts (>100 fpm) caused by open doors or windows, air conditioning/heating vents, or personnel movement. Drafts will pull contaminants from the hood into the laboratory.

100 fpm is generally not perceptible. Air conditioning and heating vents plus personnel traffic all create airflows in excess of 200 fpm; therefore, care should be taken in fume hood placement, and activity should be minimized while the hood is in use.

7.4 Do not use fume hoods for storage. If a small number of highly explosive, volatile and/or toxic chemicals must be stored in the hood, then the hood must be left running continuously.

7.5 Only items necessary to perform the present experiment should be in the hood. Unnecessary equipment or chemical containers create excess air turbulance.

8.0 PERSONAL PROTECTIVE APPAREL AND EQUIPMENT

The following personal protective apparel and equipment are available to all laboratory employees:

8.1 *Fire Extinguishers* are located in prominent locations throughout the laboratories and in the halls. The locations are marked by red and white "Fire Extinguisher" signs in some cases. Any room in which an operation is being performed using an open flame must have a fire extinguisher present.

8.2 *Respirators* are required to be used wherever airborne chemical or radioactive contamination is expected to exceed established selection criteria (contact Regulatory Compliance for guidance). In order to use respirators, employees must receive annual respirator training, medical respirator approval, a quantitative fit test, and be clean-shaven (refer to Respirator Protection Procedures for details).

8.3 *Safety Glasses (or Goggles)* are required to be worn by employees in all lab rooms which are marked "CAUTION – EYE PROTECTION REQUIRED – SAFETY GLASSES," even if not working with chemicals. They are to be worn whenever working with chemicals.

8.4 *Face Shields* provide more complete protection than safety glasses and are non-shattering to protect against an explosive impact. They shall be worn when working with: heated strong acids or alkalies; hot solutions being evaporated; potentially explosive or reactive materials; cryogenic liquids; highly evacuated glass systems; and pressurized systems. Also, they shall be worn when transferring hazardous liquid chemicals which are severe skin irritants and have the potential of splashing.

8.5 *Gloves* shall be used whenever necessary to prevent direct contact with hazardous chemicals, including certain bench top and glassware cleaning operations. When pouring solvents or concentrated acids or alkalis, gloves should be worn. Gloves are provided in various types: cotton; disposable latex or surgical; leather palm or full leather; latex (blue); latex soft lined; neoprene (black); nitrile (green); nylon; red vinyl; synthetic rubber; and zetex welders gloves. The Chemical Hygiene Officer should be consulted for the best glove choices for specific chemicals; however, the following general selection guidelines are useful:

8.5.1 Nitrile (green) or neoprene (black) rubber gloves must be worn when working with concentrated acids or alkalies or hazardous organic solvents.

8.5.2 Neoprene (black) gloves must be worn when handling concentrated hydrofluoric acid.

8.5.3 Latex (blue) gloves must be worn when working with dry materials, dilute aqueous solutions, and radioactive materials.

8.5.4 Leather, welders, or Kevlar (yellow) gloves must be worn when working with cryogenic liquids or handling cryogenically cooled material or when handling hot objects.

8.5.5 Cotton or nylon gloves may be worn underneath other gloves, or the soft lined latex gloves can be worn to reduce sweating and irritation.

8.5.6 Disposable latex or surgical gloves shall not be worn when working with corrosives. They are worn when working with powdered solid chemicals or samples to reduce chemical contamination or cross contamination of samples or when working with skin irritants. These gloves do not provide protection from liquid chemicals (e.g., corrosives or solvents) and

are not to be used in these cases, since they may absorb and trap chemicals near the skin.

8.6 *Neoprene Aprons* shall be worn when working with extremely corrosive reagents. They shall be used when handling large quantities of concentrated acids, strong alkalies, or when handling any quantity of hydrofluoric acid.

8.7 *Lab Coats, Smocks, or Uniforms and Sturdy Shoes* shall be worn at all times when working with any chemicals or in any room in which chemicals are stored or being used by others.

9.0 OPERATIONS REQUIRING PRIOR WRITTEN APPROVAL FROM THE CHEMICAL HYGIENE OFFICER

New operations and developmental work must be submitted in writing for approval to the Chemical Hygiene Officer.

The Chemical Hygiene Officer shall also review new or renovated laboratory facilities and equipment at the design stage, as well as prior to putting them into use. In these reviews, engineering controls will be required instead of using administrative or personal protection controls wherever feasible.

10.0 CHEMICAL EXPOSURE SIGNS AND SYMPTOMS

Hazardous chemicals can affect many body organs and systems. Signs are adverse health effects which are observable externally, whereas symptoms refer to complaints experienced by the person who has been exposed. Some effects occur immediately following a single exposure and are known as acute adverse health effects. Others, known as chronic effects, slowly develop following repeated exposures over a long period of time. It is useful to discuss signs and symptoms in terms of the routes of entry for contaminants into the body: skin, eyes, inhalation, and swallowing.

10.1 Skin Contact

Natural skin defense against chemicals includes multiple layers of skin, and dilution of chemicals by perspiration and the natural oils of the skin. As long as the skin is intact, it offers a reasonably good barrier to water soluble contaminants. When the outer layer of skin (the epidermis) is broken (i.e., cut or punctured), the skin is no longer an effective barrier to chemical or biological agents. Fortunately, if skin damage is superficial, the skin is able

to repair much of the damage caused by chemicals.

10.1.1 *Fat Soluble Chemicals*: The skin defenses can be removed by solvents, which remove the natural oils, or through cuts in the skin. Some chemicals can penetrate the skin even when it is not broken because they dissolve in the skin fat layer; e.g., organophosphate pesticides or tetraethyl lead. Repeated contact of the skin with organic solvents such as acetone, chloroform, trichloroethylene, or 1,1,1-trichloroethane can defat the skin, causing it to dry, shrink, crack, and bleed. This can allow infection, inflammation, and dermatitis to occur.

10.1.2 *Irritants*: These chemicals which include fat soluble chemicals, oxidizers, acids, caustics, and irritant chemicals, directly attack the skin causing burns, blisters, and wasting of the skin tissue. Concentrated chemicals may cause such deep seated damage that skin repair is slow and long lasting scars result. Irritants include organic solvents, inorganic alkalies (sodium hydroxide), organic amines (quaternary ammonium compounds), metallic salts (zinc chloride, chromates, nickel sulfate), and reducing agents (urea, oxalic acid, and salicylic acid).

10.1.3 *Photosensitizers*: Chemicals such as coal tars, polynuclear aromatic compounds, and certain dyes, are able to capture light energy and release it inside the skin as free radicals, which then cause the skin to be more sensitive to sunburn.

10.1.4 *Stimulants*: Some chemicals stimulate the skin resulting in abnormal growth patterns, tumors or cancer. These include chrome compounds, coal tar products, and arsenic.

10.1.5 *Allergens*: Some individuals can develop an immune system reaction to a chemical such as epoxy or isocyanate once they have been exposed to it on their skin. Subsequent low level exposures, not high enough to cause irritation in most people, can result in rashes in sensitized persons not only at the exposed skin but over large non-exposed skin areas.

10.2 Eye Contact

The eyes can be affected by direct chemical contact or by vapor penetration. The main defense is blinking, which distributes a layer of tear

fluid over the surface of the eye. Damage to the eye usually occurs to the outer layer or cornea or to the conjunctival membranes around the eye and eyelid. Because of its sensitivity, damage of the eye usually is preceded by considerable pain, blinking, watering, and aversion to light so that there is considerable warning.

10.2.1 *Irritants*: Irritants affect the eye causing smarting or excessive tearing (lacrimation). An example of a lacrimator chemical is ammonia. Caustics and acids are extremely irritating if splashed into the eye. Caustics cause the most damage to the eyelids, conjunctiva, and cornea. These agents may cause temporary or lasting damage to the eye. Severe damage to the cornea can cause blindness.

10.2.2 *Toxics*: Toxic chemicals affect the eye slowly over time. Dinitrophenol can cause opacity of the eye lens. Thallium or methanol can damage the optic nerve.

10.2.3 *Allergens*: Some people may react to certain chemicals at very low levels with resulting itchiness, redness, and inflammation around the eyes. The levels required are much lower than those at which most people would react.

10.2.4 *Photosensitizers*: These agents make the eyes more sensitive to sunburn. Examples are drugs such as psoralens, anti-fungal agents, tetracyclines, anti-psychotic drugs (chlorpromazine), oral anti-diabetics, and some anti-depressants. Combined with sunlight, these chemicals may cause inflammation of the eyelids and conjunctiva, opacity of the eye lens (cataracts), and damage to the retina.

10.3 Inhalation

Inhalation is a major route of entry for airborne contaminants penetrating the human body. Chemical contaminants once inhaled can rapidly reach the brain and other target organs, because of the close contact between blood in lung capillary vessels and the air inside the lung. Unlike the skin, there is no dry layer to keep chemicals from passing through lung tissue. Even though contaminants may only be present at low levels, the fact that the average person inhales 4.4 cubic meters of air in a 8½ hour work day can result in a significant intake of contaminant. Chemicals which cause adverse health effects following inhalation can be put in the following

classes:

10.3.1 *Allergens*: Some chemicals such as isocyanates can cause allergic responses in people who have previously had their immune systems become sensitized to them. Allergic reactions involve difficult breathing and even circulatory shock. Isocyanates are allergens as well as irritants.

10.3.2 *Anesthetics*: These are either gases or vapors which cause initial excitation then depression of the central nervous system of the human body. This results in nervousness, then dizziness, headache, and at high enough contaminant concentrations, unconsciousness. Solvents such as 1,1,1-trichloroethane, ethyl ether, acetone, and freons are all anesthetics.

10.3.3 *Asphyxiants*: There are two kinds of asphyxiants: simple and chemical. Simple asphyxiants are non-oxygen containing gases such as nitrogen, carbon dioxide, helium, argon, or methane. In a confined space where there is poor exchange of the air inside the space with the normal outside air, these gases can displace oxygen and create an oxygen deficient atmosphere (an atmosphere which contains less than 19.5% oxygen). When subjected to oxygen deficiency, the person has trouble breathing, gets dizzy, faints, and dies if not returned to a normal oxygen containing atmosphere. The second class of asphyxiants are gases such as carbon monoxide which prevent blood from transporting oxygen to the tissues in the body.

10.3.4 *Blood Toxins*: These damage the blood forming organs of the spleen, bone marrow, and liver. Examples are benzene, which can cause abnormal cell numbers or ratios, and lead, which interferes with red blood cell hemoglobin synthesis and causes anemia.

10.3.5 *Carcinogens*: Some chemicals inhaled as airborne particles or vapors increase the likelihood of cancer resulting. This process requires years to occur and there does not appear to be a threshold for carcinogenesis. This is the reason why exposures to carcinogens are kept as low as reasonably achievable (ALARA). Examples of carcinogenic chemicals are: asbestos (causes lung cancer and mesothelioma), benzene (leukemia), beryllium (berylliosis and lung cancer), and formaldehyde (nasal and

pharyngeal cancer).

10.3.6 *Fibrosis Producers*: These are primarily dusts which deposit in deeper regions of the lung where they cannot be cleared and where they cause scarring of the lung tissue after prolonged (years) inhalation. The best example of these agents is crystalline silica.

10.3.7 *Hepatotoxins*: These chemicals are toxic to the liver. Carbon tetrachloride is a hepatotoxin.

10.3.8 *Irritants*: Irritants can cause severe coughing or possible fluid in the lungs (pulmonary edema). Ozone from photocopiers or 1st generation laser printers or nitrogen dioxide from uranium metal cleaning operations are examples of irritants. Nuisance dusts at high enough concentrations can also cause irritation.

10.3.9 *Mutagens*: These are chemicals which are able to change the hereditary information in genes. This can be passed on to future generations if the changed cell does not die and is a germ cell (egg or sperm). Mutagenesis is seen as the first step in carcinogenesis.

10.3.10 *Neurotoxins*: Neurotoxins are toxic to the central nervous system. Organophosphate insecticides are rapidly neurotoxic by interrupting nerve transmission. Mercury is slowly neurotoxic and causes tremor, mood swings, and delirium.

10.3.11 *Nephrotoxins*: Nephrotoxins damage the kidneys. Heavy metals such as uranium, lead, and cadmium are nephrotoxins.

10.3.12 *Reproductive Toxins*: Chemicals such as dibromochloropropane, a pesticide, can cause sterility in men.

10.3.13 *Synergistic Effects*: Two different chemicals having little harm alone can combine to create very serious effects when combined. Examples are ethyl alcohol and barbiturates. Alone the former causes drunkenness, while the latter causes sleep. Together they can cause death.

10.3.14 *Teratogens*: These chemicals damage the developing fetus in pregnant women. Examples of teratogens are the drug

thalidomide, mercury, lead and alcohol.

10.4 Ingestion

Although one does not purposely eat toxic chemicals, inadvertent ingestion of contaminants can occur. When working with materials where residues may be carried away on the skin of hands and face, proper hygiene practices must be followed prior to smoking or eating. A good example of ingestion of toxic contaminants is lead after soldering with lead - tin alloy solder.

10.5 Recognition by the Senses

If a chemical is an acute irritant, the first sign of exposure is given by the senses of touch, smell, taste, or eye irritation. Skin contact with concentrated mineral acids (e.g., sulfuric and perchloric) causes immediate pain, whereas some acids (hydrofluoric) and alkalis (sodium hydroxide solution) cause delayed pain, which is often too late to prevent serious burns. Many chemical agents have distinctive odors which can be detected at concentrations below allowable exposure limits. For instance, ethyl ether has an odor threshold of less than 1 part per million (ppm) which gives people plenty of warning either to leave the area or to put on personal protection well before the OSHA Permissible Exposure Limit (PEL) of 400 ppm is reached. Other chemicals are eye irritants which cause severe involuntary eye watering, blinking, or aversion to lights. Common examples of these are ammonia, cresols, and chlorine gas. Some chemicals (e.g., chlorinated solvents such as 1,1,1-trichloroethane or methylene chloride or freons) cause freezing burns when released on the skin or eyes, because their boiling points are below room temperature. When some chemicals are released, they can be seen. A fume hood which shuts down while samples inside are being acid digested will usually fill up and then release dense white bitter smoke into the laboratory room. A leaking mass spectroscopy tube of uranium hexafluoride will release wisps of white smoke comprised of uranyl fluoride and hydrogen fluoride.

Other chemicals, however, do not have good warning properties, because they can not be detected at low levels by the senses, their smell is not persistent over time, or because they are not detectable at all by human senses. In the latter category are chemicals such as metallic mercury, carbon monoxide, or inert gases, which are completely undetectable although they cause serious or even fatal adverse health effects. Hydrogen sulfide can be readily detected by its smell for the first few breaths, but

later cannot be smelled because it fatigues the sense of smell. Thus, one should not rely on one's senses for warning about hydrogen sulfide, because its acrid, rotten eggs smell is not persistent. Other chemicals have poor warning properties because by the time they have been detected by smell, the employee is already over the exposure limit. A good example of this would be methyl alcohol (methanol) which has an odor threshold of 400 ppm and an OSHA PEL of 200 ppm.

Over-exposure to a chemical can cause mild to serious adverse health effects to occur. Solvent exposure may cause light-headedness, dizziness, loss of feeling at the extremities, shaking at the extremities, headache, nausea, coughing, wheezing, difficulty breathing, or loss of vision. These effects may occur during exposure, after the end of the shift, or in a cycle which begins and continues during the week and clears up during the weekend. Anyone experiencing these problems must report them immediately to their supervisor and go to the Company Medical Review Officer.

11.0 WORK AREA MONITORING AND PERMISSIBLE EXPOSURE LIMITS

In accordance with the OSHA Chemical Hygiene Standard, Quadrex shall measure employee's exposure to any substance regulated by an OSHA standard for which there is reason to believe that the action level (or exposure limit) might be exceeded. If the action level is exceeded, monitoring will continue periodically as required by the relevant standard. When periodic monitoring shows that the action level is no longer exceeded, the periodic monitoring shall cease as allowed by the relevant standard. Within 15 days of receipt of results of air sampling, employees shall be informed in writing of the contaminant concentrations measured in the air samples. Air monitoring results will be maintained by Regulatory Compliance, and will be available to laboratory workers upon request.

These air samples shall be used to:

1. determine levels of exposures to workers for various atmospheric contaminants;

2. determine the effectiveness of engineering control measures;

3. determine compliance with OSHA or ACGIH limits for airborne contaminants;

4. evaluate recognized health hazards for new or changed operations;

5. follow-up on medical findings or requests;

6. investigate factual basis for employee complaints; and

7. comply with requests for air sampling information from management.

12.0 EMPLOYEE INFORMATION AND TRAINING

Information and training is provided to employees to ensure that all individuals who are at risk in working around hazardous chemicals are adequately informed of the hazards of the chemicals in their work area, of the risks involved in working with these chemicals, and what to do if an accident occurs.

Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be one year. Supervisors are responsible for ensuring that their employees are informed and trained.

12.1 Information and Training

Employees shall be informed and trained in the following areas:

12.1.1 the contents of 29 CFR 1910.1450 and its appendices which shall be made available to the employees;

12.1.2 the location and availability of this Laboratory Chemical Hygiene Plan;

12.1.3 the availability of permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

12.1.4 signs and symptoms associated with exposures to hazardous chemicals used in the laboratory;

12.1.5 the location and availability of known reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets (MSDS) received from the chemical supplier;

12.1.6 the physical and health hazards of chemicals in the work area; and

12.1.7 the measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

13.0 MEDICAL EXAMINATIONS/MONITORING

The opportunity to receive medical attention and follow-up exams will be provided to employees under the following circumstances:

- whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed to;
- when exposure monitoring reveals that an employee is exposed to levels greater than the PEL (or action level if the chemical has one), medical surveillance shall be established as prescribed by the appropriate OSHA standard; and
- when an event takes place (i.e., lead, spill, explosion) resulting in the liklihood of a hazardous exposure to an employee, the employee shall be provided with an opportunity for a medical examination.

14.0 EMERGENCY RESPONSE TO SPILLS AND ACCIDENTS

14.1 Personnel shall be familiar with the hazards of the chemicals with which they are working and the steps to take if a spill or accident occurs. In general, minimize the exposure by thoroughly flushing the affected area in running water and removing contaminated clothing and obtaining immediate medical attention. If the reagent is hydrofluoric acid, wash the affected area for at least 15 minutes and then get immediate medical attention.

14.2 The following equipment is available to be used in the event of a spill or accident with a chemical:

14.2.1 *Safety Showers* are located in each individual laboratory room. Personnel should learn the location of the safety shower nearest their work area. It is easy to find and pull the chain or rod, even for a person temporarily blinded by a foreign material. Doors

should not be opened where they would block access to it and all floor materials should be kept clear of the shower. Use the shower immediately if a considerable quantity of acid of alkali is spilled on your clothing or your head or face.

14.2.2 *Eye Wash Fountains* are located in strategic locations in the laboratory. Employees must familiarize themselves with the location of the eye wash fountain nearest your work area.

14.2.3 *Spill Control Kits*. There are mercury spill cleanup chemicals with the kits in the areas where mercury is used, and personnel in these work areas must be trained on the use of these kits.

14.3 Metals

14.3.1 *Alkali metals* (e.g., sodium and potassium) react violently with water and decompose the water to give off hydrogen which may be ignited by the heat of reaction. Alkali metals can also ignite spontaneously in air, especially when the metal is in powdered form and/or the air is moist.

Suggestions for safe use and storage:

- Store alkali metals under mineral oil or kerosene. Avoid using oils containing sulfur since a hazardous reaction may occur.
- Use only special, dry powder fire extinguishers on alkali metal fires.
- Any waste alkali metals should be placed in a labeled, leak proof container, covered with mineral oil and disposed of with direction from Regulatory Compliance.

14.3.2 *Metal Powders*

Finely powdered metals that come in contact with acids may ignite and burn. Metal powders can also create a dust explosion hazard when the powders become airborne in area where a spark or flame is present. In addition, metal powders are subject to rapid oxidation which may result in a fire or explosion.

14.4 Chemical Spills

14.4.1 *General*

Chemical spills can be handled effectively if some preplanning has been conducted. Individuals should become familiar with proper cleanup procedures before a spill occurs. This preplanning should include consideration of:

- potential location of the spill;
- quantities of material that might be released;
- chemical and physical properties of the material (e.g., its physical state, vapor pressure, and air or water reactivity);
- hazardous properties of the material; and
- the types of personal protective equipment that might be needed.

14.4.2 *Spill Kits*

Cleanup material shall be available in the laboratory. These materials shall include:

- neutralizing agents such as sodium carbonate or sodium bisulfate;
- absorbants such as vermiculite. Paper towels, rags and sponges may be used, but caution should be exercised because some chemicals may ignite upon contact with them; and
- spill kit specifically for mercury.

Commercial spill kits are available that have instructions, absorbants, reactants and protective equipment. For additional information on commercial spill kits, call Regulatory Compliance.

14.4.3 *Emergency Procedures*

If a spill does occur, the following general procedures may be

used but should be tailored to individual needs:

- Attend to any person who may have been contaminated.
- Notify individuals in the area about the spill.
- Evacuate nonessential personnel.
- If the spilled material is flammable, turn off ignition and heat source.
- Avoid breathing vapors of spill material. If necessary, use a respirator.
- Leave on or establish exhaust ventilation if it is safe to do so. Please note that most air handling units are recirculating.
- If a spill is large or involves a highly toxic material or carcinogen, call Regulatory Compliance.

14.4.4 *Spill Cleanup Procedures:*

Flammable Liquids - All flames should be extinguished and spark producing equipment turned off. The spilled liquid should be absorbed and the absorbing material should be placed in a plastic bag and kept away from sources of ignition. This material should be handled in cooperation with Waste Management for disposal.

Toxic Chemicals - All flames should be extinguished, all spark-producing equipment turned off, and all experiments shut down. The room should be evacuated until it is decontaminated. In the case of volatile liquids or poisonous gases, respiratory protection should be worn when entering the room. Call Regulatory Compliance for information on how to deal with a toxic chemical spill.

Acids or Alkalis - Do not neutralize the spilled liquid unless you are sure that the resulting reaction will not release hazardous fumes or cause explosion. Otherwise, neutralize the spilled liquid and absorb it.

Mercury - Droplets and pools of mercury metal can be pushed

together and then collected by suction by using an aspirator bottle with a long capillary tube or a vacuum device made from a filtering flask, a rubber stopper, and several pieces of flexible and glass tubing. Cover droplets of mercury in nonaccessible crevices with calcium polysulfide and excess sulfur. Dispose of this material in the same manner as hazardous chemical waste.

Alkali Metals - Smother the spill with a special, dry powder extinguisher.

14.4.5 The following steps should be followed in case of fire:

Sound the alarm for others in the area and call the emergency number, 911. Remain calm, give your name and the location of the fire in detail.

When aware of a fire, you should:

- turn off all electrical appliances (except corridor lighting);
- close all doors and windows to contain the fire;
- if the fire is small and you feel you can safely extinguish it, do so with the **PROPER** fire extinguisher installed in the area; and
- evacuate the building to a safe area at least 50 feet from the structure.

When leaving the building, you should:

- be sure to use protected stairways; never use an elevator; the power may fail and you could become trapped;
- in areas filled with smoke, keep low to the floor to breathe better;
- never attempt to jump from a multi-story building! Stay near a window; hang a sheet, towel or other object outside and wait for rescue by the fire department;
- once you have evacuated the building, **STAY OUT**; do not re-

enter for any reason; and

- stand by to give emergency personnel and vehicles directions to the fire location.

Before a fire occurs, you should:

- learn the location of fire exits and fire extinguishers where you work and when traveling--it may save your life;
- maintain exit corridors clear of all obstructions; and
- keep doors labeled "Fire Doors" closed unless equipped with automatic self-closing devices connected to the building fire alarm system.

15.0 WASTE DISPOSAL

Hazardous waste chemicals as defined by the U.S. Environmental Protection Agency as either listed chemicals or those which exhibit one or more of the following characteristics: ignitability, corrosivity, reactivity, or toxic materials which can be leached from the waste by the Toxicity Characteristic Leaching Procedure (TCLP). Examples of such wastes in Quadrex laboratories are: acetone, xylene, and methyl chloroform. Compatible materials are segregated into categories which are collected in separate containers in satellite accumulation areas. When waste containers in satellite accumulation areas are almost filled, then they are labelled, paperwork is completed, and they are transferred to Waste Operations for disposal by a licensed off-site hazardous chemical disposal operator. Due to the stringent requirements for handling these waste and the costs of storing and disposing of them, hazardous waste generation should be minimized.

16.0 SIGNS AND LABELS

16.1 Signs

Signs are used to warn employees of chemical and physical dangers. Examples of these are: designated areas where a select carcinogen or highly toxic chemical is used; high noise level areas where hearing protection must be used; or high voltage equipment areas. Signs are also used throughout laboratories to warn of safety and emergency equipment: fire alarms, fire extinguishers, fire exits, eyewashes, safety showers, fire blankets, etc. RCRA satellite accumulation areas are also posted with

several required signs.

16.2 Labels

Labels attached to containers of chemicals are essential to communicating physical and health hazards of their contents. It is required by the Hazard Communication Program that labels on incoming chemicals are not removed. If chemicals are transferred into another container, then it too must be labelled with the NFPA diamond giving its health (blue), fire (red), and reactivity (yellow) ratings, plus any other special warning in the white square, such as use no water. All unknown chemicals are to be treated as hazardous, until they can be identified. All chemicals prepared for shipment and use outside the laboratory must have Material Safety Data Sheets (MSDS) prepared for them. MSDS's are required when ordering each chemical for the first time. They are updated as they are revised by the chemical supplier and kept accessible to employees using those chemicals. A list of chemicals used in the laboratory is maintained in MSDS binders in the laboratory area. If the chemical label supplied by the vendor does not identify material compatibility, carcinogenicity, and/or high toxicity, then such warnings shall be added to the container prior to stocking or distribution, if appropriate.

17.0 RECORDS

Records will be generated either as part of compliance with the OSHA 29 CFR 1910.1450 standard or from other health and safety programs. This section summarizes the kinds of records collected, who holds them, and how long they are maintained.

17.1 *Accident records* are maintained by Regulatory Compliance.

17.2 *Air sample exposure records* are collected for chemical air contaminants. Copies of these records are maintained for 30 years. Such records are available to the employees. Regulatory Compliance maintains all air sample records.

17.3 *Fire extinguisher inspection records* are maintained by Regulatory Compliance.

17.4 *Fume Hood test records* are maintained by Regulatory Compliance.

17.5 *Lists of chemicals* are maintained by Regulatory Compliance as required by the site Hazard Communication Program.

17.6 *Material Safety Data Sheets* (MSDS) are maintained by Regulatory Compliance for all chemical materials used at Quadrex. Copies of MSDS's are provided in a notebook which is updated as new chemicals are received.

17.7 *Medical records* including periodic physical exams, occupational injuries and illnesses, incident investigation reports, and the Physicians Written Opinion required by the medical monitoring section of the Chemical Hygiene Plan, shall be maintained for 30 years. Such records shall be treated as confidential and be made available to employees or their legally designated representatives according to the OSHA medical records standard (29 CFR 1910.20).

17.8 *Respirator medical approval, training and fit-testing records* are maintained by Regulatory Compliance.

18.0 HOUSEKEEPING, MAINTENANCE, AND INSPECTIONS

18.1 Good housekeeping practices shall be adhered to, to ensure an orderly, clean working environment and help to minimize unforeseen events and their unwanted consequences. These practices include the following:

18.1.1 Keep individual work area clean and orderly.

18.1.2 Have the floors cleaned regularly and keep them dry.

18.1.3 Report any spill to your supervisor.

18.1.4 Clean up spills quickly and safely, in the approved manner.

18.1.5 Discard cracked or chipped beakers or other defective laboratory glassware to prevent cuts and spills.

18.1.6 Place waste in its proper receptacles.

18.1.7 Rinse glassware thoroughly and empty reagent bottles and jars before placing them in the receptacles for waste glass.

18.1.8 Store all chemical supplies and personal protective equipment properly.

18.1.9 Keep clear all hallways, aisles, and stairways of trip hazards. They shall not be used as chemical storage areas, unless

chemicals are stored in a locked storage cabinet, which is identified as to its owner and contents, and which does not block the aisle.

18.1.10 Keep clear access to exits, emergency equipment (eyewash stations, safety showers, and fire extinguishers), utility controls and certain electrical equipment.

18.2 Proper maintenance and testing of equipment shall be done to ensure that safety equipment and supplies are available and working properly when needed. These tasks include the following:

18.2.1 Laboratory Manager shall ensure that permanently installed eye wash fountains are inspected and tested weekly.

18.2.2 Laboratory Manager shall ensure that safety showers are inspected and tested annually.

18.2.3 Velocity flows of laboratory hoods and glove boxes shall be tested annually by Regulatory Compliance.

18.2.4 Fire extinguishers shall be checked monthly and maintained by Regulatory Compliance. If a fire extinguisher is used or found to be depleted, notify Regulatory Compliance.

18.2.5 Spill control kits shall be maintained and resupplied when necessary. A spill control kit must be maintained at each hazardous waste satellite accumulation area.

18.2.6 Personal protective and emergency response equipment shall be maintained in proper working order and an adequate supply kept in stock.

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Benzene	Am. Burdick & Jackson	1 kg/Lab
Benzoic Acid	Mallinckrodt Inc.	500 g/Lab
Benzyl Chloride, 99%	Aldrich Chemical Co.	50 g/Lab
Biphenyl	Mallinckrodt Inc.	1 kg/Lab
Bis(2-Chloroethoxy)methane	Chem Service, Inc.	2 g/Lab
Bis(2-chloroisopropyl)ether	Chem Service, Inc.	14.22 g/Lab
Bleach, White Arrow	Astor Products	17 gals/Mezzanine
Bonding Additive, 413	Tennant	4 pts/Warehouse
Brazing Flux	Engelhard	7 oz/Warehouse
Brom Thymol Blue Indicator Solution	Hach Company	.5 oz/Lab
Bromine Water	Ricca Chemical Co.	2350 ml/Lab
Bromobenzene, 99+%	Aldrich Chemical Co.	50 ml/Lab
Bromodichloromethane, 98%	Aldrich Chemical Co.	10 g/Lab
Bromoform, 99+%	Aldrich Chemical Co.	50 g/Lab
Bromothymol Blue, ACS Reagent	Aldrich Chemical Co.	50 g/Lab
Butyl Alcohol, n-	Am. Burdick & Jackson	1 kg/Lab
Cadmium Reference Standard Solution	Fisher Scientific	250 ml/Lab
Calcium Chloride Anhydrous	Mallinckrodt Inc.	400 g/Lab
Calcium Chloride Dihydrate, 98+%, ACS Reagent	Aldrich Chemical Co.	450 g/Lab
Calcium Hydroxide	Mallinckrodt Inc.	250 g/Lab
Calibrating Buffer, pH 10	Baxter Chemical Co.	1 pt/Lab
Calibrating Buffer, pH4	Baxter Chemical Co.	5 pt/Lab
Calibrating Buffer, pH5	Baxter Chemical Co.	5 pt/Lab
Carbon Dioxide	FL Compressed Gases	2 cyl/Lab
Carbon Disulfide	Aldrich Chemical Co.	2775 ml/Lab
Carbon Tetrachloride	Am. Burdick & Jackson	1 kg/Lab
Catalyst Reducer R7K44	Sherwin Williams	2 gals/Paintbooth
Catalyst R-3010	Randolph Products	1 pt/Paintbooth
Chlordane, mix of isomers	Chem Service, Inc.	2 g/Lab
Chloroacetaldehyde	Aldrich Chemical Co.	250 ml/Lab
Chlorobenzene, Anhydrous, 99+%	Aldrich Chemical Co.	75 ml/Lab
Chlorodibromomethane	Chem Service, Inc.	2 ml/Lab
Chloroethane	Chem Service, Inc.	5 g/Lab
Chloroethane, Anhydrous, 2.0M Solv. in Diethyl Ether	Aldrich Chemical Co.	200 ml/Lab
Chloroethyl Ethyl Sulfide, 2-	Fairfield Chem. Co.	100 g/Lab
Chloroethyl Vinyl Ether, 2-	Aldrich Chemical Co.	25 g/Lab
Chloroform	Am. Burdick & Jackson	3 l/Lab
Chloroform	Mallinckrodt Inc.	100 g + 10 l/Lab
Chloromethane, Anhydrous 1.0M Sol. in Diethyl Ether	Aldrich Chemical Co.	200 ml/Lab
Chlorothene SM Solvent	Dow Chem. Co.	2 oz/Lab
Chlorotoluene, 2-	Aldrich Chemical Co.	100 g/Lab
Chromerge	Manostat Corporation	1.6 gal/Lab
Chromium Reference Standard Solution	Fisher Scientific	450 ml/Lab
Chromium Trioxide	Fisher Scientific	5.5 lbs/Whse; 100g/Lab
Citric Acid	Mallinckrodt Inc.	250 g/Lab
Classic 99 Enamel A26W11 & A26W12	Sherwin Williams	.5 gal/PB; 1 gal/Mezz.
Classic 99 Wall Paint A27W10	Sherwin Williams	2 gals/Mezzanine
Classic Plastic	The Clausen Co.	1 qt/Mezzanine
Claw Glas Fiberglass Filler	The Clausen Co.	1 qt/Mezzanine
Cobalt Chloride	Mallinckrodt Inc.	125 g/Lab
Comet	Proctor & Gamble	20-21 oz/Jan. Supply
Contact Adhesive, Multi-Purpose	Macklanburg-Duncan	1 gal/Paintbooth
Copper Heavy Foil	J.T. Baker	500 g/Lab
Coumarin 311	Sigma Chemical Co.	25 g/Lab
Cream Hardener	Catalyst Systems	4 oz/Mezzanine
Cumene	Chem Service, Inc.	15 g/Lab
Cupric Sulfate	Fisher Scientific	2.25 kg/Lab
Cyclohexane	Chem Service, Inc.	10 g/Lab
Cyclohexanone	Mallinckrodt Inc.	500 ml/Lab
Decroion Spray Enamel	Sherwin Williams	29-16 oz cans/LSV Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
1,3-Dichloro-2-propanol	Chem Service, Inc.	1 oz/Lab
5-Methyl-2-Hexanone	Aldrich Chemical Co.	50 g/Lab
95% Argon/5% Methane (Compressed Cyl.)	Air Products	4 cyl/Lab
a,a-Dibromo-m-Xylene, 97%	Aldrich Chemical Co.	25 g/Lab
a,a-Dibromo-o-Xylene, 96%	Aldrich Chemical Co.	75 g/Lab
Ace Out Porcelain Cleaner	Ace Supply	5 qts/Jan. Supply
Acetaldehyde, 99%	Aldrich Chemical Co.	200 g/Lab
Acetic Acid Glacial	Mallinckrodt Inc.	1000 ml/Lab
Acetone	Am. Burdick & Johnson	94.5 l/Lab
Acetone	Baxter Chemical Co.	32 L/Warehouse
Acetonitrile	Chem Service, Inc.	10 g/Lab
Acetonitrile	Mallinckrodt Inc.	1 gal/Lab
Acetophenone	Chem Service, Inc.	10 g/Lab
Acrolein	Chem Service, Inc.	98 g/Lab
Acrylic Enamel/Black B66B11	Sherwin Williams	.75 gal/Paintbooth
Acrylic Latex Paint	Glidden	2 gals/Mezzanine
Activated Carbon	Bacharach Inc.	75 g/Lab
Adhesive for Lt. Wall Cork, Manton Adhesive #404	NY Bronze Powder Co.	1 qt/Mezzanine
Aircraft Remover (Paint Stripper) Klean Strip	William Barr, Inc.	1 gal/Paintbooth
Alumina Absorption	Fisher Scientific	9 lbs/Warehouse
Aluminum Potassium Sulfate	Fisher Scientific	500 g/Lab
Aluminum Sulfate (crystals)	Mallinckrodt Inc.	525 g/Lab
Amberlite	Rohm & Haas Co.	300 g/Lab
Ammoniated Anti-Fog Cleaning Solution	USD Corporation	3 pts/Warehouse
Ammonium Chloride	Mallinckrodt Inc.	500 g/Lab
Ammonium Hydroxide	Mallinckrodt Inc.	350 mg/Lab
Ammonium Myristate	Chem Service, Inc.	10 g/Lab
Ammonium Phosphate	Fisher Scientific	500 g/Lab
Ammonium Sulfate	Fisher Scientific	500 g/Lab
Analytical Filter Aid (CAFA)	Manville	300 g/Lab
Analytical Grade Anion Exchange Resin	Bio-Rad Labs	500 g/Lab
Analyzed Reagent (Lead Granular)	J.T. Baker	250 g/Lab
Aniline, 99+%	Chem Service, Inc.	5 g/Lab
Aniline, 99.5+%, ACS Reagent	Aldrich Chemical Co.	100 g/Lab
Antifoam A Compound	Dow Corning	1 lb/Lab
Antifoam B Silicone Emulsion	J.T. Baker	100 ml/Lab
Anti-Rust Primer	Sears	12 oz/Warehouse
Arochlor 1016	Chem Service, Inc.	10 ml/Lab
Arochlor 1221	Chem Service, Inc.	.5 g/Lab
Arochlor 1242	Chem Service, Inc.	7 ml/Lab
Arochlor 1242	Supelco, Inc.	1 ml/Lab
Arochlor 1248	Chem Service, Inc.	5 g + 2 ml/Lab
Arochlor 1254	Chem Service, Inc.	10 ml/Lab
Arochlor 1260	Chem Service, Inc.	5 ml/Lab
Arochlor 1262	Chem Service, Inc.	5 ml/Lab
Arochlor 1268	Chem Service, Inc.	5 ml/Lab
Aromatic Volatile Organics Mixture	Chem Service, Inc.	10 ml/Lab
Arsenic Reference Standard Solution	Fisher Scientific	350 ml/Lab
Arsenic Trioxide, Solid	Fisher Scientific	100 g/Lab
Auto Transmission Dexron II	Valvoline	10.5 gals/Mezzanine
AW Hydraulic Oil 32	Chevron	5 gals/Mezzanine
A-33	Airkem	1 gal/Mezzanine
a-Bromo-2,6-Dichlorotoluene	Aldrich Chemical Co.	100 g/Lab
Barium Chloride	Fisher Scientific	100 g/Lab
Barium Hydroxide	Mallinckrodt Inc.	975 g/Lab
Barium Hydroxide	Sigma Chemical Co.	1 kg/Lab
Barium Reference Standard Solution	Fisher Scientific	250 ml/Lab
Base B54W103	Sherwin Williams	.5 gal/Mezzanine
Basic Fuchsin	Fisher Scientific	75 g/Lab
BBL Yeast Extract, ext. of autolyzed yeast cells	Becton Dickinson	600 g/Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Delstar Acrylic Enamel DAR33127	PPG	1 gal/Paintbooth
Delstar Acrylic Enamel DAR3331-K	PPG	1 gal/Paintbooth
Delstar Acrylic Enamel DAR41754SC	PPG	1 gal/Paintbooth
Delstar Acrylic Enamel DMR451	PPG	.5 gal/Paintbooth
Delstar Enamel DAR 33131	PPG	1 gal/Paintbooth
Delthane Ultra DXR80	PPG	1 pt/Paintbooth
Denatured Proprietary Ethanol	Am. Scientific Products	3.5 gal/Lab
Detro Enamel 7300 Booth Coating (Strippable)	Detro Mfg.	1 gal/Paintbooth
Dibromomethane	Chem Service, Inc.	50 g/Lab
Dichlorobenzene, 1,3-	Chem Service, Inc.	.5 g/Lab
Dichlorobenzene, 1,4-	Aldrich Chemical Co.	100 g/Lab
Dichlorobenzene, 1,4- 5G	Supelco, Inc.	5 g/Lab
Dichlorobenzene, m- (EXP 2-91)	Chem Service, Inc.	1 oz/Lab
Dichlorobenzene, o-	Chem Service, Inc.	10 g/Lab
Dichlorobenzene, p- (EXP 1-91)	Chem Service, Inc.	34 g/Lab
Dichlorodifluoromethane	Chem Service, Inc.	5 ml/Lab
Dichloroethane, 1,1-	Chem Service, Inc.	3 g/Lab
Dichloroethane, 1,2-, 99.8% HPLC Grade	Aldrich Chemical Co.	1000 ml/Lab
Dichloroethylene, 1,2-	Aldrich Chemical Co.	50 g/Lab
Dichloromethane, HPLC	Aldrich Chemical Co.	500 ml/Lab
Dichlorophenoxyacetic Acid, 2,4-	Aldrich Chemical Co.	100 g/Lab
Dichloropropane, 1,2-	Aldrich Chemical Co.	100 g/Lab
Dichloropropane, 1,2	Chem Service, Inc.	5 g/Lab
Diethylenetriamine, 95%	Aldrich Chemical Co.	1 kg/Lab
Diisopropane (EXP 11-90)	Chem Service, Inc.	20 g/Lab
Diluent Motor Oil	NBS Standard Ref. Matl.	100 ml/Lab
Dimethyl Methyl Phosphonate	Pfaltz & Bauer	250 g/Lab
Dinitrotoluene, 2,4-	Aldrich Chemical Co.	75 g/Lab
Dioxane, 1,4-, 99+%	Aldrich Chemical Co.	25 ml/Lab
Dioxane, 1,4-, 99.8%, HPLC Grade	Aldrich Chemical Co.	500 ml/Lab
Diphenylcarbazone, 2-	Mallinckrodt Inc.	25 g/lab
Diphenylcarbazone-Bromophenol Blue Ind. Soln.	Mallinckrodt Inc.	.75 l/lab
Diphenyloxazole, 2,5-	Sigma Chemical Co.	50 g/Lab
Diphenylthiocarbazone	Sigma Chemical Co.	10 g/Lab
Dipropylamine	Chem Service, Inc.	1 oz/Lab
Dipropylamine (EXP 11-90)	Chem Service, Inc.	15 g/Lab
DMSO	American Marketing	16 oz/Lab
Dowex 1-X8 (Anion Exchange Resin)	Bio-Rad Labs	475 kg/Lab
Dowex-50W-Hydrogen	Sigma Chemical Co.	100 g/Lab
DP40 Primer DAR6531	PPG	1 pt/Paintbooth
Drierite (CaSO4)	W.A. Hammond Drierite Co.	1 lb/Lab
DSX 1900 Bonding Clear	PPG	1 gal/Paintbooth
Dust Mop Treatment	Gator Chemical	1 can/Jan. Supply
D(+)Galactose	Sigma Chemical Co.	8 g/Lab
D(+)Xylose	Fisher Biotech	1500 g/Lab
D(+)Xylose	Sigma Chemical Co.	4.5 kg/Lab
D(+)-Mannose (Mixed Anomers)	Sigma Chemical Co.	10 g/Lab
D(-)Arabinose	Sigma Chemical Co.	105 g/Lab
D-Sorbitol, 99+%	Aldrich Chemical Co.	75 g/Lab
D-Xylose	Fisher Scientific	100 g/Lab
D-Xylose, 99+%	Aldrich Chemical Co.	150 g/Lab
Easy Scrub	Airkem	2 qts/Mezz.; 5 qts/Jan.Supp
Enamel, Lead-Free Safety B54Y37	Sherwin Williams	1 gal/Mezzanine
Enamel DAR60346K	PPG	2 qts/Paintbooth
Enamel Reducer DTR602	PPG	.5 gal/Paintbooth
Endrin, 99.0%	Chem Service, Inc.	1.5 g/Lab
Engine Oil, 2 cycle	Whitco Corp.	24 oz/Mezzanine
Epoxi-Patch	Hysoc	28 oz/Warehouse
Epoxy Primer Catalyst DP401	PPG	1 gal/Paintbooth
Epoxybutane, 1,2-	Aldrich Chemical Co.	200 ml/Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Ethoxyethanol, 2-	Aldrich Chemical Co.	75 ml/Lab
Ethyl Acetate	Am. Burdick & Jackson	500 ml/Lab
Ethyl Alcohol Denatured	Mallinckrodt Inc.	.5 gal/Lab
Ethyl Alcohol (EXP 4-91)	Chem Service, Inc.	20 g/Lab
Ethyl Ether	Am. Burdick & Jackson	25 ml/Lab
Ethyl Ether	Mallinckrodt Inc.	1000 g/Lab
Ethylbenzene	Chem Service, Inc.	10 g/Lab
Ethylene Chloride	Chem Service, Inc.	5 g/Lab
Ethylene glycol	Chem Service, Inc.	20 g/Lab
Ethylene glycol dimethyl ether, 99+%,spect grade	Aldrich Chemical Co.	500 ml/Lab
Ethylenedinitrilo tetraacetic acid disodium salt	Mallinckrodt Inc.	75 g/Lab
Ethylhexadecyldimethylammonium Bromide	Eastman Kodak Co.	100 g/Lab
E-Z Kit Adhesive, HE 17017	Hartel Plastics	8 oz/Warehouse
Ferric Chloride	Mallinckrodt Inc.	750 g/Lab
Ferric Sulfate	Mallinckrodt Inc.	1000 g/Lab
Ferrous Chloride	Mallinckrodt Inc.	500 g/Lab
Ferrous Sulfate	Mallinckrodt Inc.	500 g/Lab
Fiske & Subarrow Reducer	Sigma Chemical Co.	25 g/Lab
Floor Tile Adhesive 3057	Roberts Consolidated Industries	1 gal/Mezzanine
Florosil	Supelco, Inc.	.25 lb/Lab
Fluorescein	EM Science	25 g/Lab
Fluorescein Sodium	Sigma Chemical Co.	25 g/Lab
Fluorotrichloromethane	Aldrich Chemical Co.	100 ml/Lab
Formic Acid Sodium	Sigma Chemical Co.	500 g/Lab
Freon TA Solvent	DuPont	1000 ml/Lab
Furaldehyde, 2-	Sigma Chemical Co.	100 g/Lab
Furan	Aldrich Chemical Co.	100 ml/Lab
Furan	Chem Service, Inc.	5 g/Lab
Furfural	Eastman Kodak Co.	.5 gal/Lab
Gas Detector	Highside Chemical	32 oz/Warehouse
Gilsonite Asphalt Driveway C[illegible]	Gate Roofing	5 gals/Mezzanine
Glass Beads	Fisher Scientific	250 g/Lab
Halogenated Volatile Organics	Chem Service, Inc.	10 ml/Lab
Helium	Union Carbide Corp.	2 cyl/Lab
Heptachlor, 99.0%	Chem Service, Inc.	2 g/Lab
Heptane HPLC	Aldrich Chemical Co.	500 ml/Lab
Hexachlorobenzene	Chem Service, Inc.	10 g/Lab
Hexachlorocyclohexane, 1,2,3,4,5,6-	Aldrich Chemical Co.	100 g/Lab
Hexachloroethane, 99%	Aldrich Chemical Co.	100 g/Lab
Hexachloro-1,3-Butadiene	Aldrich Chemical Co.	50 g/Lab
Hexane	Am. Burdick & Jackson	12 gal/Lab
Hexane	Baxter Chemical Co.	24 L/Warehouse
Hexane Non-Spectro	Baxter Chemical Co.	116 l/Lab
Hexane UV	Baxter Chemical Co.	24 l/Lab
High Purity Standards 1000 ug/ml: Fe	High Purity Standards	250 ml/Lab
High Purity Standards 1080 ug/ml: Mg	High Purity Standards	250 ml/Lab
High Purity Standards Waveeal Soln ug/ml in 2% HCl	High Purity Standards	150 ml/Lab
Hi-Clear Glass Cleaner	Ace Supply	6 cans/Jan. Supply
House Paint A-100 ABB512	Sherwin Williams	4 gals/Mezzanine
Hydrochloric Acid, 37%	Mallinckrodt Inc.	4 gal + 1500 ml/Lab
Hydrogen	Union Carbide Corp.	2 cyl/Lab
Hydrogen Peroxide	VWR Scientific Inc.	400 ml/Lab
Hydrogen Peroxide Solution, 30%	Mallinckrodt Inc.	500 ml/Lab
Hydrogen Peroxide Solutions	Fisher Scientific	500 ml/Lab
Hydroxylamine HCL Grade I	Sigma Chemical Co.	500 g/Lab
Hydroxylamine Hydrochloride (Crystals)	Mallinckrodt Inc.	1000 g/Lab
Indicator pH 3-4	Mallinckrodt Inc.	20 g/Lab
Indicator pH 6-7	Mallinckrodt Inc.	25 g/Lab
Industrial Maintenance Coating/B54W101 Pure White	Sherwin Williams	1.5 gals/Paintbooth
Industrial Maintenance Coating/B54Y17 Osha Yellow	Sherwin Williams	2.25 gals/PB; 8 gals/Mezz.

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Insecticide II	Waterbury Co.	10 oz/Mezzanine
Installation Solution, 2% HNO	Leeman Labs	100 ml/Lab
Iron Fillings	Mallinckrodt Inc.	500 g/Lab
Isobutyl Alcohol	Mallinckrodt Inc.	400 ml/Lab
Isooctane	Am. Burdick & Jackson	11.5 l/Lab
Isopropyl Alcohol	Am. Burdick & Jackson	14 l/Lab
Iso-Amyl Alcohol (EXP 3-90)	Chem Service, Inc.	1 oz/Lab
Kerosene	Fisher Scientific	3 gal/Lab
Kerosene	Sunnyside Corp.	3 gal/Lab
Kodak Developer	Kodak	3 kg/Copy Room
Kodak Toner	Kodak	900 g/Copy Room
Krylon Interior/Exterior Enamel Spray Paint	Borden, Inc.	2 cans/Paintbooth
Krytox Fluorinated Grease	DuPont	12 oz/Warehouse
LaFinish Rust-Resistant Spray Finish	DeSoto Inc.	12- 12 oz cans/Mezzanine
Lauryl Sulfate Sodium	Sigma Chemical Co.	75 g/Lab
Lead Nitrate	Fisher Scientific	50 g/Lab
Lead Standard Reference Solution (1000 PPM PB)	Fisher Scientific	350 ml/Lab
Lead (II) Oxide, 99.999%	Aldrich Chemical Co.	2 g/Lab
Lemon Shine-Up	Johnson Wax	8 cans/Jan. Supply
LIDOK 000 Petroleum Oil	Exxon	5 gals/Mezzanine
Lift-It Butyl Cleaner	Dora Supply Co.	7 gals/Jan. Supply
Liquid Scintillation Standard (Cocktail)	Beckman	4 l/LSV Lab; 32 l Mezz.
Lithium Grease PT #609	Valvoline	3200 g/Mezzanine
Loctite 242	Loctite	450 ml/Warehouse
Loctite 277	Loctite	250 ml/Warehouse
Loctite 290	Loctite	250 ml/Warehouse
L(+)-Lactic Acid Lithium	Sigma Chemical Co.	15 g/Lab
L-Ascorbic Acid ACS Reagent	Sigma Chemical Co.	50 g/Lab
Magnesium Perchlorate, Anhydrous Mg	Bacharach Inc.	100 g/Lab
Magnesium Sulfate	Fisher Scientific	500 g/Lab
Magnesium Sulfate, Anhydrous	Mallinckrodt Inc.	250 g/Lab
Manganese Atomic Absorption	Mallinckrodt Inc.	400 ml/Lab
Manganese Chloride	Mallinckrodt Inc.	125 g/Lab
Manganese Reference Standard Solution, 1000PPM	Fisher Scientific	500 ml/Lab
Mercuric Acetate	Mallinckrodt Inc.	125 g/Lab
Mercuric Chloride	Sigma Chemical Co.	100 g/Lab
Mercuric Nitrate Monohydrate	Mallinckrodt Inc.	500 g/Lab
Mercury	Mallinckrodt Inc.	2.25 lb/Lab
Mercury Analyzer Reagent	Bacharach Inc.	450 ml/Lab
Mercury Analyzer Reagent 10% Stannous Chloride	Bacharach Inc.	400 ml/Lab
Mercury Analyzer Reagent 1.5% Hydroxylamine HCL	Bacharach Inc.	50 ml/Lab
Mercury Analyzer Reagent/48.3% Sulfuric Acid	Bacharach Inc.	250 ml/Lab
Mercury Analyzer/5% Potassium Permanganate	Bacharach Inc.	250 ml/Lab
Mercury Standard 1000 mg/l	Bacharach Inc.	250 ml/Lab
Methane	Union Carbide Corp.	1 cyl/Lab
Methoxychlor, 98%	Aldrich Chemical Co.	5 g/Lab
Methoxyethanol, 2-	Aldrich Chemical Co.	500 ml/Lab
Methyl Alcohol	Baxter Chemical Co.	9.5 gal/Lab
Methyl Alcohol, Anhydrous, 99+%	Aldrich Chemical Co.	950 ml/Lab
Methyl Bromide	Chem Service, Inc.	5 ml/Lab
Methyl Chloride	Chem Service, Inc.	5 ml/Lab
Methyl Ethyl Ketone	Am. Burdick & Jackson	1 kg/Lab
Methyl Orange ACS Reagent	Sigma Chemical Co.	100 g/Lab
Methyl Salicylate	Fisher Scientific	500 ml/Lab
Methylimidazole, 1-	Aldrich Chemical Co.	200 g/Lab
Methylpyrrole, 1-	Aldrich Chemical Co.	50 g/Lab
MinWax 2716 Dark Walnut	MinWax	1 gal/Mezzanine
MinWax Polyurethane	MinWax	2 qts/Mezzanine
Misc. Spray Paints	Misc.	6 cans/Warehouse
Mixed Solvents - Light	Ashland Chemical Co.	.5 gal/Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Molecular Biology Grade Cation Exchange Resin	Bio-Rad Labs	75 g/Lab
Molybdic Acid Ammonium Salt	Sigma Chemical Co.	85 g/Lab
Muriatic Acid	Sunnyside Corp.	.75 gal/Lab
M-Cresol	Aldrich Chemical Co.	100 g/Lab
M-xylene 5G	Chem Service, Inc.	15 g/Lab
Naphthalene	Chem Service, Inc.	38.5 g/Lab
Naval Jelly	Loctite	8 oz/Paintbooth
Nitric Acid	Mallinckrodt Inc.	19.75 l/Lab
Nitrobenzene	Chem Service, Inc.	10 g/Lab
Nitrobenzene	Eastman Kodak Co.	.5 gal/Lab
Nitrogen	Airco Welding Prod.	1 cyl/Lab
Nitrogen	Union Carbide Corp.	4 cyl/Lab
Nitromethane, 99+%	Aldrich Chemical Co.	100 ml/Lab
Nitropropane, 2-	Aldrich Chemical Co.	100 g/Lab
Nonane, Anydrous, 99+%	Aldrich Chemical Co.	75 ml/Lab
Nonane, n-	Chem Service, Inc.	4 g/Lab
NOSOL UTA 4	Kluber Lubrication	100 g/Warehouse
NUTO H46 Hydraulic Oil	Exxon	10 gals/Mezzanine
Octane, Anhydrous	Aldrich Chemical Co.	75 ml/Lab
Opti-Fluor	United Technologies	500 ml/Lab
Oxygen	Union Carbide Corp.	2 cyl/Lab
O-cresol, 99+%	Aldrich Chemical Co.	100 g/Lab
O-xylene	Chem Service, Inc.	5g/Lab
O-xylene, 98%, HPLC Grade	Aldrich Chemical Co.	500 ml/Lab
PCB QC Check Sample 1242-A, 5ml	Supelco, Inc.	500 mg + 1 ml/Lab
PCB QC Check Sample 1260-A	Supelco, Inc.	5 ml/Lab
Pecard Shoe Oil	Pecard Chem. Co.	1 gal/Mezzanine
Pentachlorobenzene	Chem Service, Inc.	2.5 g/Lab
Pentachlorophenol	Aldrich Chemical Co.	100 g/Lab
Pentane, HPLC	Aldrich Chemical Co.	500 ml/Lab
Phenol, Liquefied	Mallinckrodt Inc.	500 g/Lab
Phenolphthalein	Mallinckrodt Inc.	125 g/Lab
Phenolphthalein ACS Reagent	Sigma Chemical Co.	35 g/Lab
Phenolphthalein Certified ACS	Fisher Scientific	75 g/Lab
Phenylpiperazine, N-	Aldrich Chemical Co.	100 g/Lab
Plasma Standard/Nickel	Spex Industries	500 ml/Lab
Plasma Standard/Potassium	Spex Industries	500 ml/Lab
Plasma Standard/Sodium	Spex Industries	500 ml/Lab
Plasma Standard/Thallium	Spex Industries	500 ml/Lab
Plasma-Pure Custom Multi-element Std. 5% HNO3	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1000 ug/l Ca	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1000 ug/l Co	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1000 ug/l Mo	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1000 ug/l Na	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1001 ug/l Cu	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1001 ug/l Fe	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1002 ug/l Zn	Leeman Labs	250 ml/Lab
Plasma-Pure Standard Soln. 1080 ug/l Mg	Leeman Labs	250 ml/Lab
Polane B F63B13	Sherwin Williams	1 gal/Paintbooth
Polane B F63W13	Sherwin Williams	1 pt/PB; 1 gal/Mezz.
Polane Catalyst V66V44	Sherwin Williams	2 gals/Warehouse
Polane Plus F63W91 Gloss White	Sherwin Williams	1 gal+1 qt/Paintbooth
Polane Polyurethane Enamel F63BXA836	Sherwin Williams	1 gal/Paintbooth
Polane Reducer R7K69	Sherwin Williams	1 qt/Paintbooth
Polane Reducer R7K84	Sherwin Williams	1 gal/Paintbooth
Polar Isothermal Test Mix (2ml methylene chloride)	Supelco, Inc.	2 ml/Lab
Polyurethane T8207 Porch & Floor	Scotty's	6 gals/Mezzanine
Pool Brite pH Minus	EMSCO	32 oz/Warehouse
Pool Brite pH Plus	EMSCO	32 oz/Warehouse
Popop	Sigma Chemical Co.	25 g/Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Potassium Acid Phthalate	Mallinckrodt Inc.	120 g/Lab
Potassium Bromide ACS Reagent	Sigma Chemical Co.	5 g/Lab
Potassium Carbonate Anhydrous ACS Reagent	Sigma Chemical Co.	35 g/Lab
Potassium Chloride	Fisher Scientific	500 g/Lab
Potassium Chromate Certified ACS	Fisher Scientific	50 g/Lab
Potassium Dichromate	MCB Manufacturing Chemists	250 g/Lab
Potassium Hydroxide	Aldrich Chemical Co.	975 g/Lab
Potassium Hydroxide	Mallinckrodt Inc.	505 g/Lab
Potassium Iodide Neutral	Mallinckrodt Inc.	250 g/Lab
Potassium Oleate	Chem Service, Inc.	10 g/Lab
Potassium Permanganate	Mallinckrodt Inc.	1500 g/Lab
Potassium Permanganate	Sigma Chemical Co.	450 g/Lab
Potassium Persulfate	Mallinckrodt Inc.	500 g/Lab
Potassium Persulfate	Sigma Chemical Co.	450 g/Lab
Potassium Phosphate	Fisher Scientific	400 g/Lab
Potassium Phosphate Monobasic	Mallinckrodt Inc.	900 g/Lab
Potassium Phosphate Monobasic Anhydrous ACS Rgt.	Sigma Chemical Co.	350 g/Lab
Pre-Kleane 900 (Wax & Silicone Remover)	BASF Corp.	3 gal/Paintbooth
Primer B5ON26	Sherwin Williams	3 gals/Mezzanine
Propane Fuel	Copper Tools	2 lbs/Warehouse
Propanol, 1-, 99+%, HPLC Grade	Aldrich Chemical Co.	500 ml/Lab
Propanol, 2-	Fisher Scientific	.5 l/Lab
Propionic Acid, 2-(2,4,5-Trichlorophenoxy)-	Aldrich Chemical Co.	5 g/Lab
Propylene Glycol	Chem Service, Inc.	1 oz/Lab
Protein Standard (Human Serum Albumin&Globulin)	Sigma Chemical Co.	5 ml/Lab
Pyridine	Am. Burdick & Jackson	500 ml/Lab
Pyrophosphate Tetrasodium	Sigma Chemical Co.	500 g/Lab
Python Adhesive No. 1062	Lauren MFG	.5 gal/Lab
P-Cresol	Aldrich Chemical Co.	100 g/Lab
P-Cresol	Chem Service, Inc.	1 oz/Lab
P-Xylene, 99+%, HPLC Grade	Aldrich Chemical Co.	500 ml/Lab
P-Xylene, Anhydrous 99%	Aldrich Chemical Co.	300 ml/Lab
Quick Dry Enamel F77B1	Sherwin Williams	10 gals/Paintbooth
Ready Protein	Beckman	5 gal/Mezzanine
Ready-Mixed Joint Compound	US Gypsum	50 lbs/Mezzanine
Rubberized Undercoating	3M Corp.	2 cans/Paintbooth
Safe Step	Andesite of CA	400 lbs/Warehouse
Safest Stripper	3M Corp.	1.5 gal/Mezzanine
Sec-Butyl Alcohol (EXP 6-91)	Chem Service, Inc.	15 g/Lab
Selenium Reference Standard Solution, 1000 PPM	Fisher Scientific	250 ml/Lab
Silica Gel	W.R. Grace & Co.	25 g/Lab
Silicone Rubber GE012 Clear	GE Silicones	5.5 gals/Mezzanine
Silicone Transformer Fluid L-305	Union Carbide Corp.	4.75 oz/Lab
Silicone Transformer Liquid, 561	Dow Corning	1 gal/Warehouse
Silver Nitrate	Fisher Scientific	925 g/Lab
Silver Nitrate	Ricca Chemical Co.	32 oz/Lab
Silver Reference Standard Solution, 1000 PPM AG	Fisher Scientific	350 ml/Lab
Slic-Tite Thread Sealing Compound	Lake Chemical Co.	64 oz/Warehouse
Smoothie II 20242	Marson Corporation	1 pt/Paintbooth
Sodium Acetate Anhydrous ACS Reagent	Sigma Chemical Co.	25 g/Lab
Sodium Borohydride, 98% OR	Mallinckrodt Inc.	150 g/Lab
Sodium Carbonate Anhydrous	Mallinckrodt Inc.	800 g/Lab
Sodium Carbonate Solution	Sigma Chemical Co.	75 ml/Lab
Sodium Chloride	Mallinckrodt Inc.	900 g/Lab
Sodium Chlorite	Eastman Kodak Co.	250 g/Lab
Sodium Hydroxide 20-40 Mesh Beads, 97%	Aldrich Chemical Co.	2 kg/Lab
Sodium Hydroxide (Pellets)	Mallinckrodt Inc.	.25 kg/Lab
Sodium Metal	Mallinckrodt Inc.	Nailed shut-wood box/Lab
Sodium Metasilicate Pentahydrate	Sigma Chemical Co.	450 mg/Lab
Sodium Phosphate Dibasic, Anhydrous ACS	Sigma Chemical Co.	150 g/Lab

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Sodium Phosphate Dibasic Anhydrous	Mallinckrodt Inc.	125 g/Lab
Sodium Sulfate	J.T. Baker	300 g/Lab
Sodium Sulfate Anhydrous ACS Reagent	Sigma Chemical Co.	350 g/Lab
Sodium Thiosulfate Anhydrous	Mallinckrodt Inc.	250 g/Lab
Spray Paint, Spruce #98-4	Seymour	15 gals/Mezzanine
Stannous Chloride, Dihydrate	Fisher Scientific	5 g/Lab
Stannous Chloride (Crystals)	Mallinckrodt Inc.	1000 g/Lab
Starch Indicator	Mallinckrodt Inc.	1 l/Lab
Succinic Acid	Sigma Chemical Co.	50 g/Lab
Sulfuric Acid	Mallinckrodt Inc.	46 lbs + 400 ml/Lab
Sunisc Refrigeration Oil 3GS	VA KMP Corporation	1 gal/Mezzanine
Super Supreme Traffic Paint	Fox Valley Systems, Inc.	27- 18 oz cans/Mezzanine
Sure-Fix Concrete Patch	W.R. Bonsal Co.	2.5 lbs/Mezzanine
Sure-Mix Blacktop Sealer	W.R. Bonsal Co.	180 lbs/Mezzanine
Sylon CT	Supelco, Inc.	500 ml/Lab
Synesstic 32	Exxon	3 gals/Mezzanine
Teresstic 68 Turbine Oil	Exxon	5 gals/Mezzanine
Tetrabutylammonium Hydroxide	Mallinckrodt Inc.	100 ml/Lab
Tetrachlorobenzene, 1,2,3,4-	Chem Service, Inc.	.5 gr/Lab
Tetrachlorobenzene, 1,2,3,5-	Chem Service, Inc.	10 mg/Lab
Tetrachlorobenzene, 1,2,4,5-	Chem Service, Inc.	6 mg/Lab
Tetrachloroethane, 1,1,1,2-	Aldrich Chemical Co.	10 g/Lab
Tetrachloroethane, 1,1,2,2-	Aldrich Chemical Co.	125 ml/Lab
Tetradecane	Eastman Kodak Co.	800 ml/Lab
Tetradecane, 99%	Aldrich Chemical Co.	400 g/Lab
Tetradecane, n-	Sigma Chemical Co.	500 ml/Lab
Tetrahydrofuran	Chem Service, Inc.	24 g/Lab
Thiamine Hydrochloride	Fisher Scientific	75 g/Lab
Tile-Like Catalyst Coating 37800	Benjamin Moore	.75 Gal/Paintbooth
Tneme Converter 51B	Tnemec Protective Coatings	1 qt/Mezzanine
Tneme Liner 61A	Tnemec Protective Coatings	1 gal/Mezzanine
Toilet Bowl Cleaner	Ellison Sanitary Supply	3 gals/Mezzanine
Toluene	Am. Burdick & Jackson	2 gal/Lab
Toluidine, m- (EXP 12-90)	Chem Service, Inc.	10 g/Lab
Toluidine, o-	Chem Service, Inc.	10 g/Lab
Toluidine, p-	Chem Service, Inc.	8 g/Lab
Total Protein Reagent	Sigma Chemical Co.	500 ml/Lab
Touch-Up Paint for Transformers/Brown Glaze	Warco, Inc.	16 oz/Warehouse
Touch-Up Paint for Transformers/Gray Glaze	Warco, Inc.	16 oz/Warehouse
Toxaphene	Chem Service, Inc.	1.5 g/Lab
Toxigrams Blank B	Analytical Systems	5 g/Lab
Transformer Fluid, L-305	Union Carbide Corp.	4oz/Lab
Trans-1,3-Dichloropropene	Chem Service, Inc.	5 ml/Lab
Trichlorobenzene, 1,2,4-	Am. Burdick & Jackson	2 gal/Lab
Trichloroethane, 1,1,1-	Chem Service, Inc.	10 g/Lab
Trichloroethane, 1,1,2-	Aldrich Chemical Co.	1 kg/Lab
Trichloroethane, 1.1.2-	Chem Service, Inc.	5 g/Lab
Trichloroethylene	Am. Burdick & Jackson	1000 ml/Lab
Trichlorofluoromethane	Chem Service, Inc.	5 ml/Lab
Trichlorophenol, 2,4,5-	Aldrich Chemical Co.	25 g/Lab
Trichlorophenol, 2,4,5-	Sigma Chemical Co.	25 g/Lab
Trichlorophenol, 2,4,6-	Aldrich Chemical Co.	50 g/Lab
Trichloropropane, 1,2,3-	Aldrich Chemical Co.	100 g/Lab
Trichlorotrifluoroethane, 1,1,2-	Am. Burdick & Jackson	1000 ml/Lab
Trichlorotrifluoroethane 113	General Plastics	250 ml/Lab
Trimethylpentane, 2,2,4-	Mallinckrodt Inc.	16 l/Lab
Triton CF-54 Surfactant	Rohm & Haas Co.	1 gal/Lab
Triton X-100 Surfactant	Rohm & Haas Co.	16 oz/Lab
TruTest DP-3 Lt Gray Polyurethane Floor Enamel	General Paint & Chem. Co.	2 gals/PB; 2 gals/Mezz.
TruTest U-30 Hi-O Enamel	General Paint & Chem. Co.	5- 12 oz cans/Mezzanine

CHEMICAL INVENTORY 1991

TRADENAME	MANUFACTURER	QUANTITY
Trypton	Dfco Labs	.5 lb/Lab
Ultra Deep Base B54T104	Sherwin Williams	2.75 gals/PB; 8 gals/Mezz.
Undecane, n-	Chem Service, Inc.	6 g/Lab
Urea (electrophoresis grade)	Fisher Scientific	500 g/Lab
Urea (practical)	Eastman Kodak Co.	.75 g/Lab
Vinyl Chloride	Chem Service, Inc.	6 ml/Lab
Vinylidene Chloride, 99%	Aldrich Chemical Co.	55 g/Lab
Virginia Vacuum Pump Oil	VA KMP Corporation	3 gals/Warehouse
Vulken 202 Sealant	Mameco	6 gals/Mezzanine
WD-40	WD-40 Company	12 cans/Warehouse
Xylene 164-2398	Sherwin Williams	5 Gals/PB; 1.25 gals/Mezz.
Xylenes	Fisher Scientific	3.5 gal/Lab
Xylitol, 98%	Aldrich Chemical Co.	20 g/Lab
Zinc, Ribbon	J.T. Baker	250 g/Lab
Zinc Sulfate	Mallinckrodt Inc.	475 g/Lab
Zinc Sulfide Particles (Green Fluorescin)	Duke Scientific	25 ml/Lab

APPENDIX A

QUADREX ENVIRONMENTAL COMPANY

ROBERT PITRE

VICE PRESIDENT

Professional Experience

PRESENT — **QUADREX ENVIRONMENTAL COMPANY, GAINESVILLE, FLORIDA.**

Vice President and Manager of Environmental Remediation Services.

P&L responsibility for the business unit including Quality Performance, Operations, Safety, Marketing and Sales. Reports to the President, Quadrex Environmental Company.

01/91 - 07/91 — **QUADREX ENERGY SERVICES COMPANY**

Regional Manager reporting to Sr. Vice President, QESC.

P&L responsibility for regional office including Quality Performance, Operations, Marketing and Sales.

1987 - 1991 — **KEANE INCORPORATED, BOSTON, MA**

Director of Business Development and Product Marketing for this Applications Software Development Company. Reporting to Executive Vice President, Operations.

Area Office Manager reporting to Sr. Vice President.

P&L responsibility for Midwest Area Office including Operations and Sales.

1983 - 1987 — **CYGNA ENERGY SERVICES CORPORATION**

Vice President and Manager of Marketing.

P&L responsibility for Midwest Regional Office including

Quality, Operations, Marketing and Sales, for this Commercial Nuclear Power industry consulting firm.

1972 - 1983 **IMPELL CORP, SAN FRANCISCO, CA**

Various positions for this Nuclear Power industry consulting firm including:

- Project Engineer
- Project Manager
- Director, Business Development

1969 - 1972 **BECHTEL CORP., SAN FRANCISCO, CA**

Various engineering positions with technical responsibility for design, engineering and construction support for commercial nuclear power stations..

1965 - 1968 **U.S. MERCHANT MARINE**

Engineering Officer for ocean-going steam vessels, unlimited horsepower.

Education

- B.S. Engineering, United States.
- Merchant Marine Academy, Kings Port, NY, 1961 - 1965

QUADREX ENVIRONMENTAL COMPANY

GERALD M. SMITH

MANAGER OF PROJECTS

Experience Highlights

- Over Fifteen Years Nuclear Power Plant Experience
- Construction and Controls Management
- Site Control Management
- Startup Engineer
- Project Planning

Professional Experience

1991 - PRESENT

QUADREX CORPORATION
QUADREX ENVIRONMENTAL COMPANY, GAINESVILLE, FLORIDA

Manager of Projects. Responsible for all field operations for Quadrex' Field Remediation teams for disposal of PCBs. Coordination of crews, scheduling, cost tracking, and adherence to Quadrex' Permit and all regulations.

Responsible to CEO in assistance on monitoring other capital projects for Quadrex and other consulting tasks as directed by the Chairman.

1978 - 1991

FLORIDA POWER AND LIGHT

Services Manager - Turkey Point Nuclear Power Plants

Part of management team to enable plant to get off of the NRC "Trouble Plant" list. Responsible for all non-technical support of the plant. Six departments reporting to this position; Security, Fire Protection, Hazardous Materials, Budget, Administration, and Management Information Systems departments. Turkey Point has an O&M budget greater than $114 million.

Responsible for the coordination of the Fitness For Duty Program. All financial transactions and purchases are reviewed. With the guard force, there are over 400 positions reporting.

1985 - 1988 **Project Site Manager - St. Johns River Power Park**

FPL Project Site Manager on a joint venture with Jacksonville Electric Authority. Represented Florida Power & Light Company in the construction of two 624 MW net coal fired electrical generating stations. Also filled in the position of Construction Support Manager in the joint venture project. Duties included contract administration for the non-manual support contract, security contract, safety and first aid and consulting to JEA. Owner representative for labor relations and drug and alcohol abuse programs. Duties also included the Claims Group, Quality Assurance, and FPL administration duties.

1984 - 1985 **Site Control Manager - St. Johns River Power Park**

Entailed covering all project controls responsibilities; budgets, cost, scheduling, estimating, and site accounting.

Also responsible for quality assurance, purchasing and warehouse interface. Due to the joint venture project, there were requirements of three budgets; Project/JEA Administrative and FPL Administrative.

1983 - 1984 **Project Control Supervisor - Seabrook Station**

Temporary assignment (subsidiary of FPL Group, Inc.) as a consultant to Public Service of New Hampshire.

1980 - 1983 **Construction Control and Coordination Superintendent - St. Lucie Nuclear Power Plant**

Responsibilities included all matters concerning estimating, cost and schedule for the project, material deliveries and coordination and budget and cash flow projections. The project was an integrated organization using both Ebasco Services' personnel and Florida Power and Light Company

project was an integrated organization using both Ebasco Services' personnel and Florida Power and Light Company personnel, with FP&L as the construction manager.

1978 - 1980 **Senior Project Planning Analyst - Martin Project**

Supervisor of Planning and Scheduling department, in an integrated organization utilizing management assistance from United Engineers and Constructors, Inc., of Philadelphia. Primarily responsible for all planning and scheduling for the project, which included monthly progress reporting and analysis of the project status.

1976 - 1978 **DUQUESNE LIGHT AND VIRGINIA POWER**

Planner and Scheduler - Beaver Valley Unit 2 and North Anna Power Station

Primary responsibilities included development of many levels of scheduling for piping and mechanical work and interfacing those schedules with structural and electrical schedules. Duties also included supervisory activities of job assignments, employee evaluations and implementation of affirmative action programs.

1966 - 1976 **NEWPORT NEWS SHIPBUILDING**

Held many positions from Apprentice Steam Pipefitter to Planner to Construction Supervisor on many different ship building programs. Spent six years on the Nuclear Aircraft Carrier program at the shipyard.

Education

- Apprentice School of Newport News Shipbuilding, 1970
- Florida Community College & University of North Florida, working on an undergraduate degree.

Professional Societies

- American Management Association
- American Society for Industrial Security

QUADREX ENVIRONMENTAL COMPANY

CURTIS L. FORT

PROJECT MANAGER

Experience Highlights

- Hazardous Site Safety
- Hazardous Waste Packaging
- Decontamination of PCBs and Radioactive Contamination
- Project Supervision
- Project Management
- Project Assessment & Pricing

Professional Experience

1989 - PRESENT — **QUADREX ENVIRONMENTAL CO., GAINESVILLE, FL**

Project Manager. Responsible for field project management on PCB remediation projects. Duties include maintenance of schedules and monitoring areas of decontamination with client representatives for small budget contracts; ensuring compliance with Quadrex' Permit for alternate disposal of PCBs issued by the EPA, and all other federal, state, and local environmental regulations; and general supervision of field crews 8 to 12 people in size.

1986 - 1989

Site Supervisor of pipeline decontamination project for a large natural gas company. Responsibilities include the supervision of 2 shifts of decon technicians, maintaining productivity, maintenance of equipment, procurement of materials and providing daily work reports to project manager.

Operations supervisor on decon trailers refurbishing. Completed courses in CPR and High Voltage Training. Task included assuring necessary parts and equipment ordered and placed to each unit being retrofitted. These preparations were scheduled to be completed so that Quadrex Field Operations could mobilize and begin a large contract with a natural gas pipeline company.

Service Technician I, Field Operations department. Primary responsibility was to assist experienced field operation employees. In January completed training as a radiation worker. Also in January selected to be a supervisor technician for a field project at Arkansas Power & Light's refueling outage. Work included supervision of four personnel while maintaining equipment operation and repairs.

Production Technician I with the Manufacturing department. Worked in various areas of production including sub-assembly as well as final assembly for eight months. During that time also worked temporarily for Field Operations as a service technician.

Major Achievements

Promoted to project manager in February, 1991. Management skills supplemented by continuous training in project development, scheduling and cost assessment. Duties included implementing Quadrex' standard operating procedures to subordinate personnel and the timely completion of several large contracts over $200,000.00

Education

- **U.S. Army** - Basic training and then specialized training in electronics and radio use and repair. 1977 - 1980
- **Eastside High School** - Graduated with diploma in basic studies and music major. 1974 - 1977

QUADREX ENVIRONMENTAL COMPANY

ROBERT KENNER SHOEMAKE, JR.

INDUSTRIAL HYGIENIST

Experience Highlights

- Air & Noise Sampling
- Safety & Health Training Delivery
- Workers Compensation Administration
- Loss Control/Risk Management
- EPA & State Permitting
- Workers Compensation Insurance Underwriting

Professional Experience

1991 - PRESENT

QUADREX ENVIRONMENTAL COMPANY, GAINESVILLE, FLORIDA.

Industrial Hygienist responsible for providing health and safety technical support for all operations in Quadrex Environmental Company, in which employees may be exposed to hazardous conditions. Duties include coordinating and delivering safety training, OSHA training for hazardous waste operations and hazardous sites in accordance with 29 CFR 1910.120, hazard communication training in accordance with 29 CFR 1910.1200; air monitoring; medical surveillance program coordination; OSHA compliance inspections; accident reporting in accordance with OSHA standards.

Peripheral duties include health and safety plan review; field site investigations and inspections; procedure writing; report preparation; on-site health and safety consulting; other duties as required.

1989 - 1991

FLORIDA EMPLOYERS INSURANCE SERVICE COMPANY, SARASOTA, FLORIDA.

Loss Control Counselor/Field Underwriter responsible for providing loss control services to insured including visits to corporate offices, field inspections, claims review, recommendations for improving safety program and termination of non-performing members; inspect applicants to determine

insurability; provide training for Loss Control field staff; conduct industrial hygiene surveys and training as requested by insured.

1988 - 1989 **GATES ENERGY PRODUCTS, GAINESVILLE, FLORIDA.**

Industrial Hygienist performing noise and air monitoring studies to assure compliance with OSHA Pel's. Conduct training of employees i.e., Hazcom, hearing conservation, respiratory protection, etc; assisted plant engineering on design and installation of ventilation equipment.

1980 - 1988 **PEAVEY ELECTRONICS CORPORATION, MERIDIAN, MISSISSIPPI.**

Director of Safety and Health responsible for assuring compliance with OSHA regulations, EPA regulations (hazardous waste, air emissions, NPDES & POTW water regulations) and other state and local regulatory agencies; administer company's self-insured workers compensation program/ conduct employee training.

1979 - 1980 **BALDWIN PIANO AND ORGAN COMPANY, GREENWOOD, MISSISSIPPI.**

Safety Director responsible for assuring compliance with OSHA and NFPA regulations,,conduct safety meetings, organize safety committee activities.

1978 - 1979 **DeSOTO, INC., JACKSON, MISSISSIPPI.**

Jr. Industrial Engineer responsible for performing time and motion studies, plant layout and labor estimating.

Education

- B.S., Business Administration (Industrial Management), Southern Mississippi University.

QUADREX ENVIRONMENTAL COMPANY

DENNIS L. FLEETWOOD

REGULATORY COMPLIANCE MANAGER

Experience Highlights

- RCRA Storage & Treatment Facility Management
- Health & Safety Training Delivery
- RCRA Site Remediation
- Accident Prevention
- Research Laboratory Waste Management
- Hazardous Materials Transportation
- Emergency Response Management

Professional Experience

1988 - PRESENT **QUADREX ENVIRONMENTAL COMPANY, GAINESVILLE, FLORIDA.**

Regulatory Compliance Manager responsible for assisting Quadrex Environmental Company in complying with programs regulated by the U.S. EPA, (RCRA, TSCA, SARA), OSHA, DOT, State of Florida DER, and other state and local agencies as applicable. Duties include EPA permit application, maintenance, and compliance monitoring; SARA Title III reporting; PCB waste disposal coordination and monitoring; EPA permit requirement training delivery, and investigations of regulatory requirements for new business areas.

1986 - 1988 **UNIVERSITY OF GEORGIA, ATHENS, GEORGIA.**

Hazardous Material Program Manager responsible for the implementation and administration of the comprehensive hazardous materials program for the University of Georgia and thirty colleges in the State of Georgia University System. Duties include maintaining regulatory compliance for the generation, treatment, storage, and transportation of hazardous waste and other areas associated with RCRA CERCLA, SARA, DOT and TSCA; RCRA site remediation management, budget preparation and allocation; supervision and personnel functions. Peripheral duties include emergency response coordination and participation, TSC permit application and

maintenance, and consultation and training delivery in the area of laboratory safety.

1984 - 1986: Environmental Health/Accident Prevention Officer responsible for the quality of environmental health and safety for the students and employees of the University of Georgia. Principle duties include Georgia Public Health Code compliance activities, plan review, waste anesthetic gas monitoring, emergency response participation, safety training delivery, and complaint investigation.

1981 - 1984 **JACKSON COUNTY HEALTH DEPARTMENT**

Public Health Specialist responsible for inspection activities associated with the North Carolina Public Health Code. Principle duties include compliance inspection, inspection of individual drinking water systems and septic tank systems, and plan review. Peripheral duties include hazardous materials complaint referral, microwave oven emissions testing, and formaldehyde monitoring.

1986 - 1988 **CONSULTATION & TRAINING DELIVERY**

Consultant, Hazardous Waste & Safety. Private consulting delivered to businesses involved in genetic engineering, packaging, healthcare, resin manufacturing, drycleaning, and hazardous waste disposal. Public service consulting provided for high schools and other public educational units.

Education

- B.S., Environmental Health/Biology, Western Carolina University.
- Masters in Public Administration, University of Georgia

Continuing Education

- Industrial Toxicology, OSHA Training Institute
- Laboratory Safety and Health, OSHA Training Institute
- Recognition, Evaluation & Control of Ionizing Radiation, OSHA Training Institute
- Radiation Short Course, University of Georgia, Athens, Georgia
- Hazardous Waste Management for Universities, Campus Safety Systems, Louisville, Kentucky
- Hazardous Waste Management Compliance, Lion Technology, Inc., Atlanta, Georgia

- Hazardous Materials and Waste Management Seminars, Transportation Skills Program, Inc., Kutztown, Pennsylvania
- Managing Hazardous Waste: Potential for Local Involvement, N.C. Mountain AHEC, Ashville, North Carolina
- Draeger Products Seminar, ASA Safety, Inc., Atlanta, Georgia
- Fire Fighting School, U.S. Navy, San Diego, California

Certifications and Registrations

- Hazardous Waste Regulatory Compliance Manager, Hazardous Materials and Waste Management Association, Inc.
- OSHA Hazard Communication Compliance Manager, Hazardous Materials and Waste Management Association, Inc.
- Environmental Health Scientist, Society for Environmental Health Scientists
- Registered Sanitarian, National Environmental Health Association
- Licensed Pesticide Applicator, Georgia Department of Agriculture

Presentations and Publications

- "Strategies for Laboratory Waste Disposal," Southeast Regional Meeting of American Chemical Society, 1988
- "Design and Implementation of a Hazard Communication Program," UGA Public Safety Division Hazardous Materials Management Program, 1988
- "New Rules Under SARA," UGA Public Safety Division Hazardous Materials Management Program, 1988
- "Managing Hazardous Waste in Healthcare Facilities," Mountain Area Health Education Center, 1988
- "Hazardous Waste: The Sanitarian's Role," Georgia Environmental Health Association Annual Conference, 1987
- "Managing Hazardous Waste in the Laboratory," Western Carolina University Symposium on Environmental Health, 1986
- "Hazardous Waste: A Primer," University of Georgia Hazardous Materials Management Seminar, 1986
- Fleetwood, D., "A Cost Effective Analysis Concerning Hazardous Materials Management for the University System of Georgia," Current Topics in Campus Health & Safety, 1986
- Hazardous Materials Management Training Conferences Host 1986, 1987, 1988

APPENDIX B

QUADREX ENVIRONMENTAL COMPANY
STANDARD OPERATING PROCEDURE (SOP)
TITLE: EPA PERMIT OPERATIONAL AND RECORDS REQUIREMENTS FOR COMPRESSOR STATIONS

SOP NO: QFS-100
REV. NO.: 2

PREPARED BY: Bruce M. Zuk **DATE:** 1/30/92

APPROVED BY: [signature] **DATE:** 1/31/92

1.0 PURPOSE

The purpose of this procedure is to describe and define the operational and records requirements of Quadrex's PCB Alternate Disposal Permit (Permit). Quadrex Environmental Company (QEC) has nationwide approval from the EPA to dispose of PCBs by alternative methods in accordance with the provisions of 40 CFR 761.60 (e). This approval is contingent upon QEC's compliance with certain permit conditions, which are addressed by this procedure.

2.0 SCOPE

The scope of this procedure will cover the generation, retention and storage of information that must be verified, monitored and recorded per the Permit. Verification of prerequisite and test results required prior to the start/continuance of operation are covered herein. The technical requirements are contained in a format including narrative instructions, checklists and daily log entries.

This procedure covers those on-site operational and records keeping activities that occur during applicable remediation projects. It covers only those requirements relative to decontamination of compressed air systems and natural gas transmission pipe, valves, appurtenances and scrap contaminated by PCB pipeline liquids.

The information required covers a variety of items such as emergency names, phone numbers and addresses; equipment descriptions and model numbers; accident reporting requirements; process results and waste concentrations.

The intent and goal of this procedure is to define the requirements and provide aids in such a way that minimizes interpretation of the Permit, on the part of the individuals responsible for implementation. This goal does not relieve all appropriate personnel from being cognizant of the Permit requirements.

3.0 RESPONSIBILITIES

3.1 The Director of Projects, or designee, shall be responsible for approving the results of this procedure.

3.2 The Field Service Manager has ultimate responsibility to assure that the requirements of the Permit are being completed and documented properly.

3.3 The Quadrex on-site Assignment Designated Lead shall have day to day responsibility to assure that all requirements of the EPA Permit are being met. The on-site Assignment Designated Lead shall also be responsible for maintaining working knowledge of the Permit's requirements.

3.4 The Field Service Manager, or designee, shall assure that all Field Service employees have received the appropriate training regarding implementation of the Permit's requirements commensurate with their job responsibilities.

3.5 The Regulatory Compliance Manager, or designee, shall assure that these procedure continues to be in agreement with any Permit revisions.

3.6 The Regulatory Compliance Manager, or designee, shall be responsible for specifying the applicability of the Permit and audit performance against Permit requirements.

3.7 The Regulatory Compliance Manager, or designee shall be responsible for all Permit notifications, as required.

3.8 The Assignment Designated Leader (ADL) has the responsibility to ensure that a copy of all records generated are sent to the Field Remediation Services Secretary.

3.9 The Field Remediation Services Secretary is responsible for placing the records into the project files in the correct location.

4.0 DEFINITIONS

Daily Log - Record of significant events that occur during the performance of a project.

40 CFR 761.60 - Title 40 of the Code of Federal Regulations that describes the

requirements for the disposal of PCBs and PCB articles.

High Pressure - A pump discharge of between 1000 and 1500 psi.

Minimal - An amount contained that is felt to be least attainable even with successive cleaning.

Operation - the process of treating PCBs, including set up and take down of the Quadrex unit as well as actual treatment.

PCB - Polychlorinated biphenyls.

Rinsate - Solvent that has been used in a process flush or rinse.

Volume - The holding capacity of a vessel in gallons calculated by:

$$\frac{\pi r^2 h \times 7.48 \text{ gal}}{ft^3}$$

Where:

r = the radius of the vessel in feet
h = the height of the vessel in feet

Working Pressure - the average discharge pressure of a pump during a flush or rinse operation, measured at the pump head.

5.0 PREREQUISITES

5.1 Verifier Identification

Each individual who will be verifying steps in this procedure shall fill in the information required below.

	Name *(Printed)*	Signature	Initials	Title
5.1.1				
5.1.2				
5.1.3				
5.1.4				
5.1.5				

5.2 Prior to beginning operation the Site Assignment Designated Lead must verify the following:

5.2.1 That an advance written notification of intent to operate has been provided to the EPA at least 30 days prior to the scheduled start date. _____

5.2.2 That the solvent to be used has been analyzed and contains less than 2 ppm PCB's per gram. _____

5.2.3 That the system has been drained of free flowing fluid. _____

5.2.3.1 All drained fluids have been deposited in waste containers. _____

5.2.4 That the solvent has been verified to be the type specified for the project. _____

5.2.5 That this entire procedure has been reviewed prior to commencement of work. _____

6.0 PROCEDURE

Note: Only the solvents, Freon 113, QPS-2 (1,1,1 Trichloroethane), and QPS (1,1,2 Perchloroethane) have been authorized for use. However, not all of the solvents are authorized for specific decontamination applications. All procedural sign offs and required information shall be placed on the appropriate forms in Attachment 1.

6.1 Air Compressor Receiver Tanks

Caution: Verify that all pressure has been bleed from the tank prior to removing inspection plate.

6.1.1 Prior to the cleaning process, inspect the interior of the air receiver tank for sludge or debris accumulation.

6.1.2 Remove any sludge or debris from the bottom of the tank and deposit in waste containers.

6.1.3 Calculate from the following equation the maximum amount of

solvent, with a minimum theoretical concentration of 4 ppm PCBs allowable, for use in the final rinse pass.

H x D x .001 = _____G

Where:

H = The height of the tank in inches
D = The diameter of the tank in inches
G = Gallons of solvent for the final rinse

Note: Show in the daily log all calculations required to determine the maximum amount of solvent to be used. The individual performing the calculations shall place his/her initials in the appropriate place in Attachment 1. All calculations shall be independently checked and verified.

6.1.3.1 Calculated by _____

6.1.3.2 Checked by _____

In the event that the value of G calculated above is smaller than the amount of solvent needed for the system to operate, skip to the alternative performance based procedure in step 6.1.15.

6.1.4 Spray-rinse air receiver tank under high pressure with the solvent designated for this project. Record the solvent type, pressure and duration of rinse.

6.1.4.1 Solvent type _____
6.1.4.2 Working Pressure _____PSI
6.1.4.3 Working Duration _____Min.

6.1.5 Upon completion, verify visual inspection, that the rinsate contains a minimal quantity of suspended solids.

6.1.6 If the rinsate contains excessive suspended solids after the first spray-rinse repeat Steps 6.1.4 and 6.1.5 until the rinsate is acceptable. Record the number of spray-rinses required to obtain an acceptable rinsate sample.

6.1.6.1 Number of Spray-Rinses _____

6.1.7 Have a 20 ml sample of the rinsate taken and analyzed with gas chromatography with an electron capture detector (ECD). If the concentrations of the sample is between 6 and 8 ppm proceed to Step 6.1.10. Note requirements for chain-of-custody handling of samples.

6.1.7.1 Initial Sample Concentration _____ppm PCB

6.1.8 If the sample of concentration is above 8 ppm repeat Steps 6.1.4 and 6.1.7 until the sample is between 6 and 8 ppm PCB. Record the required information in the daily log.

6.1.9 Record the number of additional spray rinses required.

6.1.9.1 Number of spray rinses _____
6.1.9.2 Volume of solvent used _____gal

6.1.10 Drain any previous wash/flush solvents from the receiver tank. Inspect again for sludge and solvent and return to the dirty tanks.

6.1.11 Make one rinse pass through the receiver tank with the calculated amount of clean solvent calculated in Step 6.1.3.

6.1.12 Collect a 20 ml sample of the rinse solvent using either one of the two following methods.

METHOD 1

6.1.12.1 Collect all of the rinse in a single container. Circulate the solvent by pumping out of the bottom of the container and into the top until at least three total volumes of the solvent have been pumped. Record the information required.

6.1.12.1.1 Average discharge pressure _____psi
6.1.12.1.2 Pump manufacturer _____
6.1.12.1.3 Pump model number _____

6.1.12.1.4 Duration of circulation _____min.

6.1.12.1.5 Stop the pump and immediately sample the solvent.

METHOD 2

6.1.12.2 Sample for one cycle portions of the solvent to fill a 20 ml sample during the entire rinse time by using a small peristaltic pump; the pump pick-up is at the point where the solvent flows out of the receiver and into the suction of the main circulating pump. The sample shall be collected before any filters and the peristaltic pump shall be operated so that the rate of the pump allows for production of sample of 20 ml for use with the analytical procedure.

6.1.13 Have the collected sample analyzed with gas chromatography and (GC/ECD) record the results. Label and attach the GC printout in Attachment 2.

6.1.13.1 Initial sample concentration _____ppm

If the definitive value determined in Step 6.1.13 is less than 4 ppm PCB additional cleaning is not required and the receiver tank can be classified as unregulated for distribution in commerce, use or disposal. If the gas chromatography analysis of the sample shows that the PCB concentration of the rinse solvent is equal to or greater than 4 ppm repeat Steps 6.1.11 through 6.1.13 until results of the sample analysis are below 4 ppm. Record required information for additional samples in the daily log.

6.1.14 If additional rinses are required, record the final sample value and the number of additional rinses required.

6.1.14.1 Final sample value _____ppm

6.1.14.2 Number of additional rinses _____

6.1.15 This alternate performance-based procedure includes rinsing the interior surfaces with no less than three successive rinse cycles using

the specified solvent. For each rinse cycle, all of the following conditions apply:

6.1.15.1 The total volume of solvent to be sprayed is equal to or greater than ten percent of the volume of the tank.

6.1.15.1.1 Type of solvent used _____
6.1.15.1.2 Volume of solvent _____gals.
6.1.15.1.3 Volume of tank _____gals.

6.1.15.2 This volume shall be sprayed, using a high pressure spray of at least 1000 psi, over the entire surface of the tank at least twice.

6.1.15.3 The solvent to be used in the rinse cycle must contain less than 2 ppm at the beginning of the rinse cycle.

Note: The total solvent volume in 6.1.15.2 (above) may be constituted of a smaller volume which is recycled within a rinse cycle, as long as the smaller volume is recycled to the extent of rinsing with a total rinse solvent volume equivalent to 10% of the total tank volume.

For example, for total required rinse volume of 200 gallons (that is, to be used to treat a 2,000 gallon tank), only 100 gallons of solvent may be sprayed over the interior surface of the tank/bottle repeatedly until at least a total of two hundred gallons had been circulated. That is, all 100 gallons shall be sprayed at least twice during at least two passes over the entire surface of the tank/bottle. For this example, the volume must be used at least twice and then shall be sprayed at least twice. For the solvent to be reused within a rinse cycle, the recycling loop must contain a particulate filter which shall be disposed of by incineration.

6.1.16 Following the completion of each rinse cycle, return the rinsate to the dirty tanks for reprocessing the residual PCBs in the recovered solvent for reuse must be less than 2 ppm.

6.1.17 **Procedure Reviewed and Approved by:**

NAME (Printed)	SIGNATURE	TITLE
_____	_____	_____

6.2 Compressor Systems & Piping Six Inches and Less In Diameter

Note: The following procedure is applicable to compressor systems, exclusive of receiver tanks, natural gas pipeline, and pipe six inches inner diameter and less only.

6.2.1 Verify that the system or segment of the system to be cleaned has been filled with the appropriate solvent.

6.2.1.1 Solvent type _____
6.2.1.2 Solvent volume _____ gals

6.2.2 Circulate the solvent for a period of one hour.

6.2.3 Drain the flush solvent via air purge to dirty tanks and have a sample analyzed by gas chromatograph (GC/ECD) for PCB concentration. Record below the concentration of the initial sample. Label and attach the GC printout in Attachment 2. The system can be considered drained when 98% of the solvent has been recovered.

6.2.3.1 Initial sample concentration _____ppm
6.2.3.2 Solvent volume recovered ____ gals

6.2.4 If the concentration of the initial sample in 6.2.3 is between 6 and 8 ppm, proceed to Step 6.2.7.

6.2.5 If the sample in 6.2.3 concentration is above 8 ppm, refill the system/segment with the same type of clean solvent used initially for this system/segment.

6.2.6 Repeat Steps 6.2.1 through 6.2.5 until the sample is between 6 and 8 ppm. Once the sample analysis is between 6 and 8 ppm, proceed to Step 6.2.7 and record the required information. Record other

required information in the daily log.

6.2.6.1 Final sample value _____ ppm

6.2.6.2 Number of additional flushes _____

6.2.7 Refill the system/segment with clean solvent for the verification rinse. Record volume of solvent used.

6.2.7.1 Solvent volume _____ gals

6.2.8 Recirculate the solvent by pumping through the system/segment long enough for three times the total volume to pass through the closed system or for 15 minutes, whichever is longer. Record the required information.

6.2.8.1 Initial if the 15 minute option was performed.

6.2.8.2 If the 3 volume option was used initial and record:

6.2.8.2.1 Average discharge pressure _____psi

6.2.8.2.2 Pump manufacturer _____

6.2.8.2.3 Pump model number _____

6.2.8.2.4 Duration of circulation _____min

6.2.9 Drain the solvent used in the verification rinse and obtain a 20 ml representative sample for analysis by gas chromatography using either one of the two sampling procedures that follow. Record the amount of solvent recovered.

6.2.9.1 Solvent volume recovered _____ gal

METHOD 1

6.2.9.2 Collect all of the rinse in a single container. Circulate the solvent by pumping, out of the bottom of the container and into the top until at least three total volumes of the solvent have been pumped. Record the information required.

6.2.9.2.1 Average discharge pressure _____psi

6.2.9.2.2 Pump manufacturer _____

6.2.9.2.3 Pump model number _____

6.2.9.2.4 Duration of circulation _____min.

6.2.9.2.5 Stop the pump and immediately sample the solvent.

METHOD 2

6.2.9.3 Sample for one cycle, portions of the solvent to fill a 20 ml sample during the entire rinse time by using a small peristaltic; the pump pick-up is at the point where the solvent flows out of the system and into the suction of the main circulating pump. The sample shall be collected before any filters and the peristaltic pump shall be operated so that the rate of the pump allows for production of sample of 20 ml for use with the analytical procedure.

6.2.10 Have the collected sample analyzed with gas chromatography (GC/ECD) and record the results. Label and attach the GC print out in Attachment 2.

6.2.10.1 First sample value _____ppm

If the definitive value determined in Step 6.2.10 is less than 4 ppm PCB additional cleaning is not required and the system can be classified as unregulated for distribution in commerce, use or disposal. If the gas chromatography analyses of the sample shows that the PCB concentration of the rinse solvent is equal to or greater than 4 ppm repeats Steps 6.2.7 through 6.2.10 until the results of the sample analysis are below 4 ppm. Record the required information for additional rinses in the daily log.

6.2.11 If additional rinses are required, record below the final sample value and the number of <u>additional</u> rinses required. _____

6.2.11.1 Final sample value _____ppm

6.2.11.2 Number of additional rinses _____

6.2.12 If the rinse sample was of a segment of an entire system, the PCB

concentrations found in the rinse samples of each segment of a continuous system can be averaged using weighted averaging to verify the level of residual contamination remaining in the entire system. The formula for calculating the weighted average for a system that is flushed in segments is:

$$\text{system ppm} = \frac{W_{rs1} \times ppm_1 \times + W_{rs2} \times ppm_2 + \ldots \times W_{rsn}\ ppm_n}{W_{rs1} + W_{rs2} + \ldots W_{rsn}}$$

Where:

W_{rsn} is the weight (in grams) of the rinse solvent used to flush the n^{th} segment and ppm_n is the measured PCB concentration in the rinse solvent after flushing the n_{th} segment.

Label and show in the daily log all calculations required to determine the average PCB concentration of each system. Show the results of those calculations. The individual performing the calculations shall place their initials in the space provided. All calculations shall be independently checked and verified.

6.2.12.1 Calculated by _____
6.2.12.2 Checked by _____
6.2.12.3 Segment 1 initial sample concentration _____ppm
6.2.12.4 Segment 3 initial sample concentration _____ppm
6.2.12.5 Segment 4 initial sample concentration _____ppm
6.2.12.6 Segment 5 initial sample concentration _____ppm
6.2.12.7 Segment 6 initial sample concentration _____ppm

Note: If more than 6 segments constitute a system, label and record the values of the initial sample concentrations in daily log.

6.2.13 If the system average concentration from this calculation is less than 4 ppm, PCB, no further cleaning is required and the overall system and its components cleaned in these procedures will be considered decontaminated and unregulated for further distribution in commerce, use or disposal.

6.2.14 If the result of the calculation shows that the overall average is 4

ppm or greater, selected individual segments must be recleaned using the following process:

6.2.14.1 Pick the segment within the system having the highest concentration.

6.2.14.2 Reclean this segment performing Steps 6.2.7 through 6.2.10. Record the information required in these steps in the daily log.

6.2.14.3 Recalculated the overall system concentration using the equation in 6.2.12, the new value from 6.2.14.3 and the previous values used initially. Record that resultant below. Label and show in the daily log the calculations.

6.2.14.3.1 System average _____ppm

6.2.14.4 If the new average concentration is less than 4 ppm, further cleaning stops and the overall system and its components will be considered decontaminated and unregulated for further distribution is commerce, use or disposal.

6.2.14.5 If the result of the calculation shows that the overall average is 4 ppm or greater, selected cleaning must continue.

6.2.14.6 If evaluation shows that additional cleaning of the segment chosen in 6.2.14.1 will, after analysis, and recalculation, result in a system value less than 4 ppm; the segment should be recleaned. If the existing segment is again recleaned, explain the decision in the daily log.

6.2.14.7 If it is determined that recleaning the segment again would not be cost effective repeat Steps 6.2.14.1 through 6.2.14.6 until the value for Step 6.2.19.3 is less than 4 ppm. Record below the final acceptable system concentration. Record required information in the daily log.

6.2.14.7.1 System concentration _____ppm

6.2.15 Results of Section 6.2 reviewed and approved by:

NAME (Printed)	SIGNATURE	TITLE
_____	_____	_____

6.3 System Piping Greater than 6 inches in Diameter

Note: The following procedural requirements are applicable to the cleaning of PCB contaminated pipeline that is greater than six inches in diameter and no greater than 40 feet in length.

6.3.1 If the pipe is in its installed position, using an indelible marker or paint stick, place a mark on the outside of the pipe at both bottom ends that is approximately 1" wide and 4" long.

6.3.2 If the pipe has been removed, determine what had been the bottom of the pipe when it was installed by noting internal sediment and markings.

6.3.3 Slope the pipe at a minimum of 3" for every 10 ft.

6.3.3.1 Using an indelible marker or paint stick, place a mark on the outside of the pipe at both bottom ends that is approximately 1" wide by 4" long.

6.3.4 Attach extension pieces to both ends of the pipe to assure that the spray fan passes over the entire internal area of the pipe.

6.3.5 At the upper end of the pipe install the extension piece designed for pass-through of the spray cleaning wand.

6.3.6 At the lower end of the pipe install the extension piece designed to allow drainage of the spray solvent.

6.3.7 Begin cleaning the inside of the pipe using the high pressure spray

wand in accordance with procedure.

6.3.8 Continue full length spray passes while conducting a visual inspection of the rinsate.

6.3.9 Monitor the rinsate until visual inspection shows the presence of minimal quantities of suspended solids.

6.3.10 Take a standard 100cm^2 wipe sample at the bottom of both ends of the pipe.

6.3.11 Have the samples analyzed with gas chromatography. Record the concentration level. Label and Attach the GC printout in Attachment 2.

6.3.11.1 Concentration level _____ $\mu g/cm^2$ upper

6.3.11.2 Concentration level ___ $\mu g/cm^2$ lower

If the contamination levels of both samples are less than 1$\mu g/cm^2$ but greater than 0.1$\mu g/cm^2$ the pipe is unregulated for disposal but is regulated for distribution in commerce where long-term dermal contact can occur. If the analysis shows that the pipe is contaminated with PCBs at a surface concentration of greater than or equal to 1$\mu g/cm^2$ continue the spraying process until the desired cleanliness is met.

6.3.12 If additional rinses are required, repeat Steps 6.3.7 through 6.3.11 until the desired surface concentration is met. Record the number of rinses required, the final concentration level value and the volume of clean solvent used and recovered.

6.3.12.1 Number of rinses _____
6.3.12.2 Final concentration level _____ $\mu g/cm^2$
6.3.12.3 Solvent volume used _____ gal
6.3.12.4 Solvent volume recovered _____ gal

6.3.13 Results of Section 6.3 reviewed and approved by:

NAME (Printed)	SIGNATURE	TITLE
_____	_____	_____

6.4 Decontamination of Pipeline Appurtenances

Note: The following procedures apply to the cleaning (generally for recovery, re-use) of large, valuable pipeline appurtenances such as valves, controllers, meters and other pipeline equipment exposed to PCB contaminated pipeline liquids.

6.4.1 Spray Process in Enclosed Chamber

6.4.1.1 Disassemble item to be cleaned as required to expose all surfaces that could be contaminated or to prevent seals from coming in contact with the staging solvent. Disassembly should take place in a bermed staging area; drain or collect any PCB liquids and sludges that may be contained by the item.

6.4.1.2 Place item/s in the cleaning chamber and thoroughly spray using QPS-2 via glove ports.

6.4.1.3 Clear the chamber of solvent vapors using appropriate recovery systems and drain only collected solvent from the item. Prior to removing the item from the chamber, take a 100cm^2 wipe sample at the location where PCBs would most likely have accumulated. This location must be noted in cleaning log.

6.4.1.4 Have the sample analyzed by gas chromatography GC/ECD. Record the concentration level. Label and attach the GC printout in Attachment 2.

6.4.1.4.1 Concentration level _____ $\mu g/cm^2$

If the analysis indicates that the contamination level is less than 0.1 $\mu g/cm^2$, no further

cleaning is necessary. The item is considered unregulated for distribution in commerce, use or disposal. If the contamination level is less than 1$\mu g/cm^2$ but greater than 0.1$\mu g/cm^2$ the item is unregulated for disposal but is regulated for distribution in commerce. If the analysis shows that the item is contaminated with PCBs at a level greater than 1 $\mu g/cm^2$ the spraying process shall continue until the desired surface concentration is met.

6.4.1.5 If additional sprays are required repeat Steps 6.4.1.2 through 6.4.1.4 until the desired surface concentration is met. Record the number of rinses required and the final concentration level value.

6.4.1.5.1 Number of sprays _____
6.4.1.5.2 Final concentration level _____ $\mu g/cm^2$

6.4.1.6 Results of Section 6.4 reviewed and approved by:

NAME (Printed)	SIGNATURE	TITLE
_____	_____	_____

6.4.2 Batch Recirculatory/Soak Process

Applicable for batch processing of small items, and scrap which have been exposed to PCB contaminated pipeline liquids.

6.4.2.1 Disassemble items to be cleaned as necessary to expose all contaminated surfaces.

6.4.2.2 Using a suitable lifting device or holding basket, lower items to be cleaned in the decontamination tank.

6.4.2.3 Assure that placement of these items within the tank is such that their internal and external surface areas will be exposed to a laminar mixing when solvent is recirculated

within the tank.

6.4.2.4 Prepare two surrogate sample plates in accordance with the following steps. The plates and contaminating solvent are to be obtained from Quadrex' lab.

6.4.2.4.1 Verify the sample plate is carbon steel 4cm wide and at least 25cm long with a mill smooth finish. One side of the first plate should be etched with "A-PRE", the other side "A-POST."

The sides of the second plate should be similarly etched as "B-PRE", and "B-POST."

6.4.2.4.2 Dip the plates in a mixture of hexane solvent which has been spiked with PCBs at 500 ppm or greater. The PCB Aroclor should be the same as that on the items.

6.4.2.5 Place the wet sample plate in a piece of 2" pipe, 1 foot in length with a cap on one end and allow the solvent to evaporate. The pipe is also used as a "carrier" for the sample plates to prevent contact with the spiked surfaces.

6.4.2.6 After the sample plates have dried, take a standard 100cm^2 wipe sample from the etched sides marked "A-PRE" and "B-PRE".

6.4.2.7 Have the collected wipe samples analyzed by gas chromatography/ECD and record the results below. Label and attach the resultant printout in Attachment 2.

6.4.2.7.1 Sample A-PRE value _____ μg/cm^2
6.4.2.7.2 Sample B-PRE value _____ μg/cm^2

6.4.2.8 Place the two surrogate sample plates in the tank in areas where the least solvent turbulence will occur during the solvent recirculation flush process.

6.4.2.9 Fill the tank with QSP-2 to a level that is at least one inch

above the level of the items in the tank.

6.4.2.10 Assure that the top of the tank is sealed and vented through a vapor control system.

6.4.2.11 Establish a continuous high volume recirculating flush via the external pump and filter circuit for a period of at least two hours.

6.4.2.12 At the end of the flush period, drain the tank and remove the two surrogate sample plates.

6.4.2.13 Take a standard 100cm^2 wipe sample of each surrogate sample from the sides that are etched "A-POST" and "B-POST."

6.4.2.14 Have the samples analyzed by gas chromatography/ECD. Record the concentration levels. Label and attach the GC chart in Appendix 2.

6.4.2.14.1 Sample A-POST value _____ $\mu g/cm^2$
6.4.2.14.2 Sample B-POST value _____ $\mu g/cm^2$

If the analysis indicates that both "A" & "B" sample plate sides marked "POST" are contaminated with PCBs at a level less than 1$\mu g/cm^2$ but greater than 0.1$\mu g/cm^2$ the processed batch of items shall be unregulated for disposal but regulated for distribution in commerce. If the sample's concentration is less than 0.1$\mu g/cm^2$, the processed batch of items is unregulated. Consult project specification for required cleanliness. If the analysis shows that the surrogate samples have a contamination concentration of greater than or equal to 1$\mu g/cm^2$, re-perform Steps 6.4.2.10 through 6.4.2.15 until the analysis results in the desired value.

6.4.2.15 If additional flush periods are required record below the

final value of the samples and the additional number of flush period required.

6.4.2.15.1 Final value Sample A-POST _____ $\mu g/cm^2$

6.4.2.15.2 Final value Sample B-POST _____ $\mu g/cm^2$

6.4.2.15.3 Number of additional cycles _____

6.4.2.16 Date records sent to Gainesville Facility (home office):

_____

Sent by: _____
(Print)

6.4.2.17 Procedure reviewed and approved by:

NAME (Printed)	SIGNATURE	TITLE
_____	_____	_____

ATTACHMENT 1

6.0.1 PROJECT DATA

6.0.1.1 Project Number: _____

6.0.1.2 Date: _____

6.0.1.3 Operator: _____

6.0.1.4 Supervisor: _____

1940 N.W 67th Place
Gainesville, FL 32606

6.0.1.5 On-site Phone#: _____

6.0.2 CLIENT DATA

6.0.2.1 Client: _____

6.0.2.2 Client's Business Address: _____

_____

_____

6.0.2.3 Process Location: _____

B. PROCEDURE SIGN-OFFS AND REQUIRED INFORMATION

STEP	TECHNICAL INFORMATION	VERIFIED/COMPLETED
6.1.1		_____
6.1.2		_____
6.1.3	_____ gals	
6.1.3.1		_____
6.1.3.2		_____
6.1.4		_____
6.1.4.1		_____
6.1.4.2	_____ psi	
6.1.4.3	_____ min	
6.1.5		_____
6.1.6		_____ _____
6.1.6.1	_____	
6.1.7		_____
6.1.7.1	_____ ppm	
6.1.8		_____
6.1.9		_____
6.1.9.1	_____	
6.1.9.2	_____ gal	
6.1.10		_____
6.1.11		_____
6.1.12		_____
6.1.12.1		_____
6.1.12.1.1	_____ psi	
6.1.12.1.2	_____	
6.1.12.1.3	_____	

6.1.12.1.4 _____ min

6.1.12.1.5 _____

6.1.12.2 _____

6.1.13 _____

6.1.13.1 _____ ppm

6.1.14 _____

6.1.14.1 _____ ppm

6.1.14.2 _____

6.1.15 _____

6.1.15.1 _____

6.1.15.1.1 _____

6.1.15.1.2 _____ gals

6.1.15.1.3 _____ gals

6.1.15.2 _____

6.1.15.3 _____

6.1.16 _____

COMPRESSOR SYSTEMS

AND

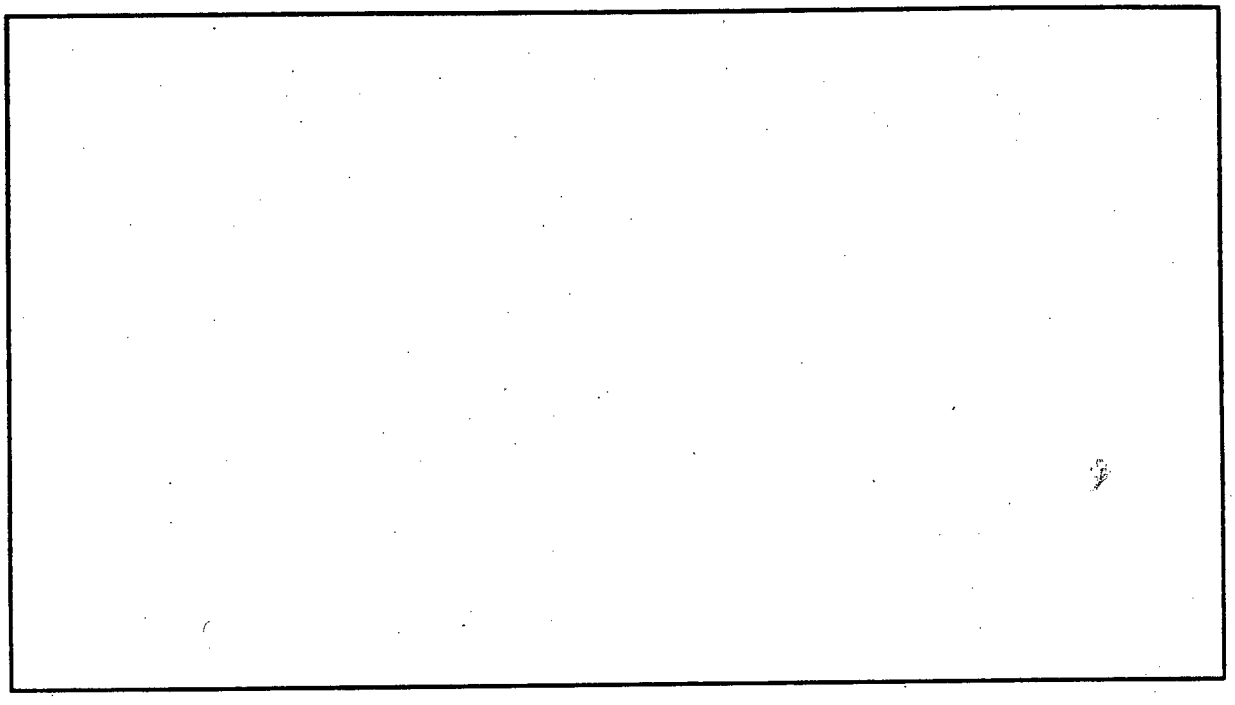
PIPING SIX INCHES AND LESS IN DIAMETER

A. SYSTEM ID# _____

1. Date System Received _____
2. Date System Processed _____
3. Date System Returned to Client _____
4. Time Processing Begins _____

Compressor/Piping Sketch (w/dimensions)

Quadrex System (w/dimensions)



B. PROCEDURE SIGN-OFFS AND REQUIRED INFORMATION

STEP	TECHNICAL INFORMATION	VERIFIED/COMPLETE
6.2.1		_____
6.2.1.1	_____	
6.2.2	_____ gals	
6.2.3		_____
6.2.3.1	_____ ppm	
6.2.3.2	_____ gals	

6.2.4 _____

6.2.5 _____

6.2.6 _____

6.2.6.1 _____ ppm

6.2.6.2 _____

6.2.7 _____

6.2.7.1 _____ gals

6.2.8 _____

6.2.8.1 _____

6.2.8.2 _____

6.2.8.2.1 _____ psi

6.2.8.2.2 _____

6.2.8.2.3 _____

6.2.8.2.4 _____ min

6.2.9 _____

6.2.9.1 _____ gals

6.2.9.2 _____

6.2.9.2.1 _____ psi

6.2.9.2.2 _____

6.2.9.2.3 _____

6.2.9.2.4 _____ min

6.2.9.2.5 _____

6.2.9.3 _____

6.2.10		_____
6.2.10.1	_____ ppm	
6.2.11		_____
6.2.11.1	_____ ppm	
6.2.11.2	_____	
6.2.12		_____
6.2.12.1		_____
6.2.12.2		_____
6.2.12.3	_____ ppm	
6.2.12.4	_____ ppm	
6.2.12.5	_____ ppm	
6.2.12.6	_____ ppm	
6.2.12.7	_____ ppm	
6.2.13		_____
6.2.14		_____
6.2.14.1		_____
6.2.14.2		_____
6.2.14.3		_____
6.2.14.3.1	_____ ppm	
6.2.14.4		_____
6.2.14.5		_____
6.2.14.6		_____
6.2.14.7		_____
6.2.14.7.1	_____ ppm	

PIPING GREATER THAN SIX INCHES IN DIAMETER

A. SYSTEM ID#_____

1. Date System Received _____
2. Date System Processed _____
3. Date System Returned to Client _____
4. Time Processing Begins _____
5. Time Processing Ends _____

System Sketch (w/dimensions)

B. PROCEDURE SIGN-OFFS AND REQUIRED INFORMATION

STEP	TECHNICAL INFORMATION	VERIFIED/COMPLETED
6.3.1		_____
6.3.2		_____
6.3.2.1		_____
6.3.3		_____
6.3.4		_____
6.3.5		_____
6.3.6		_____
6.3.7		_____
6.3.8		_____
6.3.9		_____
6.3.10		_____
6.3.11		_____
6.3.11.1	_____ $\mu g/cm^2$ upper	
6.3.11.2	_____ $\mu g/cm^2$ lower	
6.3.12		_____
6.3.12.1		_____
6.3.12.2	_____ $\mu g/cm^2$	
6.3.12.3	_____ gal	
6.3.12.4	_____ gal	

PIPELINE APPURTENANCES

A. System Identification # _____

1. Item _____
2. Manufacturer _____
3. Model Number _____
4. Serial Number _____
5. Part Number _____

B. Procedure Sign - offs and Required Information

STEP	TECHNICAL INFORMATION	VERIFIED/COMPLETED
6.4.1		_____
6.4.1.1		_____
6.4.1.2		_____
6.4.1.3		_____
6.4.1.4		_____
6.4.1.4.1	_____	
6.4.1.5		_____
6.4.1.5.1	_____	
6.4.1.5.2	_____ $\mu g/cm^2$	

RECIRCULATING
SOAK AND FLUSH

A. SYSTEM ID# _____

1. Items _____
_____
_____
_____
_____
_____
_____
_____

B. PROCEDURE SIGN-OFFS AND REQUIRED INFORMATION

STEP	TECHNICAL INFORMATION	VERIFIED/COMPLETED
6.4.2.1		_____
6.4.2.2		_____
6.4.2.3		_____
6.4.2.4		_____
6.4.2.4.1		_____
6.4.2.4.2		_____
6.4.2.4.3		_____

6.4.2.4.4		_____
6.4.2.4.5		_____
6.4.2.4.5.1	_____ $\mu g/cm^2$	
6.4.2.4.5.2		_____
6.4.2.5		_____
6.4.2.6		_____
6.4.2.7		_____
6.4.2.8		_____
6.4.2.9		_____
6.4.2.10		_____
6.4.2.11		_____
6.4.2.11.1	_____ $\mu g/cm^2$	
6.4.2.11.2	_____ $\mu g/cm^2$	
6.4.2.12		_____
6.4.2.12.1	_____ $\mu g/cm^2$	
6.4.2.12.2	_____ $\mu g/cm^2$	
6.4.2.12.3	_____ $\mu g/cm^2$	

RECORD REQUIREMENTS

Process Monitoring

The following information must be monitored and recorded per our EPA permit:

1. Name, address, and telephone number of the Quadrex disposal unit operator and supervisor;

2. Name and Business address of the person or firm whose PCB contaminated transformer, natural gas air compressor system of pipeline pipe and appurtenances, PCB containing wastewater are being processed;

3. the location, manufacturer, rated capacity and identification (serial) number of the transformer, heat transfer system or hydraulic system, natural gas pipeline appurtenances;

4. a description of the air compressor system, natural gas pipeline pipe and appurtenances including the estimated dimensions of all receivers and the estimated dimensions of the air compressor system exclusive of the receivers, including the diameter and length of all the pipe in the system;

5. a copy of all calculations used in surrogate sampling procedures and verification rinses for air compressor sampling procedures and verification rinses for air compressor systems and natural gas pipeline pipe;

6. the date the transformer/system is received by Quadrex, the date(s) processed, and the date returned to the custody of the owner (if applicable);

7. estimated quantity and PCB concentration of solvent charged into the transformer, heat transfer system, hydraulic fluid system, and/or air compressor system, natural gas pipeline and appurtenances;

8. estimated quantity and PCB concentration of treated solvent and other treated materials produced;

9. date, time and duration of treatment per transformer or system or batch of wastewater;

10. a copy of the gas chromatogram and/or final records from tests conducted to determine the final concentration of the treated solvent or wastewater;

11. estimated quantity and quality of wastes produced, the method of disposal and location of the disposal facility for each waste must be documented; and

12. temperature of separation process in at least one-half hour intervals

13. estimated quantity of wastewater to be treated

Disposal Service Documents

Disposal recordkeeping documents must be:

1. compiled within 60-days of the testing date
2. kept at one centralized location
3. made available for inspection by authorized representatives of the EPA.

What Must Be Kept on Mobile Unit

Quadrex must maintain on site during the operation of a mobile unit:

1. a copy of the approval (i.e, the Permit)
2. a copy of the spill prevention and cleanup plan (SOP-111, part of every Health and Safety Plan)
3. Sampling and analytical procedures used to determine PCB concentrations in untreated and treated materials (Quality Assurance Generic Plan for Quadrex Analytical Laboratories)

In addition, a record of the PCB disposal services performed by the unit during the previous month must be stored aboard that mobile unit.

In Case of Termination of Business

Records or their copies must be submitted to the Director of the Exposure Evaluation Division, should Quadrex or its authorized agents terminate business.

PCB Release During Processing

In the event of a PCB release during processing, Quadrex must inform the appropriate EPA Region by telephone within two working hours. A written report describing the incident must be submitted to the appropriate EPA Regional Contact, the Regional Administrator, and the Director, Exposure Evaluation Division of OTS by the close of business on the regular business day following the incident.

In Case of a Spill

In the event of a spill, (after control/clean-up per 52 FR 10688, April 2, 1987), a written report describing the spill, operations involved, cleanup actions and changes in operation to prevent such

spills in the future must be submitted to the appropriate EPA Region Contact, Region Administrator, and Director, EED of OTS within 5 business days.

If the Still Fails (Solvent Isn't Clean)

If the mobile unit malfunctions (≥2 three times in a row), the unit must cease operation, Quadrex must notify the EPA Regional PCB Disposal Coordinator in the Applicable EPA Region prior to moving the unit off site. If repeated incidence of process failure occur, Quadrex must notify the Chief, PCB Disposal Section at (202) 382-3964 and the Regional Coordinator during the next business day, and file with them a written report within 7 days.

Decommissioning a Unit

A unit that has been decommissioned must also be reported immediately to the Chief, PCB Disposal Section and at EPA Headquarters the Regional PCB Coordinator for the EPA Region in which such unit is decommissioned.

Financial Assurance

Quadrex is required to incorporate financial assurance of closure and liability coverage provisions into its closure plan; provisions must be equivalent to 40 CFR 264 (under Subpart H of RCRA). Quadrex must submit annual updates to the Director, Exposure Evaluation Division of the financial assurance of closure and liability coverage.

Manufacture of a New Unit

Within thirty (30) days from the date of manufacture of any additional Quadrex mobile unit Quadrex must file a written pre-operation report with the Director of the Exposure Evaluation Division. This report must contain:

1. date of manufacture of the unit

2. identification and/or serial number of the new Quadrex mobile unit

3. certification by an independent, registered professional engineer to the effect that the Quadrex mobile unit is substantially identical to the original unit in terms of engineering design, hardware, process capacity, quality of workmanship;

4. certification by the chief executive officer of Quadrex Environmental Company signifying that the Quadrex mobile unit construction has been completed in such a manner; and

5. a list of all substantive and nonsubstantive changes made to the design and construction of any new Quadrex mobile unit which is not identical to the original Quadrex mobile unit.

Design Modifications

Major modifications to the design cannot be made without the written approval of the Director of the Exposure Evaluation Division. (See the application and demonstration portion of the Permit.)

****

Quadrex must also maintain the records required by 40 CFR 761.180(f) (records and monitoring) and 40 CFR 761, Subpart J (PCB waste disposal - records and reports).

7.0 ATTACHMENTS

7.1 Attachment 1 - Procedure Sign-Off Sheets

7.2 Attachment 2 - Record Requirements

7.3 Attachment 3 - Chromatographs

7.4 Attachment 4 - EPA Permit

PREPARED BY: _____ DATE: 2/3/92

APPROVED BY: _____ DATE: 2/6/92

1.0 PURPOSE

This Procedure provides instructions for the disposition of PCBs and PCB contaminated wastes from Quadrex field projects.

2.0 SCOPE

This Procedure applies to any field project producing PCB wastes. For purposes of this Procedure, wastes are materials which will be disposed of by incineration or landfill (not reclaimed).

3.0 DEFINITIONS

RCO - Quadrex Regulatory Compliance
PCBs - Polychlorinated Biphenyls
DOT - U.S. Department of Transportation
Waste - Any material which is contaminated with PCBs to such an extent that it is unusable in its present form; wastes must either be reclaimed in accordance with EPA authorized methods or disposed of in accordance with EPA regulations.

4.0 RESPONSIBILITIES

The client will specify storage areas for PCBs and PCB contaminated materials. The Quadrex Site Manager will inspect stored materials labels and manifesting documents.

5.0 PROCEDURE

Any waste generated as a result of the PCB remediation projects will be packaged for disposal by placing in properly labeled and lined drums. PCB waste collected at the site will be inventoried and transferred to a temporary waste storage area designated by the client, and ultimately transported to an EPA approved disposal site. Short term storage of drummed solids, within the work area, may be necessary to meet transportation schedules. Waste drums placed into storage will

be inspected by the Quadrex Site Manager for proper closure documentation and transport labeling.

5.1 Waste Containers, Storage, Documentation and Labeling

The waste products resulting from PCB remediation projects will consist of:

	Projects	PCB Concentration
a.	Solvents	> 50 ppm
b.	Solid Waste (PCB Contaminated)	> 50 ppm

5.1.1 Waste Containers

As waste is generated it will be placed into properly labeled DOT approved drums. Any drums used for the storage, transport, and disposal of PCB materials must comply with the Shipping Container Specification of the Department of Transportation, 49CFR178. Single trip containers (17C and 17E only) in good condition can be reused to ship waste for disposal as per 49CFR173.28. The containers may not be used again for storage or shipment of hazardous materials unless reconditioned and tested per DOT regulation.

5.1.1.1 PCB Liquid Wastes

PCB liquid wastes must be packaged in one of the following DOT approved container types:

- Specification 5 container without a removable head
- Specification 5B container without a removable head
- Specification 6D overpack with specification 2S or 2SL polyethylene containers
- Specification 17E container

5.1.1.2 Solid PCB Waste

PCB contaminated solids must be packaged in one of the following DOT approved container types:

- Specification 5
- Specification 5B
- Specification 17C

5.1.2 Waste Storage

The client shall designate an area for temporary storage. PCB contaminated solvents are RCRA and TSCA wastes, and shall not be stored on site for a period exceeding 30 days unless the site meets 40CFR761 requirements for long term PCB storage. In order to store PCB contaminated solvents for longer than 90 days, the site must be an EPA permitted TSD facility. PCB contaminated solid materials are TSCA wastes. All drums shall be dated on the exterior when they are closed and placed into storage. Each drum must have a record that includes for each batch of PCBs, the quantity of the batch and the date the batch was added to the container. To aid in proper inventory of wastes during their accumulation, a log will be attached to each drum. All packing is to be performed by trained individuals (see HSP-003). All individuals handling PCB's and PCB contaminated materials must be properly attired (see HSP-004). Periodic inspections of drums will occur to assure that no damage has caused leakage. No drums are to be stacked. Temporary berms or containment devices will be employed to prevent the loss of and to contain any PCB material which might be accidentally released.

5.1.3 Waste Documentation for Shipment

All waste to be shipped for disposal will first be documented using a waste profile sheet. This form is to be completed by the Regulatory Compliance Officer and submitted to the disposal facility for approval.

NOTE: Any solvent-bearing waste will require 4-6 weeks for approval and **must** have a sample submitted with the waste profile sheet. All wastes shipped for disposal will be accompanied by a Uniform Hazardous Waste Manifest or the Appropriate State Hazardous Waste Manifest. Any hazardous waste subject to land disposal restrictions will be accompanied by the appropriate land ban/treatment standard documentation as required. The Site Manager is responsible for proper waste manifesting when Quadrex has contractual disposal responsibility.

5.1.4 Drum Labeling

Because of the mixture of wastes generated, several markings are required to identify properly the container contents. It is important to maintain compliance with the rules that govern each waste stream; therefore, the labeling requirements outlined below must be strictly adhered to.

5.1.4.1 PCB and Solvent Liquids (Including Filter Wastes)

Containers designated as the receptacle of this waste stream must bear the following marking on at least one side of the container:

"Hazardous Waste" *(See Figure 1)*
"Caution - Contains PCBs" *(See Figure 2)*

NOTE: Contact personal and telephone number must be manually written on marking.

The proper shipping name for Freon/PCB waste is:

"Hazardous Waste Liquid, N.O.S. (contains 1,1,2-trichloro - 1,2,2-trifluoroethane) NA 9189 RQ (PCBs)." ORM-E - bordered by a 1/4" bold line, must be placed after or under the proper shipping name.

The proper shipping name for 1,1,1 and PCBs is:

"ORM-A, N.O.S. (contains 1,1,1-trichloroethane) NA 1693 (RQ PCBs)." ORM-A with a 1/4" spaced border line, must be placed after or below the proper shipping name.

5.1.4.2 PCB and Solvent Contaminated Waste

These will be marked the same as described in 5.1.4.1 except that "solid" will replace "liquid" in the shipping name.

5.1.4.3 PCB Contaminated Solid Waste

5.1.4.3 PCB Contaminated Solid Waste

Containers designated as receptacles for this waste stream must bear the labels shown below on at lease one side of the container:

"Waste for Disposal" *(See Figure 2)*

NOTE: The proper shipping for this waste is shown in Figure 3.

"Caution Contains PCBs"

5.2 Regulatory Compliance with 40CFR761

5.2.1 40CFR761.45

The following items shall be marked as indicated:

a. PCB containers (PCBs in concentrations of 50 ppm or greater) holding solid or liquid materials (see 5.1.4, above);

b. Each storage area used to store PCBs and PCB items for disposal (see Figure 2); and

c. Each transport vehicle shall be marked on each end and side with Label 2 if it is loaded with PCB containers holding more than 45 Kg (99.4 lbs.) of liquid PCBs in concentrations of 50 ppm or greater.

All marks required by this section must be placed in a position on the exterior of the PCB containers or transport vehicles so that the marks can be easily read by any persons inspecting or servicing the marked PCB items or transport vehicles.

a. The following forms shall be used for marking:

i. ***Large PCB Mark - Label 1*** shown in Figure 2; letters and striping on a white or yellow background, sufficiently durable to equal or exceed the life (including storage for disposal) of the PCB article, PCB equipment, or PCB container (drum). The size of the mark shall be at least 15.25 cm (6 inches) on each

side. If the PCB article or PCB equipment is too small to accommodate this size, the mark may be reduced in size proportionately down to a minimum of 5 cm (2 inches) on each size.

ii. ***Small PCB Mark - Label 2***; if PCB item is too small for the larger label.

b. All PCB markings will be supplied by Quadrex.

6.0 REFERENCES

40CFR761
40CFR172

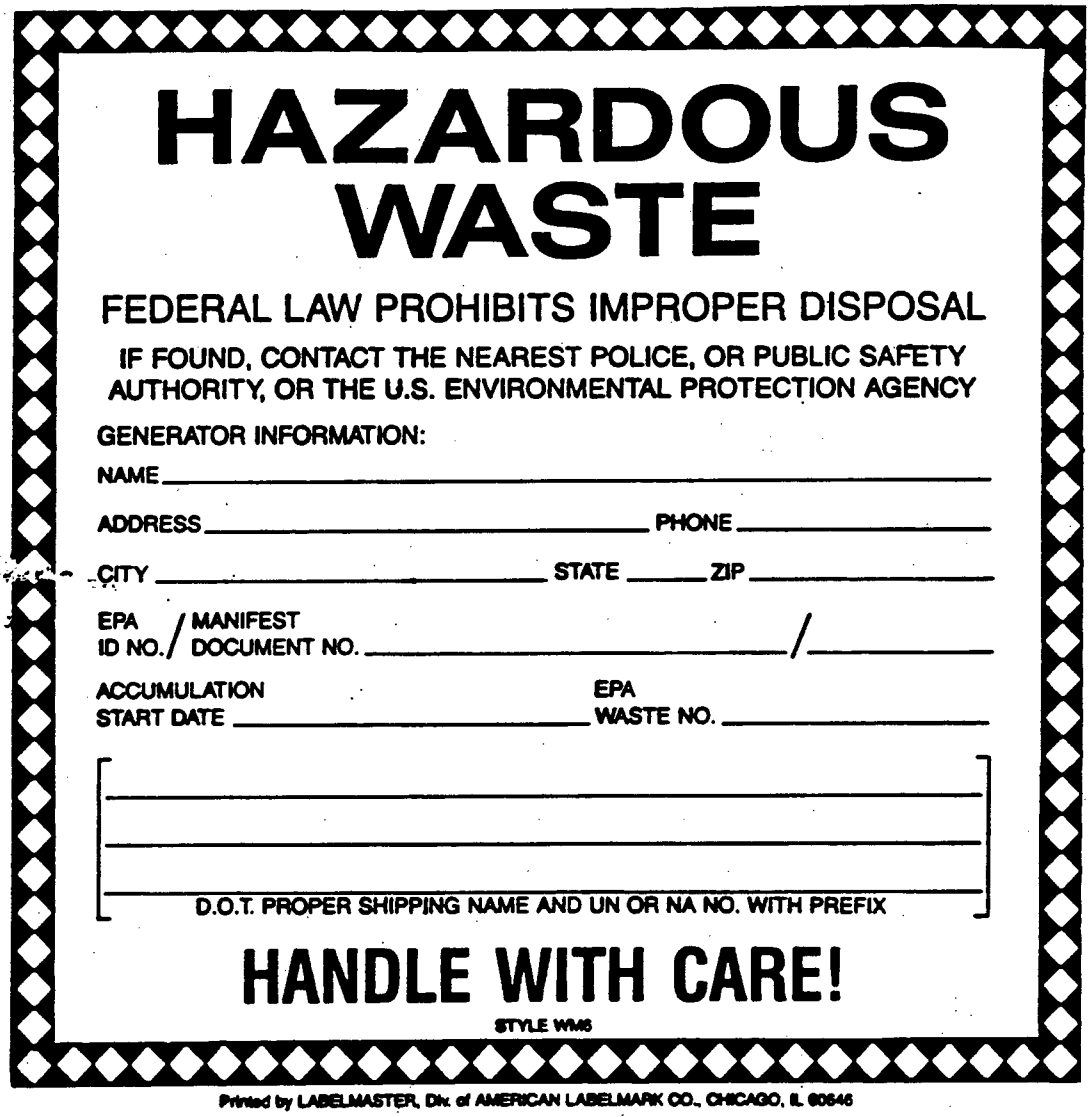
7.0 ATTACHMENTS

Figure 1, 2, and 3.

RECORD OF REVISION

REVISION NUMBER	PURPOSE OF REVISION	EFFECTIVE DATE
0	Initial Review	11/14/89
1	Number Reassignment (previously QFS-115, RV. 0)	01/31/92

FIGURE 1



HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERATOR INFORMATION:

NAME _____

ADDRESS _____ PHONE _____

CITY _____ STATE _____ ZIP _____

EPA ID NO. / MANIFEST DOCUMENT NO. _____ / _____

ACCUMULATION START DATE _____ EPA WASTE NO. _____

_____

_____

_____

D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX

HANDLE WITH CARE!

STYLE WM6

Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

FIGURE 2

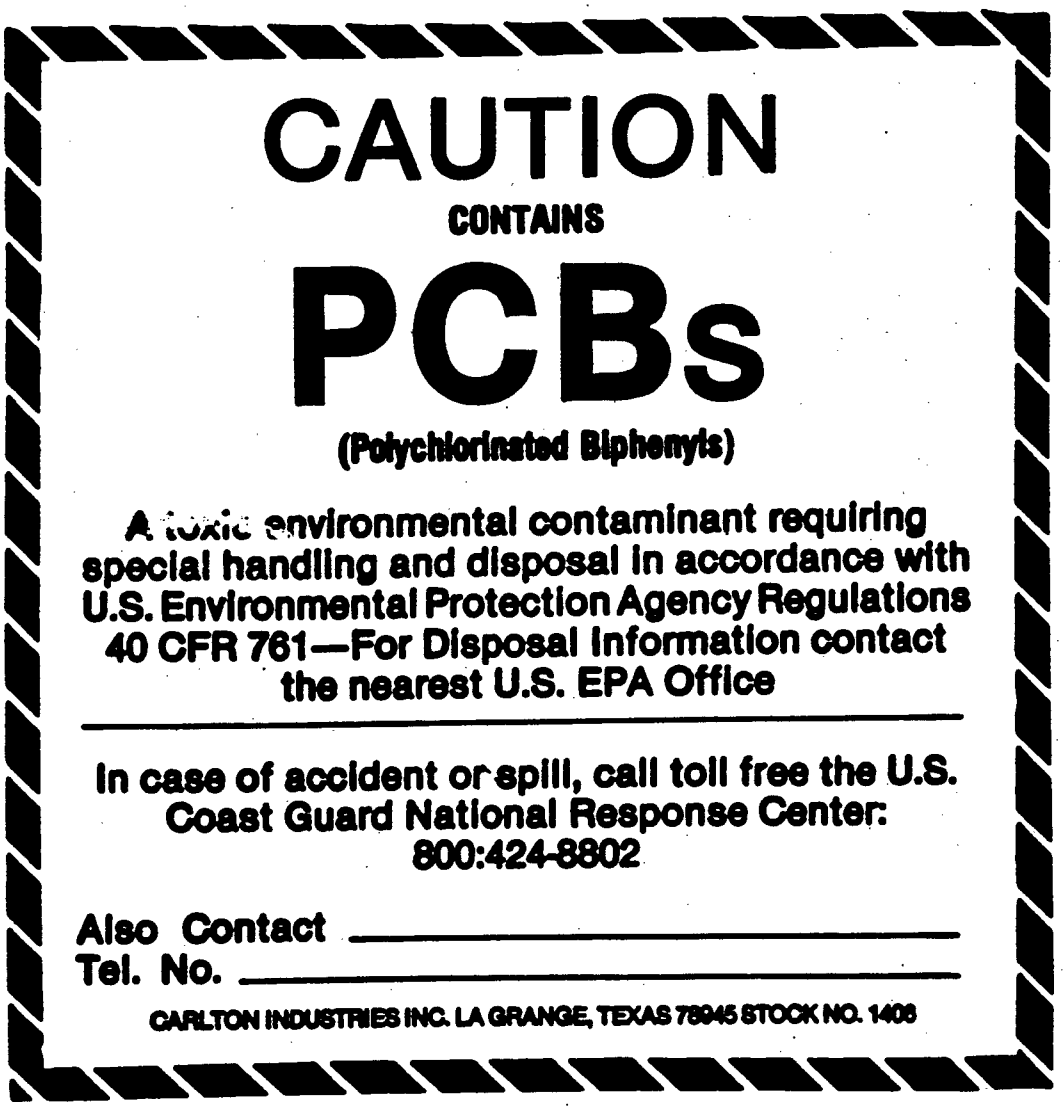

CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)
A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761—For Disposal Information contact the nearest U.S. EPA Office
In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800:424-8802
Also Contact
Tel. No.
CARLTON INDUSTRIES INC. LA GRANGE, TEXAS 78945 STOCK NO. 1406

FIGURE 3

PROPER D.O.T. SHIPPING NAME: RQ HAZARDOUS SUBSTANCE LIQUID, N.O.S. (POLYCHLORINATED BIPHENYLS) NA9188

ORM-E

RQ

WASTE FOR DISPOSAL

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR
PUBLIC SAFETY AUTHORITY, OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERATOR INFORMATION:

NAME_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

EPA ID NO._____ EPA WASTE NO._____

MANIFEST DOCUMENT NO._____

DATE REMOVED FROM SERVICE_____ DATE PLACED IN STORAGE_____

TOTAL WT. IN KILOGRAMS_____

CONTAINS TOXIC WASTE

HANDLE WITH CARE!

STYLE WMPCB-2 Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

PREPARED BY: _____ DATE: 2/4/92

APPROVED BY: _____ DATE: 2/6/92

1.0 PURPOSE

The purpose of this procedure is to minimize the probability of a spill, and, should a spill occur, to mitigate its effects; provisions for notification are included. This procedure meets the requirements of 40CFR761 Subpart G.

2.0 SCOPE

This procedure covers the use of equipment and personnel actions required to prevent, contain and control spills associated with all PCB related projects, including field sites and Company facilities (PCB remediation, transformer reclassification, sampling, and research projects). The last page of this procedure, "Emergency Notifications," will be issued for each site (site specific).

3.0 RESPONSIBILITIES

The designated Site Manager, or for Company facilities the Shift Supervisor, is responsible for assuring that workers have received training in spill prevention, containment, and control including methodology, equipment employed, and notifications. Each assigned worker has the duty and responsibility to minimize risks of spills, and will follow written and oral instructions from his/her supervisors as applicable.

4.0 DEFINITIONS

Spill: both intentional and unintentional spills, leaks, and other uncontrolled discharges where the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases. A "Spill" occurs only if the concentration of PCBs in the material spilled is 50 ppm or greater. Unknown concentrations of spilled PCB containing materials are to be assumed greater than 50 ppm.

RCO: Quadrex Regulatory Compliance Officer.

Other definitions are included in the Appendix to this SOP.

5.0 PROCEDURE

Spill Prevention

Maximum attention shall be directed towards spill prevention. All personnel handling liquid PCBs or PCB contaminated liquids shall be trained in accordance with the requirements of the project Health and Safety Plan. All fluid transfers from sampling activities will be conducted over collection pans. Should sampling be required in outdoor areas, weather will be considered (sampling will not be p mitted during periods of high winds or precipitation). If drip pans cannot be supported from normal flooring (high locations), boom trucks or scaffolding will incorporate suitable spill pan or berming as determined by the Site Manager.

Mass fluid transfers occurring during transformer retrofill operations or flushing activities will be performed with berms installed in strict compliance with QEC berming procedures which are Project specific.

Fluid drums will be checked to assure proper fitting and security of the drum closure. Waste drums will be inspected for structural damage before, during, and after loading and moving. Drums will be loaded on to pallets of ample strength for ease in moving when drums are to be loaded by a fork truck. Drums which must be loaded via a mechanical hoist will be properly secured prior to operating the hoist. Hoists must be rated to handle the load in adequate fashion. When loading and unloading the drum pallet, a ground guide will be used to prevent the fork tines from rupturing an drums. Drums will remain in the bermed area until pickup by a certified transportation company for shipment to the disposal facility.

Any fluid line connections required will be made over berms. Any "quick disconnect" type of fitting utilized will be secured, after connection, by several wraps of duct tape.

Spill Response

A spill kit consisting of:

- absorbent sheets;
- containment absorbents;
- gloves;
- pump;
- empty storage vessels;
- scoops, bags, etc., and
- broom

will be placed near the point of entry into the waste storage area, the work area exclusion zone (see project Health and Safety Plan), at system hookups, and at each cleanup location. In the event of a spill, the following actions will be initiated immediately:

- Stop the spill or leak;
- In the event a drum is ruptured, stop the leak by laying the drum on its side after assuring the drum closure is securely tightened;
- Contain fluid which has been released with a dike constructed out of amply absorbent material;
- Pump or scoop liquid into waste drum if necessary;
- Absorb remaining spilled fluid with dry absorbent material;
- Remove absorbent with scoop or broom and place into waste receptacle;
- Notify the Quadrex RCO for additional information on decontamination procedures--if required; and
- Notify the Regional EPA PCB Disposal Coordinator--if required (responsibility of the RCO).

Spill Cleanup

A. General Requirements

All PCB spills will be cleaned up expeditiously as possible in accordance with the requirements of 40CFR.761 Subpart G, or under the direction of the Regional Office of the EPA when necessary.

Personnel involved in PCB cleanup will use necessary personal protective clothing and equipment in accordance with the project Health and Safety Plan under direction of the Site Health and Safety Officer. Additional consultative assistance will be available via the Quadrex Health and Safety Office if indicated.

PCB spills will be reported by telephone to the Regulatory Compliance Officer as soon as possible, and copies of the PCB spill report will be

distributed to and reviewed by same.

B. Specific Requirements

For the purposes of this document, PCB spills will be placed into two categories: (1) spills of high-concentration PCBs (>500 ppm) or more than one pound of low-concentration PCBs (<500 ppm PCBs); and (2) spills of less than 1 pound of PCBs of low-concentration (<500 ppm).

1. Requirements for cleanup of high-concentration spills and low-concentration spills involving 1 pound or more PCBs by weight (270 gallons or more of untested mineral oil:

   a. Immediate Requirements

   The following immediate requirements must be completed within 24 hours (48 hours for PCB transformers). There is no exception for reporting the spill, however, the other immediate requirements may be delayed due to civil emergency, extremely adverse weather conditions, lack of access due to physical impossibility, or emergency operating conditions. The occurrence of a spill on a weekend or overtime costs are not acceptable reasons to delay response. In the case of any delayed cleanup, records documenting the circumstances must be completed and maintained.

   (1) Notify the Quadrex Regulatory Compliance Officer or Manager of Technical Services. The RCO will notify the EPA Regional Office and the National Response Center (NRC number is 800/434-8801). In the event that the RCO is unavailable, the Site Manager will make the necessary notifications.

   (2) Effectively cordon off or otherwise delineate and restrict the area encompassing the spill area plus a 3 foot buffer, and place signs advising persons to avoid the area.

   (3) Record and document the area of visible contamination, noting the extent of the visible trace area and the center of the visible trace area. If there are no visible traces record that fact and contact the Regional Office of the EPA for

guidance in completing statistical sampling of the spill area to establish spill boundaries.

(4) Initiate the cleanup of all visible traces of the fluid on hard surfaces and initiate removal of all visible traces of the spill on soil and other media.

(5) If there are insufficient traces of PCBs remaining at the spill site, estimate the area of the spill and immediately cordon off the area of suspect contamination. Identify the spill boundaries as soon as possible using a statistically based sampling scheme.

(6) The immediate actions are to be taken within 24 hours, but there is not a firm time requirement for completion of the cleanup of high-concentration or more than 1 pound of low-concentration PCBs. However, the cleanup must be completed as soon as possible.

b. Requirements for PCB spill directly into surface waters, drinking water, sewers, grazing lands, and vegetable gardens:

PCB spills of this type are subject to the immediate requirements of Paragraph A as indicated above. Direction for cleanup and final cleanup standards will be obtained from the Regional Office of the EPA.

c. Requirements for decontaminating spills in outdoor electrical substations:

(1) Contaminated solid surfaces (both impervious and non-impervious) must be cleaned to a PCB concentration of 100 μ/100 cm^2 as measured by standard wipe tests.

(2) At the option of the responsible party, soil contaminated by the spill will be cleaned either to 25 ppm PCBs by weight, or to 50 ppm PCBs by weight provided that a label or notice is visibly placed in the area. If this requirement will jeopardize the integrity of the electrical equipment at the substation, the EPA regional office may be contacted for alternatives.

d. Requirements for decontaminating spills in other restricted access areas:

(1) Spills which occur in restricted access locations other than outdoor electrical substations (see definitions), shall be decontaminated in accordance with paragraph 2 through 4. Conformance must be verified by post-cleanup sampling.

(2) High-contact solid surfaces shall be cleaned to 10 μg/100 cm^2.

(3) Low-contact, indoor, impervious solid surfaces will be decontaminated to 10 μ/100 cm^2.

(4) At the option of the responsible party, low-contact, indoor, n on-impervious solid surfaces will be cleaned either to 10 μg/100 cm^2 or 100 μg/100 cm^2 and encapsulated. The Regional Administrator retains the right to disallow the encapsulation.

(5) Low-contact, outdoor surfaces (both impervious and on-impervious) shall be cleaned to 100 $\mu g/100^2$.

(6) Soil contaminated by the spill will be cleaned to 25 ppm PCBs by weight.

e. Requirements for decontaminating spills in non-restricted access areas:

(1) Spills which occur in non-restricted access locations (see definition), shall be decontaminated in accordance with paragraphs 2 through 6. Conformance must be verified by post-cleanup sampling.

(2) Furnishings, toys, and other easily replaceable household items shall be disposed of in accordance with the provision of 761.60.

(3) Indoor solid surfaces and high-contact outdoor solid surfaces, defined as high contact residential/commercial surfaces shall be cleaned to 10 μg/100 cm^2, and measured

by standard wipe tests.

(4) Indoor vault areas and low-contact, outdoor, impervious solid surfaces shall be decontaminated to 10 $\mu g/100\ cm^2$.

(5) At the option of the responsible party, low-contact, outdoor, non-impervious solid surfaces shall be either cleaned to 10 $\mu g/100\ cm^2$ or cleaned to 10 $\mu g/100\ cm^2$ and encapsulated. The Regional Administrator retains the right to disallow the encapsulation.

(6) Soil contaminated by the spill will be decontaminated to 10 ppm PCBs by weight provided that soil is excavated to a minimum depth of 10 inches. The excavated soil will be replaced with clean soil, i.e., containing less than 1 ppm PCBs, and the spill site will be restored (e.g., replacement of turf).

f. **Records and Certification.** At the completion of cleanup a certification form (Form PCBCU-1) must be completed and held for a minimum of 5 years. Copies will be distributed to the Regulatory Compliance Officer.

2. Requirements for cleanup of low-concentration spills which involve less than 1 pound of PCBs by weight (less than 270 gallons of untested mineral oil).

a. **Decontamination Requirements.** Spills which involve less than 1 pound of low-concentration PCBs (<500 ppm) by weight or less than 270 gallons of untested mineral oil shall be cleaned as follows:

(1) Solid surfaces must be double wash/rinsed (see definition) except that all indoor, residential surfaces other than vault areas must be cleaned to 10 micrograms per 100 square centimeters by standard commercial wipe tests.

(2) All soil within the spill area (i.e., visible traces of soil and a buffer of 1 liter foot around the visible traces) must be excavated, and the ground be restored to its original configuration by back-filling with clean soil (i.e., containing

less than 1 ppm PCBs).

(3) The cleanup procedures in paragraphs 1 and 2 must be completed within 48 hours after the responsible party was notified or became aware of the spill.

b. **Effect of Emergency or Adverse Weather.** Completion of cleanup may be delayed beyond 48 hours in case of circumstances including but not limited, civil emergency, adverse weather conditions, lack of access to the site, and emergency operating conditions. The occurrence of a spill on a weekend or overtime costs are not acceptable reasons to delay response. Completion of a cleanup may be delayed only for the duration of the adverse conditions. If the adverse weather conditions, or time lapse due to other emergency, has left insufficient visible traces, the responsible party must use a statistically based sampling scheme to determine the spill boundaries as required.

c. **Records and Certification.** At the completion of cleanup a certification form (Form PCBCU-2) must be completed and held for a minimum of 5 years. Copies will be distributed to the Regulatory Compliance Officer.

(EXAMPLE ONLY)

PCB DISPOSAL ACTIVITY EMERGENCY NOTIFICATION FORM

DATE OF NOTIFICATION: _____

CONTACTS	Individual Contact	
Quadrex:	Dennis Fleetwood	904/373-6066
	Gerald Smith	904/373-6066
	Robert Pitre	904/373-6066
Owner Contacts:		
_____	_____	_____
	_____	_____
EPA Region ___:	_____	_____
State Environmental Department:		
_____	_____	_____
Local County Health Department:	_____	_____
Local Fire Department:	_____	_____
Local Public Safety Department:	_____	_____

NATURE OF DISPOSAL ACTIVITY

Kind of Disposal Process:	Separation of PCBs from cleaning solvent
Kinds of Material Containing PCBs:	Hydraulic lubricants, residues
Numbers and Sizes of Equipment Containing PCBs:	One air compressor system including air receiver tank and associated piping
Quantity of Solids and/or Volume of Liquids Containing PCBs:	Approx. 22ft^3 solids / Less than 55 gal. liquids
Concentration of PCBs in the Material Treated:	Less than 3100 ppm

LOCATION

Site Address:	_____
	_____
	_____
	_____
Quadrex Site Manager:	_____

TIME OF PROCESSING

Date:	_____
Time:	_____

APPENDIX

DEFINITIONS

DOUBLE WASH/RINSE: A minimum requirement to cleanse solid surfaces (both impervious and non-impervious) two times with an appropriate solvent or other material in which PCBs are at least 5 percent soluble (by weight). A volume of PCB-free fluid sufficient to cover the contaminated surface completely must be used in each wash/rinse. The wash/rinse requirement does not mean the mere spreading of solvent or other fluid over the surface, nor does the requirement mean a once-over wipe with a soaked cloth. Precautions must be taken to contain any runoff resulting from the cleansing and to dispose properly of wastes generated during the cleansing.

HIGH-CONCENTRATION PCBS: PCBs that contain 500 ppm or greater PCBs, or those materials which EPA requires to be assumed to contain 500 ppm or greater PCBs in the absence of testing.

HIGH-CONTACT INDUSTRIAL SURFACE: A surface in an industrial setting which is repeatedly touched, often for relatively long periods of time. Manned machinery and control panels are examples of high-contact industrial surfaces. High-contact industrial surfaces are generally of impervious solid material. Examples of low-contact industrial surfaces include ceilings, walls, floors, roofs, roadways and sidewalks in the industrial area, utility poles, unmanned machinery, concrete pads beneath electrical equipment, curbing, exterior structural building components, indoor vaults, and pipes.

HIGH-CONTACT RESIDENTIAL/COMMERCIAL SURFACE: A surface in a residential/commercial area which is repeatedly touched, often for relatively long periods of time. Doors, wall areas below 6 feet in height, uncovered flooring, window sills, fencing, bannisters, stairs, automobiles, and children's play areas such as outdoor patios and sidewalks are examples of high-contact residential/commercial surfaces. Examples of low-contact residential/commercial surfaces include interior ceilings, interior wall areas above 6 feet in height, roofs, asphalt roadways, concrete roadways, wooden utility poles, unmanned machinery, concrete pads beneath electrical equipment, curbing, exterior structural building components, (e.g., aluminum/vinyl siding, cinder block, asphalt tiles), and pipes.

IMPERVIOUS SOLID SURFACES: Solid surfaces which are non-porous and thus unlikely to absorb spilled PCBs within the short period of time required for cleanup of spills under this policy. Impervious solid surfaces include, but are not limited to, metals,

glass, aluminum siding, and enameled or laminated surfaces.

LOW-CONCENTRATION PCBS: PCBs that are tested and found to contain less than 500 ppm PCBs, or those PCB-containing materials which EPA requires to be assumed to be at concentrations below 500 ppm (i.e., untested mineral oil dielectric fluid).

NON-IMPERVIOUS SOLID SURFACES: Solid surfaces which are porous and are more likely to absorb spilled PCBs prior to completion of the cleanup requirements prescribed in this policy. Non-impervious solid surfaces include, but are not limited to, wood, concrete, asphalt, and plasterboard.

NONRESTRICTED ACCESS AREAS: Any area other than restricted access, outdoor electrical substations, and other restricted access locations, as defined in this section. In addition to residential/commercial areas, these areas include unrestricted access rural areas (areas of low density development and population where access in uncontrolled by either man-made barriers or naturally occurring barriers, such as rough terrain, mountains, or cliffs).

OTHER RESTRICTED ACCESS (NONSUBSTATION) LOCATIONS: Areas other than electrical substations that are at least 0.1 kilometer (km) from a residential/commercial area and limited by man-made barriers (e.g., fences and walls) to substantially limited by naturally occurring barriers such as mountains, cliffs, or rough terrain. These areas generally include industrial facilities and extremely remote rural locations. (Areas where access is restricted but are less than 0.1 km from a residential/commercial area are considered to be residential/commercial areas.)

OUTDOOR ELECTRICAL SUBSTATIONS: Outdoor, fenced-off and restricted access areas used in the transmission and/or distribution of electrical power.Outdoor electrical substations restrict public access by being fenced or walled off. For purposes of this policy, outdoor electrical substations are defined as being located at least 0.1 km from a residential/commercial area.

RESIDENTIAL/COMMERCIAL AREAS: Those areas where people live or reside or where people work in other than manufacturing or farming industries. Residential areas include housing and the property on which housing is located, as well as playgrounds, roadways, sidewalks, parks, and other similar areas within a residential community. Commercial areas are typically accessible to both members of the general public and employees and include public assembly properties, institutional properties, stores, office buildings, and transportation centers.

RESPONSIBLE PARTY: The owner of the PCB equipment, facility, or other source of PCBs or his/her designated agent (e.g., a facility manager or foreman).

SOIL: All vegetation, soils, and other ground media, including but not limited to, sand, grass, gravel, and oyster shells. It does not include concrete and asphalt.

SPILL: Both intentional and unintentional spills, leaks, and other uncontrolled discharges where the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases. This policy applies to spills of 50 ppm or greater PCBs. The concentration of PCBs spilled is determined by the PCB concentration in the material presumed to contain greater than 50 ppm, but less than 500 ppm PCBs and is subject to the relevant requirements of this policy.

SPILL AREA: The area of soil on which visible traces of the spill can be observed plus a buffer zone of 1 foot beyond the visible traces. Any surface or object (e.g., concrete sidewalk or automobile) within the visible traces area or on which visible traces of the spilled material are observed is included in the spill area. This area represents the minimum area assumed to be contaminated by PCBs in the absence of precleaning sampling data and is thus the minimum area which must be cleaned.

SPILL BOUNDARIES: The actual area of contamination as described by post-cleanup verification sampling or by pre-cleanup sampling to determine actual spill boundaries. EPA can require additional cleanup when necessary to decontaminate all areas within the spill boundaries to the levels required in this policy (e.g., additional cleanup will be required if post-cleanup sampling indicates that the area decontaminated by the responsible party, such as the spill area as defined in this section, did not encompass the actual boundaries of PCB concentration).

STANDARD WIPE TEST: For spills of high-concentration PCBs on solid surfaces, a cleanup to numerical surface standards and sampling by a standard wipe test to verify that the numerical standards have been met. This definition constitutes the minimum requirements for an appropriate wipe testing protocol. A standard-size template (10 centimeters by 10 centimeters) will be used to delineate the areas of cleanup; the wiping medium will be a gauze pad or glass wool of known size which has been saturated with hexane. It is important that the wipe be performed very quickly after the hexane is exposed to air. EPA strongly recommends that the gauze (or glass wool) be prepared with hexane in the laboratory and that the wiping medium be stored in sealed glass vials until it is used for the wipe test. Further, EPA requires the collection and testing of field blanks and replicates.

PCBCU-1
PCB SPILL CLEANUP RECORD AND CERTIFICATION

(High-concentration PCBs (>500 ppm) or More Than 1 Pound of Low-concentration PCBs by Weight

DIRECTIONS: The following is to be completed following the cleanup of high-concentration PCBs (>500 ppm) or more than one pound of low-concentration PCBs by weight. Each item must be completed with actual or estimated information. The certification must be signed by the Site Manager.

Source of Spill: (type of equipment or container)_____

_____

Date and Time of Spill: _____/_____

Date and Time of Cleanup Completion:_____/_____

If cleanup is delayed due to emergency of adverse weather, state nature and duration of delay._____

_____

Description of Spill Location and Materials Contaminated: (Include whether spill occurred in an outdoor electrical substation, other restricted access location, or in a nonrestricted access area.)_____

_____

_____

Approximate Depth of Soil Excavation and Amount of Soil Removed:_____

_____

Pre-cleanup Sampling Data and Method: (Required only if traces of PCB spill are not visible.)_____

_____

Description of Solid Surfaces Cleaned:_____

_____

I, _____ certify that the requirements for cleanup of spills of high-concentration PCBs have been set, and I further certify that the information contained above is true to the best of my knowledge.

_____ _____

Signature Date

PCBCU-2
PCB SPILL CLEANUP RECORD AND CERTIFICATION

(Less Than 1 Pound PCBs <500 ppm Concentration)

DIRECTIONS: The following is to be completed following the cleanup of less than one pound of low-concentration PCBs by weight. Each item must be completed with actual or estimated information. The certification must be signed by the Site Manager.

Source of Spill: (type of equipment or container)_____

_____

Date and Time of Spill: _____/_____

Date and Time of Cleanup Completion: _____/_____

If cleanup requires more than 48 hours from discovery due to emergency or adverse weather, state nature and duration of delay. _____

_____

Description of Spill Location: _____

_____

Approximate Depth of Soil Excavation and Amount of Soil Removed: _____

_____

Pre-cleanup Sampling Data and Method: (Required only if traces of PCB spill are not visible.) _____

_____

Description of Solid Surfaces Cleaned and of Double Wash/Rinse Method Used:

_____

_____

I _____ certify that the requirements for cleanup of spills of high-concentration PCBs have been met, and I further certify that the information contained above is true to the best of my knowledge.

_____ _____

Signature Date

RECORD OF REVISION

REVISION NUMBER	PURPOSE OF REVISION	EFFECTIVE DATE
0	INITIAL REVIEW	11-10-89
1	DOCUMENT RETYPED/NEW SOP # (Previously QFS-111 Rev. 0	02-04-92

APPENDIX C

MONSANTO PRODUCT NAME

Polychlorinated Biphenyls (PCBs)

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

Date: 10/88

PRODUCT IDENTIFICATION

Synonyms:
PCBs
Chlorodiphenyl (___% Cl)
Chlorinated biphenyl
Polychlorinated biphenyl
Chlorinated biphenyls
(approx. ___% Cl)

Trade Names/ Common Names:
Aroclor®[1] Series 1016, 1221, 1232, 1242, 1248, 1254, 1260
Therminol®[1] FR Series

PYRANOL®[2] and INERTEEN®[3] are trademarks for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL - Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

This list of trade names is representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

®[1] Registered trademark of Monsanto Company
®[2] Registered trademark of General Electric Company
®[3] Registered trademark of Westinghouse Electric Corporation

CAS No.'s: 001336363, 053469219, 021672296, 01109769, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked. (check regulations, 40 CFR 761, for details)

CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761 For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill call toll free the U.S. Coast Guard National Response Center. 800-424-8802

Also Contact _____
Tel. No. _____

CAUTION —
CONTAINS
PCBs
(Polychlorinated Biphenyls)
FOR PROPER DISPOSAL INFORMATION CONTACT U.S. ENVIRONMENTAL PROTECTION AGENCY

PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

EMERGENCY AND FIRST AID PROCEDURES

Ingestion: Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—If large amounts are ingested, gastric lavage is suggested.

Skin: If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—Hot PCBs may cause thermal burns.

Eyes: Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based opthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.

Inhalation: Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

ATTENTION! Repeated or prolonged contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Airborne Exposure Limits: Chlorinated biphenyl (approximately 42% chlorine)

OSHA PEL: 1 mg/m³ 8-hour time-weighted average - Skin*
ACGIH TLV: 1 mg/m³ 8-hour time-weighted average - Skin*
2 mg/m³ short-term exposure limit - Skin*

**Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.*

(OCCUPATIONAL CONTROL PROCEDURES continued on page 3)

CUPATIONAL CONTROL PROCEDURES *(continued)*

...rborne Exposure Limits (Continued): Chlorinated biphenyl (approximately 54% chlorine)

OSHA PEL: 0.5 mg/m³ 8-hour time-weighted average - Skin*
ACGIH TLV: 0.5 mg/m³ 8-hour time-weighted average - Skin*
1 mg/m³ short-term exposure limit - Skin*

**Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.*

FIRE PROTECTION INFORMATION

Fire and Explosion: PCBs are fire-resistant compounds. They may decompose to form CO, CO_2, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 600-650°C in the presence of excess of oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

HEALTH EFFECTS SUMMARY

Skin Contact: PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

Eye Contact: The liquid products and their vapors are moderately irritating to eye tissues.

gestion: The acute oral toxicities of the undiluted compounds are: LD_{50} rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

nhalation: Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

(HEALTH EFFECTS SUMMARY continued on page 4)

HEALTH EFFECTS SUMMARY *(continued)*

Other:

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Fourth).

PHYSICAL DATA

PROPERTIES OF SELECTED AROCLORS©

PERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
sity ybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—*Not Available*

SPILL, LEAK & DISPOSAL INFORMATION

anup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state and local regulations may require immediate reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

ENVIRONMENTAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquids or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

ADDITIONAL COMMENTS

Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives.

1972 Monsanto restricted sales of PCBs to applications involving only closed electrical systems (transformers and capacitors). In 1977 all manufacturing and sales were voluntarily terminated. In 1979 EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

John H. Craddock
Product & Environmental Safety Director

Gary W. Mappes
Product & Environmental Safety Manager

Environmental Policy Staff
Monsanto Company
800 North Lindbergh Boulevard
St. Louis, Missouri 63167
(314) 694-4764

Material Safety Data Sheet

MSD 8902.58

rev.9/91

DETREX CORPORATION P.O. Box 5111, Southfield, MI 48086-5111

Approved by U.S. Dept. of Labor as "Essentially similar" to Form OSHA-20

Date: September, 1991	Edition: Third	
Chemical Name and Synonyms: 1,1,1-trichloroethane; methylchloroform CAS No. 71-55-6	Trade Name and Synonyms: DETREX PERM-ETHANE ®	HMIS and NFPA H-2 F-1 R-0
Chemical Family: Halogenated Hydrocarbons	Formula: CH_3CCl_3	
DOT Shipping Name: 1,1,1-trichloroethane	DOT Hazard Class: ORM-A (6.1)	I. D. Number: UN 2831

SECTION 1 · PHYSICAL DATA

Boiling Point @ 760 mm Hg:	Vapor Density (Air=1):	Specific Gravity (H_2O=1):	pH of Solutions:
72°C 161.6°F Boiling Range: 72°-88°C 161.6-190.4°F	4.54	1.300-1.320 @ 25°/25°C	6.0 to 7.5
Freezing/Melting Point: -45°C -49°F	**Solubility (Weight % in Water):** Negligible	**Bulk Density:** 10.80-10.97 lbs./gal. @ 25°C	**Volume % Volatile:** Essentially 100
Vapor Pressure: 135mmHg @ 25°C	**Evaporation Rate (ethyl ether = 1):** 0.35	**Heat of Solution:** Not Applicable	**Appearance and Odor:** Clear, colorless liquid with ether-like odor

SECTION 2 · HAZARDOUS INGREDIENTS

	%	Hazard Data
1,1,1-trichloroethane (Stabilized) Glycol methylene ether (CAS #646-06-0), Sec butanol <2% (CAS #78-92-2), other stabilizers	>95 Bal	See Sections 4 & 5

NOTE: Hazard information is based upon the tested mixture and not individual ingredients.

SECTION 3 · FIRE AND EXPLOSION HAZARD DATA

Flash Point °F (Method Used)	Flammable Limits in Air (% by Volume)	Extinguishing Media:
None when tested in accordance with DOT requirements	LEL: 7% UEL: 15% (See Below)	Water, dry chemicals or carbon dioxide

Special Fire Fighting Procedures: Fire fighters should wear NIOSH/MSHA-approved pressure-demand, self-contained breathing apparatus for possible exposure to hydrogen chloride and possible traces of phosgene. Use water only in degreasers when aluminum reaction occurs.

Unusual Fire and Explosion Hazards. Vapors concentrated in a confined or poorly ventilated area can be ignited upon contact with a high energy spark, flame, or high intensity source of heat. This can occur at concentrations ranging between 7-15% by volume. Decomposition or burning can produce hydrogen chloride or possibly traces of phosgene.

SECTION 4 · HEALTH HAZARD DATA

Toxicity Data	Classification (Poison, Irritant, Etc.)
LC_{50} Inhalation (rat) 14,500 ppm/7 hours	Inhalation: Slightly toxic
LD_{50} Dermal (rabbit) >15g/kg	Skin Not significantly toxic
Skin/Eye Irritation (See Section 5)	Skin/Eye: Irritating
LD_{50} Ingestion (rat) 10-12 g/kg (rabbit; guinea pig) 5.6-9.5 g/kg	Ingestion: Not significantly toxic
Fish. LC_{50} (Lethal Concentration) Unknown	Aquatic: Unknown

24-HOUR EMERGENCY ASSISTANCE: (313) 358-5800

SECTION 5 · EFFECTS OF OVEREXPOSURE

This section covers effects of overexposure for inhalation, eye/skin contact, ingestion and other types of overexposure listed in the order of the most hazardous and the most likely route of overexposure.

Permissible Exposure Limits: Current OSHA Permissible exposure limit is 350 ppm, 8-hour TWA (time-weighted average); 29CFR 1910.1000

ACGIH: 8-hour time-weighted average (TWA) -- 350 ppm with a short term exposure limit (STEL) of 450 ppm for any 15 minute excursion, not to be repeated more than four (4) times per 8-hour day with at least 60 minutes between excursions to the STEL.

ACUTE

Inhalation: 1,1,1-trichloroethane is primarily a central nervous system depressant. Inhalation can cause irritation of the respiratory system, dizziness, nausea, lightheadedness, headache, loss of coordination and equilibrium, unconsciousness, possible central nervous system damage and even death in confined or poorly ventilated areas. Fatalities following severe acute exposure to various chlorinated solvents have been attributed to ventricular fibrillation.

Eye/Skin: Liquid splashed in the eye can result in discomfort, pain and irritation. Prolonged or repeated contact with liquid on the skin can cause irritation and dermatitis. The problem may be accentuated by liquid becoming trapped against the skin by contaminated clothing and shoes, and skin absorption can occur.

Ingestion: Swallowing of this material may result in irritation of the mouth and GI tract with other effects as listed above for Inhalation. Vomiting and subsequent aspiration into the lungs may lead to chemical pneumonia and pulmonary edema which is a potentially condition.

CHRONIC

1,1,1-trichloroethane has been extensively studied for cancer potential. There is no documented evidence to suggest that 1,1,1-trichloroethane causes an increased cancer incidence in humans or animals. The EPA's Science Advisory Board concluded that there is no evidence to suggest carcinogenic activity for 1,1,1-trichloroethane. 1,1,1-trichloroethane is not listed by IARC, NTP, or OSHA as a carcinogen.

REPRODUCTIVE:

In developmental toxicity studies, there was no evidence for birth defects in rats or rabbits after inhalation exposure to pregnant animals. No adverse finding relative to reproduction or developmental toxicity were observed following daily six-hour exposures at or below 3000 ppm in rats or rabbits.

EMERGENCY AND FIRST AID PROCEDURES:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration, ferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

Eye or Skin Contact: Flush eyes and skin with plenty of water (soap and water for skin) for at least 15 minutes, while removing contaminated clothing and shoes. If irritation occurs, consult a physician. Thoroughly clean contaminated clothing and shoes before reuse or discard.

Ingestion: If conscious, drink large quantities of water, DO NOT induce vomiting. Take immediately to a hospital or physician. If unconscious, or in convulsions, take immediately to a hospital. DO NOT attempt to give anything by mouth to an unconscious person.

Notes to Physician (Including Antidotes): NEVER administer adrenalin following 1,1,1-trichloroethane overexposure. Increased sensitivity of the heart to adrenalin may be caused by overexposure to 1,1,1-trichloroethane.

SECTION 6 - REACTIVITY DATA

Stability: Stable	**Conditions to Avoid:** Avoid open flames, hot glowing surfaces or electric arcs.
Hazardous Polymerization: Will not occur.	**Conditions to Avoid:** None

ompatibility (Materials to Avoid):
id contamination with caustic soda, caustic potash or oxidizing materials.
ck sensitive explosives may be formed. Avoid contact with aluminum, magnesium, zinc and alloys thereof under high pressures.

Hazardous Decomposition Products: Hydrogen chloride and possibly traces of phosgene.

SECTION 7 - SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Spilled or Released: Immediately evacuate the area and provide maximum ventilation. Unnecessary personnel should move upwind of spill. Only personnel equipped with proper respiratory and skin/eye protection (See Section 8) should be permitted in area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover spilled material on adsorbents, such as sawdust and vermiculite, and sweep into closed containers for disposal. After all visible traces, including ignitable vapors, have been removed, thoroughly wet vacuum the area. DO NOT flush to sewer. If area of spill is porous, remove as much contaminated earth and gravel, etc. as necessary and place in closed containers for disposal.

Waste Disposal Method: Contaminated sawdust, vermiculite or porous surface must be disposed of in a permitted hazardous waste management facility. Recovered liquids may be re-processed or incinerated or must be treated in a permitted hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. It is your duty to dispose of the chemical materials and/or their containers in accordance with the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act ell as any other relevant federal, state or local laws/regulations regarding disposal.

...MENTS: Only regulated when shipped by air. DOT Shipping Name is 1,1,1-trichloroethane, DOT Hazard Class is ORM-A, and UN Number is UN2831.

RCRA - Hazardous Waste Number - U-226

SECTION 8 · SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use a half or full facepiece organic vapor chemical cartridge or canister respir- when concentrations exceed permissible limits. Use self-contained breathing apparatus (SCBA) .11 facepiece airline respirator with auxiliary SCBA operated in the pressure-demand mode for .gencies and for all work performed in storage vessels, poorly ventilated rooms, and other con- ned areas. Respirators must be approved by NIOSH or MSHA. The respirator use limitations made by NIOSH/MSHA and by the manufacturer must be observed. Respiratory protection programs must be in accordance with 29CFR 1910.134.

Ventilation (Type): Use local exhaust or dilution ventilation as appropriate to control exposures to below permissible limits.

Eye Protection: Splashproof goggles	**Gloves:** Viton®. For limited service only; Polyvinyl alcohol*, Nitrile, Butyl, Neoprene. *(degrades in water)

Other Protective Equipment: Boots, aprons, or chemical suits should be used when necessary to prevent skin contact. Personnel protective clothing and use of equipment must be in accordance with 29CFR 1910.133 and 29CFR 1910.132.

SECTION 9 · SPECIAL PRECAUTIONS

Precautions to be Taken During Handling and Storing:

- Do not use in poorly ventilated or confined areas without proper respiratory protection (See Section 8).
- 1,1,1-trichloroethane vapors are heavier than air and will collect in low areas.
- Keep container closed when not in use.
- Store only in closed, properly labeled containers.
- Liquid oxygen or other strong oxidants may form explosive mixtures with 1,1,1-trichloroethane.
- This material or its vapors when in contact with flames, hot glowing surfaces, or electric arcs can decompose to form hydrogen chloride and possible traces of phosgene.
- AVOID CONTAMINATION OF WATER SUPPLIES. Handling, storage, and use procedures must be carefully monitored to avoid spills or leaks. Any spill or leak has the potential to cause underground water contamination which may, if sufficiently severe, render a drinking water source unfit for human consumption. Contamination that does occur cannot be easily corrected.
- Do not store or stack aluminum in contact with 1,1,1-trichloroethane to prevent possible solvent decomposition (stacking corrosion).
- Caution should be taken not to use in pressurized or totally enclosed system of aluminum construction. Example: paint or adhesive spray system.
- A chlorinated solvent used as a flashpoint suppressant must be added in sufficient quantity or the resultant mixture may have a flashpoint lower than the flammable component.
- Do not use cutting or welding torches on empty drums that contained 1,1,1-trichloroethane unless properly purged and cleaned.

Other Precautions:

- Do not breathe vapors. High vapor concentrations can cause dizziness, unconsciousness, possible central nervous system damage or death.
- Use only with adequate ventilation. Ventilation must be sufficient to limit employee exposure to 1,1,1-trichloroethane below permissible exposure limits. Observance of lower limits (outlined in Section 5) is advisable.
- Avoid contact with eyes. Will cause irritation and pain.
- Avoid prolonged or repeated contact with skin. May cause irritation or dermatitis.
- Do not swallow. Swallowing may cause injury or death.
- Do not eat, drink, or smoke in work areas.

COMMENTS:

TSCA-1,1,1-trichloroethane is on the TSCA inventory under CAS #71-55-6. Tri-Ethane formulations contain stabilizers that are listed on the TSCA inventory.

SARA TITLE III - A) 311/312 catagories - Acute, B) listed in Section 313 as 1,1,1-trichloroethane (Methyl-chloroform),also contains sec butanol which is listed in Section 313, C) Not listed as an "Extremely Hazardous Substance" in Section 302.

CERCLA - Listed in Table 302.4 of 40 CFR Part 302 as a hazardous substance with a reportable quantity of pounds, releases to air, land, or water which exceed the RQ must be reported to the National Response r, 800-424-8802.

. - Waste 1,1,1-trichloroethane and contaminated soils/materials from spill cleanup are U226 hazardous waste per 40 CFR 261.33 and must be disposed of accordingly under RCRA. See 40 CFR 261.33(C) and 261.7(B)(3) for cleaning requirements for empty containers.

CALIFORNIA PROP. 65 - This product contains ethylene dichloride, a process impurity at less than 0.1%. Prop. 65 lists this compound as known to the State of California to cause cancer.

DEFINITIONS

...finition page is intended for use with Material Safety Data Sheets supplied by the Ashland Chemical Company. ...pients of these data sheets should consult the OSHA Safety and Health Standards (29 CFR 1910), particularly subpart G - Occupational Health and Environmental Control, and subpart I - Personal Protective Equipment, for general guidance on control of potential Occupational Health and Safety Hazards.

SECTION I

PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: Chemical family or product description.

DOT HAZARD CLASSIFICATION: Product meets DOT criteria for hazards listed.

SECTION II

COMPONENTS

Components are listed in this section if they present a physical or health hazard and are present at or above 1% in the mixture. If a component is identified as a CARCINOGEN by NTP, IARC, or OSHA as of the date on the MSDS, it will be listed and footnoted in this section when present at or above 0.1% in the product. Negative conclusions concerning carcinogenicity are not reported. Additional health information may be found in Section V. Components subject to the reporting requirements of Section 313 of SARA Title III are identified in the footnotes in this section, along with typical percentages. Other components may be listed if deemed appropriate.

Exposure recommendations are for components. OSHA Permissible Exposure Limits (PELS) and American ...ference of Governmental Industrial Hygienists ...) Threshold Limit Values (TLVs) appear on the ...with the ... identification. Other ...mendations appear as footnotes.

SECTION III

PHYSICAL DATA

BOILING POINT: Of product if known. The lowest value of the components is listed for mixtures.

VAPOR PRESSURE: Of product if known. The highest value of the components is listed for mixtures.

SPECIFIC VAPOR DENSITY: Compared to AIR = 1. If the Specific Vapor Density of a product is not known, the value is expressed as lighter or greater than air.

SPECIFIC GRAVITY: Compared to WATER = 1. If Specific Gravity of product is not known, the value is expressed as less than or greater than water.

pH: If applicable.

PERCENT VOLATILES: Percentage of material with initial boiling point below 425 degrees Fahrenheit and vapor pressure above 0.1mm Hg at 68 F.

EVAPORATION RATE: Indicated as faster or slower than ETHYL ETHER, unless otherwise stated.

SECTION IV

FIRE AND EXPLOSION DATA

FLASH POINT: Method identified.

EXPLOSION LIMITS: For product if known. The lowset value of the components is listed for mixtures.

...RDOUS DECOMPOSITION PRODUCTS: Known or ...ed hazardous products resulting from heating, ...g or other reactions.

SECTION IV (cont.)

EXTINGUISHING MEDIA: Following National Fire Protection Association criteria.

FIREFIGHTING PROCEDURES: Minimum equipment to protect firefighters from toxic products of vaporization, combustion or decomposition in fire situations. Other firefighting hazards may also be indicated.

SPECIAL FIRE AND EXPLOSION HAZARDS: States hazards not covered by other sections.

NFPA CODES: Hazard ratings assigned by the National Fire Protection Association.

SECTION V

HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMIT: For product.

THRESHOLD LIMIT VALUE: For product.

EFFECTS OF ACUTE OVEREXPOSURE: Potential local and systemic effects due to single or short term overexposure to the eyes and skin or through inhalation or ingestion.

EFFECTS OF CHRONIC OVEREXPOSURE: Potential local and systemic effects due to repeated or long term overexposure to the eyes and skin or through inhalation or ingestion.

FIRST AID: Procedures to be followed when dealing with accidental overexposure.

PRIMARY ROUTE OF ENTRY: Based on properties and expected use.

SECTION VI

REACTIVITY DATA

HAZARDOUS POLYMERIZATION: Conditions to avoid to prevent hazardous polymerization resulting in a large release of energy.

STABILITY: Conditions to avoid to prevent hazardous or violent decomposition.

INCOMPATIBILITY: Materials and conditions to avoid to prevent hazardous reactions.

SECTION VII

SPILL OR LEAK PROCEDURES

Reasonable precautions to be taken and methods of containment, clean-up and disposal. Consult federal, state and local regulations for accepted procedures and any reporting or notification requirements.

SECTION VIII

PROTECTIVE EQUIPMENT TO BE USED

Protective equipment which may be needed when handling the product.

SECTION IX

SPECIAL PRECAUTIONS OR OTHER COMMENTS

Covers any relevant points not previously mentioned.

ADDITIONAL COMMENTS

Containers should be either reconditioned by CERTIFIED firms or properly disposed of by APPROVED firms. Disposal of containers should be in accordance with applicable laws and regulations. "EMPTY" drums should not be given to individuals. Serious accidents have resulted from the misuse of "EMPTIED" containers (drums,pails,etc.). Refer to Sections IV and IX.

Fisher Scientific Company

Chemical Manufacturing Division
P. O. Box 375, 1 Reagent Lane
Fair Lawn, NJ 07410

MATERIAL SAFETY DATA SHEET (Adapted from USDL Form LSD-005-4) (201) 796-710
See Disclaimer on reverse side.

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Hexane	$CH_3(CH_2)_4CH_3$

SYNONYM OR CROSS REFERENCE

SECTION II. HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD
Hexane	Flammable

SECTION III. PHYSICAL DATA

BOILING POINT 68.7°C	MELTING POINT -96°C
VAPOR PRESSURE(mm Hg) 150	SPECIFIC GRAVITY 0.66
DENSITY (AIR = 1) 2.97	PERCENT VOLATILE BY VOLUME (%) 100
WATER SOLUBILITY insoluble	EVAPORATION RATE (ether = 1) greater than 1

APPEARANCE Colorless Liquid

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Uel	Lel
(°F) -7°F (cc)		7.7%	1.1%

FIRE EXTINGUISHING MEDIA
Dry chemical, foam, carbon dioxide

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE

$180mg/M^3$ as per ACGIH 1983-84

HAZARDS Irritating to eyes and skin. Vapor harmful. May cause central or peripheral nervous system damage.

FIRST AID PROCEDURES In case of contact, flush eyes with plenty of water for 15 minutes. Call a physician. If inhaled, remove to fresh air. If breathing has stopped give artificial respiration. Contact a physician.

PERMEA

The C. M. Kemp Manufacturing Company
A Unit of Permea Inc.
Glen Burnie, Maryland 21061-2796, USA
Telephone (301) 761-5100
Telex 87-868, Telefax 301/761-5109

EMERGENCY PHONE NO.
Call Chemtrec
Day or Night
1-800-424-9300

C. M. KEMP PRODUCT NAME
K-3 SILICA GEL

PRODUCT IDENTIFICATION

Trade Names and Synonyms:	K3 Silica Gel, Amorphous Silicon Dioxide, Silica Gel, Silicic Acid
Chemical Name:	Synthetic Amorphous Silica
Chemical Formula:	SiO_2 XH_2O
Kemp I/N:	11192 (60# drum), 22360 (300# drum)
C.A.S. Number:	63231-67-4 (silica gel)
Dot Proper Shipping Name:	N/A
Dot Hazard Class/ID Number:	N/A
Dot Label:	N/A

U.S. Surface Freight Classification: N/A
Reportable Quantity Under U.S. EPA Cercla/SARA Regulations: N/A
RTECS No.: VV73220 (synonyms and OSHA stds. given are all in error). RTECS should be considered as a source of literature references, not a source of authoritative information.

This product is not a hazardous chemical under the OSHA Hazard Communication Standard.

WARNING STATEMENTS

Follow standard safety procedures

PRECAUTIONARY MEASURES

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of material from eyes, skin and clothing.

When pouring into a container of flammable liquid, ground both containers electrically to prevent static electrical spark.

SPILL, LEAK AND DISPOSAL INFORMATION

Waste Disposal - Dispose in landfill according to local, state, and federal regulations. Cover promptly to avoid the blowing of dusts.

Spill or Leak Procedures - Notify safety personnel of spills or leaks.
Sweep or vacuum up or flush to sewer.

Containers - Metal cans or plastic containers

ADDITIONAL COMMENTS

Silica Gel is not known to have any adverse effect of the aquatic environment. It is insoluble and nontoxic.

DATE: July, 1989 SUPERSEDES: 3/86
MSDS NO.: 7391C (Index 138)
FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

The C. M. Kemp Manufacturing Company
7280 Baltimore-Annapolis Boulevard
Glen Burnie, Maryland 21061-2796, USA
(301) 761-5100

EMERGENCY AND FIRST AID PROCEDURES

Inhalation - Remove to fresh air. If breathing is difficult, oxygen may be administered. If breathing has stopped, administer artificial respiration.

Ingestion - Drink large amounts of water.

Eyes - Flush immediately with water for at least 15 minutes. If irritation persists, see a doctor.

Skin - Wash with soap and water.

NOTES TO PHYSICIAN: No special information

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection - Use of goggles is recommended.

Skin Protection - Wear long sleeves and close weave cotton gloves with tight wristlets for manual handling.

Respiratory Protection - Use NIOSH/MSHA approved respiratory protection equipment when dusty conditions prevail.

Ventilation - Use adequate local ventilation to prevent dusty conditions.

AIRBORNE Exposure Limits:

Component	wt %	1988-1989 TLV-TWA
SiO_2XH_2O	99.5	20 mp/ft^3, nuisance = 10 mg/m^3 respirable = 5 mg/m^3

PERMEA
A MONSANTO COMPANY

The C. M. Kemp Manufacturing Company
A Unit of Permea Inc.
Glen Burnie, Maryland 21061-2796, USA
Telephone (301) 761-5100
Telex 87-868, Telefax 301/761-5109

EMERGENCY PHONE NO.
Call Chemtrec
Day or Night
1-800-424-9300

C. M. KEMP PRODUCT NAME
KEMP K-4 TYPE MOLECULAR SIEVE

PRODUCT IDENTIFICATION

Trade Names and Synonyms:	Zeolite
Chemical Name:	Sodium Alumina Silicate
Chemical Formula:	$Na_2OAl_2O_3SiO_2$
Kemp I/N:	11195, 50708, 75806, 86598, 58891, 70815, 74119, 74812
C.A.S. Number:	Sodium Oxide (1313-59-3) Silicon Oxide (7631-86-9) Aluminum Oxide (1344-28-1)
Dot Proper Shipping Name:	N/A
Dot Hazard Class/ID Number:	N/A
Dot Label:	N/A

U.S. Surface Freight Classification: N/A
Reportable Quantity Under U.S. EPA Cercla/SARA Regulations: N/A
Hazardous Ingredients: This product contains aluminum oxide which is a toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

WARNING STATEMENTS

Follow standard safety procedures

PRECAUTIONARY MEASURES

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of material from eyes, skin and clothing.

DO NOT TAKE INTERNALLY.

FIRE PROTECTION INFORMATION

Flashpoint	-	Does not burn
Ignition Temperature	-	N/A
Flammable Limits	-	Lower - N/A Upper - N/A
Extinguishing Media	-	Unused material will not burn. Use media for surrounding fire.

Special Firefighting Procedures - Depends on the use of the material. Used materials may contain products of a hazardous nature. The user of this product must identify the hazards of the retained material and inform the fire fighters of these hazards.

Unusual Fire and Explosion Hazards - If their fresh unused state, molecular sieves are not flammable. When exposed to water, however, they can get quite hot. When first wetted they can heat to the boiling point of water. Flooding will reduce the temperature to safe limits.

REACTIVITY DATA

Stability	-	Stable
Incompatibility	-	Sudden contact with high concentrations of chemicals having high heats of adsorption such as olefins, HCI, etc.

Hazardous Decomposition Products - Hydrocarbons and other materials that contact the molecular sieve during normal use can be retained on the sieve. It is reasonable to expect that decomposition products will come from these retained materials of use. The molecular sieve itself does not readily decompose unless subjected to extreme temperature or chemical conditions.

Hazardous Polymerization Reaction - Will not occur

SPILL, LEAK AND DISPOSAL INFORMATION

Waste Disposal - Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with local, state, and federal regulations.

Spill or Leak Procedures - Notify safety personnel of spills or leaks.

Sweep the spill area. Collect and place the spilled material in a waste disposal container. Avoid raising dust.

Containers -

ADDITIONAL COMMENTS

Before using you should know the hazards of the products to be adsorbed on the molecular sieve. The products could be flammable or toxic. You should know and follow all the safety precautions related to the adsorbed products.

DATE: January, 1990 SUPERSEDES: July/89

MSDS NO.: 7286C (Index 42 and 206)

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

The C. M. Kemp Manufacturing Company
7280 Baltimore-Annapolis Boulevard
Glen Burnie, Maryland 21061-2796, USA
(301) 761-5100

MERCURY
MERCURY
MERCURY

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS
GASTON L. PILLORI
(201) 796-7100

DATE 02/05/88
PO NBR: P1295B
ACCT: 675599-01
INDEX: 30880330005
CAT NO: 15002F

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 7439-97-6

SUBSTANCE: **MERCURY**

TRADE NAMES/SYNONYMS:
COLLOIDAL MERCURY; METALLIC MERCURY; NCI-C60399; QUICK SILVER; INORGANIC MERCURY; NA 2809; M-139; M-140; M-141; ACC14020

CHEMICAL FAMILY:
METAL

MOLECULAR FORMULA: Hg MOL WT: 200.59

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=3

COMPONENTS AND CONTAMINANTS

COMPONENT: MERCURY PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
0.1 MG(Hg)/M3 OSHA CEILING; 0.05 MG(Hg)/M3 ACGIH TWA;
0.05 MG(Hg)/M3 NIOSH RECOMMENDED CEILING; 0.15 MG(Hg)/M3 ACGIH STEL

PHYSICAL DATA

DESCRIPTION: SILVER-WHITE, HEAVY MOBILE, LIQUID METAL

BOILING POINT: 675 F (357 C) MELTING POINT: -38 F (-39 C)

SPECIFIC GRAVITY: 13.6 VAPOR PRESSURE: 0.0012 MMHG @ 20 C

SOLUBILITY IN WATER: INSOLUBLE VAPOR DENSITY: 7.0

SOLVENT SOLUBILITY: SULFURIC ACID, NITRIC ACID, LIPIDS

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FLASH POINT: NON-FLAMMABLE

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

USE AGENTS SUITABLE FOR TYPE OF FIRE; USE WATER IN FLOODING AMOUNTS AS A FOG. AVOID BREATHING CORROSIVE AND POISONOUS VAPORS, KEEP UPWIND.

TOXICITY

150 UG/M3/46 DAYS INHALATION-WOMAN TCLO; 29 MG/M3/30 HOURS INHALATION-RABBIT TCLO; TUMORIGENIC DATA (RTECS); REPRODUCTIVE DATA (RTECS).
MERCURY AS AN IRRITANT TO SKIN, EYES, RESPIRATORY TRACT AND MUCOUS MEMBRANES. IT IS ALSO A SKIN SENSITIZER, NEPHROTOXIN, NEUROTOXIN, AND PULMONARY SENSITIZER.

HEALTH EFFECTS AND FIRST AID

INHALATION:
IRRITANT/SENSITIZER/NEUROTOXIN.
28 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- INHALATION OF A HIGH CONCENTRATION OF MERCURY VAPOR CAN CAUSE ALMOST IMMEDIATE DYSPNEA, COUGH, FEVER, NAUSEA AND VOMITING, DIARRHEA, STOMATITIS, SALIVATION AND METALLIC TASTE. THE SYMPTOMS MAY RESOLVE OR MAY PROGRESS TO NECROTIZING BRONCHIOLITIS, PNEUMONITIS, PULMONARY EDEMA, AND PNEUMOTHORAX. THIS SYNDROME IS OFTEN FATAL IN CHILDREN. ACIDOSIS AND RENAL DAMAGE WITH RENAL FAILURE MAY OCCUR. INHALING VOLATILE ORGANIC MECURIALS IN HIGH CONCENTRATIONS CAUSES METALLIC TASTE, DIZZINESS, CLUMSINESS, SLURRED SPEECH, DIARRHEA, AND SOMETIMES FATAL CONVULSIONS.

CHRONIC EXPOSURE- INHALATION OF MERCURY VAPOR, DUSTS, OVER A LONG PERIOD CAUSES MERCURIALISM. FINDINGS ARE EXTREMELY VARIABLE AND INCLUDE TREMORS, SALIVATION, STOMATITIS, LOOSENING OF THE TEETH, BLUE LINES ON THE GUMS, PAIN AND NUMBNESS IN THE EXTREMITIES, NEPHRITITIS, DIARRHEA, ANXIETY, HEADACHE, WEIGHTLOSS, ANOREXIA, MENTAL DEPRESSION, INSOMNIA, IRRITABILITY, INSTABILITY, HALLUCINATIONS, AND EVIDENCE OF

MENTAL DETERIORATION. SEE ANIMAL REPRODUCTIVE EFFECTS AND TUMORIGENIC REFERENCES IN TOXICITY SECTION.

FIRST AID: REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
IRRITANT/NEUROTOXIN/NEPHROTOXIN.
ACUTE EXPOSURE- MAY CAUSE REDNESS AND IRRITATION.SENSITIZATION DERMATITIS MAY OCCUR IN PREVIOUSLY EXPOSED WORKERS. SUBSTANCE MAY BE ABSORBED THROUGH THE SKIN CAUSING ANURIA.

CHRONIC EXPOSURE- MAY CAUSE IRRITATION AND SENSITIZATION DERMATITIS. MAY RESULT IN PSYCHIC DISTURBANCES, PERIPHERAL NEUROPATHY, AND KIDNEY DAMAGE AS IN CHRONIC INHALATION. SEE ANIMAL REPRODUCTIVE EFFECTS AND TUMORIGENIC REFERENCES IN TOXICITY SECTION.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
IRRITANT.
ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION.

CHRONIC EXPOSURE- MERCURY MAY BE DEPOSITED IN THE LENS OF THE EYE, CAUSING VISUAL DISTURBANCES.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION.

INGESTION:
NEUROTOXIC/NEPHROTOXIC.
ACUTE EXPOSURE- METALLIC MERCURY GENERALLY SHOWS NO EFFECT. HOWEVER, IN EXCEPTIONAL CASES EXISTING INTERNAL SORES MAY ALLOW MERCURY TO ACCUMULATE WITH SERIOUS OR EVEN FATAL RESULTS. ALSO ASPIRATION INTO THE LUNGS IS A REMOTE POSSIBILITY, AND THIS WOULD CAUSE A PERMANENT HAZARD.

FIRST AID- IF VICTIM IS CONSCIOUS AND NOT CONVULSIVE, IMMEDIATELY GIVE 2 TO 4 GLASSES OF WATER, AND INDUCE VOMITING BY TOUCHING FINGER TO BACK OF THROAT. FROM SITTING POSITION, HEAD MUST BE LOWER THAN HIPS TO PREVENT ASPIRATION. KEEP PATIENT WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
MERCURY
ACETYLINIC COMPOUNDS: VIOLENT REACTION.
AMMONIA: VIOLENT REACTION.
BORON DIIODPHOSPHIDE: IGNITION IN MERCURY VAPORS.
DIIODOPHOSPHIDE: VIOLENT REACTION.
ETHYLENE OXIDE: VIOLENT REACTION.
METALS (POTASSIUM; LITHIUM; SODIUM; RUBIDIUM): VIOLENT REACTION.
METHYL AZIDE: VIOLENT REACTION.
METHYLSILANE AND OXYOEN: POSSIBLE EXPLOSION.
OXIDANTS (BROMINE; PEROXYFORMIC ACID; CHLORINE DIOXIDE; NITRIC ACID): VIOLENT REACTION.
TETRACARBONYLNICKEL: VIOLENT REACTION.
NITROMETHANE: VIOLENT REACTION.
SILVER PERCHLORATE: VIOLENT REACTION.

DECOMPOSITION:
NOT APPLICABLE: BOILS AWAY UNCHANGED AT 357 C.

POLYMERIZATION:
NONE KNOWN.

****
CONDITIONS TO AVOID

CONTACT WITH OR STORAGE WITH INCOMPATIBLE MATERIALS LISTED ABOVE AND EXCESSIVE HEAT.

****
SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER. MOVE CONTAINERS FROM SPILL AREA. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION AND/OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
1 MG(HG)/M3- SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

5 MG(HG)/M3- SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

28 MG(HG)/M3- TYPE C SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET, OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

ESCAPE- ANY ESCAPE SELF-CONTAINED BREATHING APPARATUS.

FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHALL PROVIDE AN EYE-WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC GROUP, INC.
CREATION DATE: 05/02/85 REVISION DATE: 05/07/85

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2460 Boulevard Of The Generals
P.O. Box 945
Valley Forge, Pennsylvania 19482

EMERGENCY PHONE
800-345-6361
800-362-0534 (in PA)

MATERIAL SAFETY DATA SHEET

415

PRODUCT NAME Nitrogen	CAS # 7727-37-9
TRADE NAME AND SYNONYMS Nitrogen	DOT I.D. No.: UN 1066
CHEMICAL NAME AND SYNONYMS Nitrogen	DOT Hazard Class: Nonflammable gas
	Formula: N_2
ISSUE DATE AND REVISIONS 25 November 1985	Chemical Family: Inert gas

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

Nitrogen is defined as a simple asphyxiant. Oxygen level should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg (ACGIH, 1985-86).

SYMPTOMS OF EXPOSURE

Effects of exposure to high concentrations so as to displace the oxygen in air necessary for life may include any, all or none of the following:

- o Loss of balance or dizziness;
- o Tightness in the frontal area of the forehead;

(Continued on last page)

TOXICOLOGICAL PROPERTIES

Nitrogen is nontoxic but the liberation of a large amount in a confined area could displace the amount of oxygen in air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO NITROGEN. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

None

PHYSICAL DATA

BOILING POINT -320.5°F (-195.8°C)	LIQUID DENSITY AT BOILING POINT 50.46 lb/ft^3 (808.3 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -232.6°F (-147°C)	GAS DENSITY AT 70°F. 1 atm .0725 lb/ft^3 (1.161 kg/m^3)
SOLUBILITY IN WATER Very slightly	FREEZING POINT -345.9°F (-209.9°C)
EVAPORATION RATE N/A	SPECIFIC GRAVITY (AIR=1) @ 70°F (21.1°C) = 0.97
APPEARANCE AND ODOR Colorless, odorless gas	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMAGLE LIMITS % BY VOLUME LEL N/A UEL N/A
EXTINGUISHING MEDIA Nonflammable, inert gas		ELECTRICAL CLASSIFICATION Nonhazardous

SPECIAL FIRE FIGHTING PROCEDURES
N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

N/A

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.

WASTE DISPOSAL METHOD
Do not attempt to dispose of waste or unused quantities. Return in the shipping containe properly labeled, with any valve outlet plugs or caps secured and valve protection cap ir place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
See Local Exhaust on last page	(See last page)	N/A
	MECHANICAL (Gen.) N/A	OTHER N/A

PROTECTIVE GLOVES
Any material

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Nitrogen or Nitrogen, Compressed DOT Hazard Class: Nonflammable gas
DOT Shipping Label: Nonflammable gas I.D. No.: UN 1066

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from cylinde Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14 and Safety Bulletin SB-2.

ECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14 and Safety Bulletin SB-2.

SPECIAL PACKAGING RECOMMENDATIONS
Nitrogen is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage

HEALTH HAZARD DATA (Continued)

SYMPTOMS OF EXPOSURE: (Continued)

- o Tingling of the tongue, fingertips or toes;
- o Weakened speech leading to the inability to utter sounds;
- o Rapid reduction in the ability to perform movements;
- o Reduced consciousness of the surroundings;
- o Loss of tactile sensations;
- o Heightened mental activity.

It should be recognized that it is possible that none of the above symptoms may occur in nitrogen asphyxia so that there are no definite warning symptoms.

SPECIAL PROTECTION INFORMATION (Continued)

LOCAL EXHAUST: (Continued)

To prevent accumulation of high concentrations so as to reduce the oxygen level in the air to less than 18 molar percent.

Mallinckrodt
Material Safety Data

Emergency Phone Number: 314-982-5000

Mallinckrodt provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.

Mallinckrodt makes no representations, or warranties, either express or implied, of merchantability, fitness for a particular purpose with respect to the information set forth herein or to the product to which the information refers. Accordingly, Mallinckrodt will not be responsible for damages resulting from use of or reliance upon this information.

Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 43061.

MERCURY

PRODUCT IDENTIFICATION:

Synonyms: Quicksilver; hydrargyrum

Formula CAS No.: 7439-97-6

Molecular Weight: 200.59

Chemical Formula: Hg

Hazardous Ingredients: None.

PRECAUTIONARY MEASURES

DANGER! MAY BE FATAL IF INHALED. HARMFUL IF SWALLOWED OR ABSORBED THROUGH SKIN. MERCURY AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM.

Do not breathe mist.
Avoid contact with eyes, skin and clothing.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

EMERGENCY/FIRST AID

In all cases call a physician immediately. If swallowed, get medical attention immediately. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes.
SEE SECTION 5.

DOT Hazard Class: ORM-B

SECTION 1 Physical Data

Appearance: Silver-white, heavy, mobile, liquid metal.

Odor: Odorless.

Solubility: Insoluble in water.

Boiling Point: 356.7°C (674°F).

Melting Point: -38.87°C (-38.0°F).

Density: 13.55

Vapor Density (Air=1): No information found.

Vapor Pressure (mm Hg): 1 @ 126°C (259°F).

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not considered to be a fire hazard.

Explosion:
Not considered to be an explosion hazard.

Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
At high temperatures, vaporizes to form extremely toxic fumes.

Hazardous Polymerization:
This substance does not polymerize.

Incompatibilities:
Acetylenes, ammonia, ethylene oxide, metal oxides, methyl silane, strong oxidants, metal carbonyls.

SECTION 4 Leak/Spill Disposal Information

Do not flush to the sewer. Isolate or enclose the area of the leak or spill. Provide forced ventilation to dissipate fumes. Clean-up personnel should wear respiratory equipment suitable for toxic metal fumes. Transfer to a suitable closed container, preferably glass or plastic, for intermediate storage before reclamation or disposal. Package unreclaimable material for disposal in a RCRA-approved waste facility. Use suction bottle with capillary tube for small amounts, vacuum or other large suction equipment should be provided with mercury vapor absorbent. Cover area of spill with powdered sulfur and floor sweeping compound, before sweeping up. Mercury should be reclaimed insofar as possible.

Reportable Quantity (RQ)(CWA/CERCLA) : 1 lb.

Ensure compliance with local, state and federal regulations.

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Highly toxic via this route due to membrane permeability. Transported by blood to brain and other organs. Central nervous system impairment (tremor, irritability, etc.) are symptoms. High vapor concentrations (over 1.2 mg/cu.m.) causes chest pains, dypsnea, and coughing. Mouth and teeth may also be attacked; inflammation of the mouth and loose teeth can result;kidney damage.

Ingestion:
Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.

Skin Contact:
Continual contact may allow the absorption of sufficient mercury to produce symptoms as listed in inhalation, above.

Eye Contact:
Not considered a health hazard (OSHA) but mercury droplets can be absorbed through eye tissues.

Chronic Exposure:
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, metallic taste, loosening of the teeth, digestive disorders, skin rashes, and kidney damage.

Aggrevation of Pre-existing Conditions:
Persons with nervous disorders, or impaired kidney or respiratory function,or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
If swallowed, get medical attention immediately. Never give anything by mouth to an unconscious person.

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

No LD50/LC50 information found relating to normal routes of occupational exposure. Mutation data references cited. Reproductive effects data cited. LDLO
Inhalation-rabbit: 29mg/m^3 30H TCLO
Inhalation-woman: 150 ug/m^3/46D

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
1mg/10m^3 ceiling.
-ACGIH Threshold Limit Value (TLV):
0.05 mg(Hg)/m^3 (TWA) (SKIN).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or self-contained breathing apparatus.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible.Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Wear special protective equipment (Sec. 6) for maintainence break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace.

MG Industries
2460 Boulevard Of The Generals
P.O. Box 945
Valley Forge, Pennsylvania 19482

EMERGENCY PHONE
800-345-6361
800-362-0534 (in PA)

MATERIAL SAFETY DATA SHEET

115

PRODUCT NAME	CAS #
Argon	7440-37-1
TRADE NAME AND SYNONYMS	DOT I.D. No.:
Argon; Argon, compressed	UN 1006
CHEMICAL NAME AND SYNONYMS	DOT Hazard Class:
Argon	Nonflammable gas
	Formula:
	Ar
ISSUE DATE AND REVISIONS	Chemical Family:
25 November 1985	Rare gas

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Argon is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg (ACGIH, 1985-86).

SYMPTOMS OF EXPOSURE

Effects of exposure to high concentrations so as to displace the oxygen in air necessary for life may include any, all, or none of the following:

- o Loss of balance or dizziness
- o Tightness in the frontal area of the forehead
- o Tingling in the tongue, fingertips or toes

(Continued on last page.)

TOXICOLOGICAL PROPERTIES

Argon is nontoxic but the liberation of a large amount in a confined area could displace the amount of oxygen in air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO ARGON. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

Breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
See Local Exhaust on last page.	See last page.	N/A
	MECHANICAL (Gen.) N/A	OTHER N/A

PROTECTIVE GLOVES
ny material

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Argon or Argon, Compressed
DOT Shipping Label: Nonflammable gas
DOT Hazard Class: Nonflammable gas
I.D. No.: UN 1006

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14, and Safety Bulletin SB-2.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9 P-14, and Safety Bulletin SB-2.

SPECIAL PACKAGING RECOMMENDATIONS
Argon is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

None

PHYSICAL DATA

BOILING POINT -302.6°F (-185.9°C)	LIQUID DENSITY AT BOILING POINT 87 lb/ft^3 (1393 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C): Above the critical temp. of -188.1°F (-122.3°C)	GAS DENSITY AT 70°F, 1 atm .1034 lb/ft^3 (1.656 kg/m^3)
SOLUBILITY IN WATER Very slightly	FREEZING POINT -308.9°F (-189.4°C)
EVAPORATION RATE N/A	SPECIFIC GRAVITY (AIR=1) 1.38
APPEARANCE AND ODOR Colorless; odorless gas	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMAGLE LIMITS % BY VOLUME LEL N/A UEL N/A
EXTINGUISHING MEDIA Nonflammable, inert gas		ELECTRICAL CLASSIFICATION Nonhazardous

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

N/A

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
Unstable		
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
May Occur		
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.

DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

SYMPTOMS OF EXPOSURE: (Continued)

- Weakened speech leading to the inability to utter sounds
- Rapid reduction in the ability to perform movements
- duced consciousness of the surroundings
- ss of tactile sensations
- eightened mental activity

It should be recognized that it is possible that none of the above symptoms may occur in argon asphyxia so that there are no definite warning symptoms.

LOCAL EXHAUST: (Continued)

To prevent accumulation of high concentrations so as to reduce the oxygen level in the air to less than 18 molar percent.

MATERIAL SAFETY DATA SHEET

September 19

An explanation of the terms used herein may be found in OSHA 29 CFR 1910.1200, available from OSHA regional or area offices.
(Essentially similar to U.S. Department of Labor Form OSHA-20 and generally accepted in Canada for information purposes)
Do Not Duplicate This Form. Request an Original.

I. PRODUCT IDENTIFICATION

PRODUCT	P-5 (Electron Capture Mixture)		
CHEMICAL NAME	Not applicable	**SYNONYMS**	P-5 Mix.
FORMULA	Mixture of Ar & CH_4	**CHEMICAL FAMILY**	Not applicable
		MOLECULAR WEIGHT	Not applicable

TRADE NAME P-5

II. HAZARDOUS INGREDIENTS

For mixtures of this product request the respective component Material Safety Data Sheets. See Section IX.

MATERIAL (CAS NO.)	Vol (%)	1984-1985 ACGIH TLV-TWA (OSHA-PEL)	
Argon (7440-37-1)	95	Simple asphyxiant	(None currently established)
Methane (74-82-8)	5	Simple asphyxiant	(None currently established)

III. PHYSICAL DATA

BOILING POINT, 760 mm. Hg	Not applicable	**FREEZING POINT**	Not applicable
SPECIFIC GRAVITY (H_2O = 1)	Gas	**VAPOR PRESSURE AT 20°C.**	Gas
VAPOR DENSITY (air = 1)	1.3	**SOLUBILITY IN WATER, % by wt.**	Negligible
PERCENT VOLATILES BY VOLUME	100	**EVAPORATION RATE (Butyl Acetate = 1)**	Not applicable

APPEARANCE AND ODOR Colorless, odorless gas at normal temperature and pressure.

IV. EMERGENCY PHONE NUMBER

IN CASE OF EMERGENCIES involving this material, further information is available at all times:
In the USA 304 — 744-3487 **In Canada 514 — 645-5311**
For routine information contact your local supplier

L-4741-A

Union Carbide requests the users of this product to study this Material Safety Data Sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product a user should (1) notify its employees, agents and contractors of the information on this MSDS and any product hazards and safety information, (2) furnish this same information to each of its customers for the product, and (3) request such customers to notify their employees and customers for the product of the same product hazards and safety information.

UNION CARBIDE CORPORATION ☐ LINDE DIVISION
UNION CARBIDE CANADA LIMITED ☐ LINDE DIVISION

THRESHOLD LIMIT VALUE: See Section II.

EFFECTS OF SINGLE (ACUTE) OVEREXPOSURE:

SWALLOWING — A highly unlikely route of exposure.

SKIN ABSORPTION: — No evidence of adverse effects from available information.

INHALATION — Asphyxiant. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting and unconsciousness. Lack of oxygen can cause death.

SKIN CONTACT: — No evidence of adverse effects from available information.

EYE CONTACT — No evidence of adverse effects from available information.

FFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No evidence of adverse effects from available information.

THER EFFECTS OF OVEREXPOSURE: None currently known.

EDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: A knowledge of the available toxicology information and of the hysical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

MERGENCY AND FIRST AID PROCEDURES:

SWALLOWING — This product is a gas at normal temperature and pressure.

Wash with soap and water.

ATION — Remove to fresh air. Give artificial respiration if not breathing. Give oxygen if breathing is difficult. Call a physician.

EYES — Flush with water.

OTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and e clinical condition.*

V. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (test method)	Not applicable	AUTOIGNITION TEMPERATURE	Not applicable

FLAMMABLE LIMITS IN AIR, % by volume	LOWER	UPPER
	Not applicable	Not applicable

EXTINGUISHING MEDIA: Gas mixture cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate all personnel to a safe distance. Immediately deluge containers with water spray from maximum distance until cool, then move containers away from fire area if without risk.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Gas mixture cannot catch fire. Container may rupture due to heat of fire. No part of a container should be subjected to a temperature higher than 52°C (approximately 125°F). Containers are provided with pressure relief devices designed to vent the contents when they are exposed to elevated temperature.

VI. REACTIVITY DATA

STABILITY	
UNSTABLE	STABLE
	X

CONDITIONS TO AVOID: See Section IX.

INCOMPATIBILITY (materials to avoid): None currently known.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition of Methane component may produce CO/CO_2.

HAZARDOUS POLYMERIZATION	
May Occur	Will not Occur
	X

CONDITIONS TO AVOID: None currently known.

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate all personnel to a safe distance. Use self-contained breathing apparatus where needed. Shut-off leak if without risk. Ventilate area of leak or move leaking container to well-ventilated area. Test area, especially confined areas, for sufficient oxygen content prior to permitting re-entry of personnel.

WASTE DISPOSAL METHOD: Slowly release into atmosphere outdoors. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with Federal, State and local regulations.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type): Select in accordance with OSHA 29 CFR 1910.134. Respirators shall be [illegible] to MSHA and NIOSH.

VENTILATION	**LOCAL EXHAUST — Preferred.**
	MECHANICAL (general) — Inadequate.
	SPECIAL — Not applicable.
	OTHER — Not applicable.

PROTECTIVE GLOVES: Preferred for cylinder handling.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133.

IX. SPECIAL PRECAUTIONS

CAUTION: High pressure gas mixture. Use piping and equipment adequately designed to withstand pressures to be encountered. Gas can cause rapid suffocation due to oxygen deficiency. Store and use with adequate ventilation. Close valve when not in use and when empty.

[illegible]URES: When two or more gases, or liquefied gases are mixed, their hazardous properties may combine to create additional, [illegible]cted hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist, or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Be sure to read and understand all labels and other instructions supplied with all containers of this product.

NOTE: Compatibility with plastics should be confirmed prior to use. For safety information on general handling of compressed gas cylinders, obtain a copy of pamphlet P-1, "Safe Handling of Compressed Gases in Containers" from the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202.

OTHER HANDLING AND STORAGE CONDITIONS: Never work on a pressurized system. If there is a leak, close the cylinder valve, blow down the system by venting to a safe place, then repair the leak.

LINDE
UNION CARBIDE

GENERAL OFFICES

IN THE USA:
Union Carbide Corporation
Linde Division
39 Old Ridgebury Road
Danbury, CT 06817-0001

IN CANADA:
Union Carbide Canada Limited
Linde Division
123 Eglinton Avenue East
Toronto, Ontario M4P 1J3

Other offices in principal cities all over the world.

Lithographed in U.S.A.

American Burdick & Jackson
Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

ACETONE

emergency telephone no. 312/973-3600 (American Scientific Products)
chemtrec telephone no. 800/424-9300
information telephone no. 616/726-3171 (American Burdick & Jackson)

I. Identification

chemical name Acetone — molecular weight 58.08
chemical family Ketone — formula C_3H_6O
synonyms Dimethyl Ketone
DOT proper shipping name Acetone
DOT hazard class Flammable Liquid
DOT identification no. UN1090 — CAS no. 67-64-1

II. Physical and Chemical Data

boiling point, 760mm Hg. 56.29°C — freezing point -94.7°C — evaporation rate (BuAc=1)ca 12
vapor pressure at 20°C 184.5 mm Hg — vapor density (air = 1) 2.0 — solubility in water @ 20°C complete
% volatiles by volume ca 100 — specific gravity (H_2O = 1) @ 20°C 0.79 — stability Stable
hazardous polymerization Not expected to occur.
appearance and odor Clear, colorless liquid with a penetrating, sweet odor.
conditions to avoid Heat, sparks, open flame, open containers, and poor ventilation.

materials to avoid Strong oxidizing agents and strong acids and bases.

hazardous decomposition products Incomplete combustion can generate carbon monoxide and other toxic vapors.

III. Fire and Explosion Hazard Data

flash point, (test method) -18°C (Tag closed cup) — auto ignition temperature 465°C
flammable limits in air % by volume: lower limit 2.6 — upper limit 12.8
unusual fire and explosion hazards Very volatile and extremely flammable. Mixtures with water can be flammable.

extinguishing media Carbon dioxide, dry chemical, alcohol foam, water mist or fog.

special fire fighting procedures Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and may rupture closed storage containers. Keep fire-exposed containers cool with water spray.

IV. Hazardous Components

	%	TLV	CAS no.
Acetone	ca 100	750 ppm	67-64-1

American Burdick & Jackson's Disclaimer: "The information and recommendations presented herein are based on sources believed to be reliable as of the date hereof. American Burdick & Jackson makes no representation as to the completeness or accuracy thereof. It is the user's responsibility to determine the product's suitability for its intended use, the product's safe use, and the product's proper disposal. No representations or warranties not expressly set forth herein are made hereunder, whether express or implied by operation of law or otherwise, including, but not limited to any implied warranties of MERCHANTABILITY OR FITNESS. American Burdick & Jackson neither assumes nor authorizes any other person to assume for it, any other or ADDITIONAL LIABILITY OR RESPONSIBILITY resulting from the use of, or reliance upon, this information."

American Burdick & Jackson Subsidiary of American Hospital Supply Corporation 1953 South Harvey Street Muskegon MI 49442

V. Health Hazards

Occupational Exposure Limits

OSHA	8-hour PEL	-	1000 ppm
	Ceiling	-	not listed
	Peak	-	not listed
ACGIH	TLV-TWA	-	750 ppm
	TLV-STEL (15-min)	-	1000 ppm
NIOSH	TLV-TWA	-	250 ppm
	TLV-C	-	not listed

Concentration Immediately Dangerous to Health

OSHA/NIOSH	20,000 ppm

Odor Threshold

NSC	2 ppm
NIOSH	not listed

Carcinogenic, Mutagenic, Teratogenic Data

Positive mutagen (RTEC)

Primary Routes of Entry

Acetone may exert its effects through inhalation, skin absorption, and ingestion.

Industrial Exposure: Route of Exposure/Signs and Symptoms

Inhalation: Exposure can cause eye, nose, and throat irritation, headache, nausea, dizziness and narcosis.

Eye Contact: Liquid and high vapor concentration can cause irritation.

Skin Contact: Prolonged or repeated skin contact can cause irritation and dermatitis through defatting of skin.

Ingestion: Symptom information is inadequate/unknown.

Effects of Overexposure

Acetone is a mild eye and mucous membrane irritant, primary irritant, and central nervous system depressant. Acute exposure irritates the eyes and upper respiratory tract. Direct skin contact produces dermatitis, characterized by dryness and erythema. High concentrations produce narcosis and hypoglycemia.

Medical Condition Aggravated by Exposure

Preclude from exposure those individuals susceptible to dermatitis.

Emergency First Aid

Inhalation: Immediately remove to fresh air. If not breathing, administer mouth-to-mouth rescue breathing. If there is no pulse administer cardiopulmonary resuscitation (CPR). Contact physician immediately.

Eye Contact: Rinse with copious amounts of water for at least 15 minutes. Get emergency medical assistance.

Skin Contact: Flush thoroughly for at least 15 minutes. Wash affected skin with soap and water. Remove contaminated clothing and shoes. Wash clothing before re-use, and discard contaminated shoes. Get emergency medical assistance.

Ingestion: Call local Poison Control Center for assistance. Contact physician immediately. Never induce vomiting or give anything by mouth to a victim unconscious or having convulsions.

VI. Safety Measures and Equipment

Ventilation: Adequate ventilation is required to protect personnel from exposure to chemical vapors exceeding the PEL and to minimize fire hazards. The choice of ventilation equipment, either local or general, will depend on the conditions of use, quantity of material, and other operating parameters.

Respiratory: Use approved respirator equipment. Follow NIOSH and equipment manufacturer's recommendations to determine appropriate equipment (air-purifying, air-supplied, or self-contained breathing apparatus).

Eyes: Safety glasses are considered minimum protection. Goggles or face shield may be necessary depending on quantity of material and conditions of use.

Skin: Protective gloves and clothing are recommended. The choice of material must be based on chemical resistance and other user requirements. Generally, neoprene or rubber offers acceptable chemical resistance. Individuals who are acutely and specifically sensitive to acetone may require additional protective equipment.

Storage: Acetone should be protected from temperature extremes and direct sunlight. Proper storage of acetone must be determined based on other materials stored and their hazards and potential chemical incompatibility. In general, acetone should be stored in an acceptably protected and secure flammable liquid storage room.

Other: Emergency eye wash fountains and safety showers should be available in the vicinity of any potential exposure. Ground and bond metal containers to minimize static sparks.

VII. Spill and Disposal Data

Spill Control: Protect from ignition. Wear protective clothing and use approved respirator equipment. Absorb spilled material in an absorbent recommended for solvent spills and remove to a safe location for disposal by approved methods. If released to the environment, comply with all regulatory notification requirements.

Waste Disposal: Dispose of acetone as an EPA hazardous waste. Hazardous waste numbers: U002(ignitable); D001(ignitable).

Revision Date: 1/85

KEY

ca	Approximately	STEL	Short Term Exposure Level
na	Not applicable	TLV	Threshold Limit Value
C	Ceiling	TWA	Time Weighted Average
PEL	Permissable Exposure Level	BuAc	Butyl Acetate

NSC National Safety Council ("Fundamentals of Industrial Hygiene", 1983)
OHS Occupational Health Services ("Hazardline")

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 1 1991

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

Mr. William Derrickson
Chairman
Quadrex Environmental Company
1940 N. W. 67th Place
Gainesville, Florida 32601

Dear Mr. Derrickson:

The Office of Toxic Substances received the letter dated April 22, 1991 from O.M. Jones, requesting renewal of Quadrex Environmental Company's Approval to dispose of PCBs, in accordance with Condition 26 of the Approval. The Approval authorizes Quadrex to operate the Quadrex mobile PCB disposal system to clean natural gas pipeline pipe and fittings, air compressor systems, PCB items and to use the Physical Separation unit.

This Approval is extended for a period of one year through July 5, 1992. The Approval will then be renewed and amended after the demonstration, which is scheduled for September 1991.

Please direct questions regarding this matter to Winston Lue at (202) 382-3962.

Sincerely,

for Elizabeth F. Bryan
Joseph J. Merenda, Director
Exposure Evaluation Division

cc: PCB Coordinators
EPA Regions I - X

Mailed
7/2/91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 14 1991

Mr. William Derrickson
Chairman
Quadrex Environmental Company
1940 N.W. 67th Place
Gainesville, Florida 32606

Dear Mr. Derrickson:

The enclosed amended approval authorizes Quadrex to separate PCBs from water, to clean natural gas pipeline pipe and appurtenances, and to separate PCBs at higher concentration using Quadrex physical separation unit. The Office of Toxic Substances (OTS) has reviewed results from two demonstration tests.

The demonstration test for disposal of PCB contaminated water occurred [illegible] April 21-24, 1989. The test vessel was an approximately 165 gallon tank in which water containing 50 parts per million PCBs was successfully treated through a physical separation process to contain less than 3 parts per billion residual PCBs.

The second demonstration was conducted from August 6-10, 1990. The results from the second demonstration indicated that Quadrex has successfully clean natural gas pipeline pipe (6 inch or more diameter) to levels of between 0.1 and 1 microgram per cm^2 but was unable to clean to below 0.1 microgram per cm^2. Therefore, such pipes and appurtenances cleaned at levels of between 0.1 and 1 microgram per cm^2 by Quadrex shall be unregulated for disposal, but regulated for distribution in commerce, when such distribution would result in long term dermal contact with the interior surface of the pipe or item.

EPA had audited and inspected the Quadrex physical separation operations during both demonstrations and verified the efficacy of the Quadrex process. EPA certified chemical analysis of the on-site laboratory. During the August 6-10, 1990 demonstration, split samples of the feed to the Transform unit and wipe samples of the natural gas pipeline pipe and appurtenances were collected for analytical confirmation by Midwest Research Institute (MRI).

Please note that Condition 1 "Advance Notification" of the approval has been revised to contain provision for two, rather than three, categories of treatment processes, i.e., mobile and permanent.

Please contact Winston Lue at (202) 382-3961 on issues regarding this amended permit.

Sincerely,

for Elizabeth F. Bryan

Joseph J. Merenda
Director, Exposure Evaluation Division

Enclosure

cc: EPA Regional PCB Coordinators

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

IN THE MATTER OF	)	APPROVAL TO DISPOSE
	)	
QUADREX ENVIRONMENTAL Quadrex	)	OF POLYCHLORINATED
	)	
1940 N.W. 67TH PLACE	)	BIPHENYLS (PCBs)
	)	
GAINESVILLE, FLORIDA 32606	)	AMENDED

AUTHORITY

This approval is issued pursuant to Section 6(e)(1) of the Toxic Substances Control Act of 1976 (TSCA), Public Law No. 94-469, and the Federal PCB Regulations, 40 CFR 761.60(e) (48 FR 13185, March 30, 1983). Background and Findings related to this approval are attached to this approval as Appendix I and II.

EFFECTIVE DATE

Quadrex is the sole operator of a solvent extraction process whereby items and equipment including natural gas pipeline air compressor systems, pipelines and fittings associated with natural gas pipelines, and water contaminated with PCBS are cleaned, and PCBs are removed from the cleaning solvents using a distillation process with different types of condensers using one or more mobile units. The Environmental Protection Agency (EPA) has carefully scrutinized Quadrex's operations. In addition, EPA has audited and has observed numerous demonstrations of Quadrex process capabilities. Pursuant to 40 CFR 761.60(e), EPA finds that the Quadrex process (when operated in accordance with the conditions of this approval) is equivalent to an approved incinerator for treatment of MODEF and solvents and that it does not pose an unreasonable risk of injury to human health or the environment. This approval to operate nationwide shall become effective ten (10) business days after signature by the Director of the Exposure Evaluation Division of the Office of Toxic Substances and shall expire on July 5, 1991.

CONTENTS

DEFINITIONS

"Analytical data" means (a) a formal report from a chemical analysis laboratory or (b) appropriate chemical instrument print outs with appropriate controls, standards, and written instrumental operating parameters and conditions; or (c) a statement that the "assumption" rule has been used. Technical judgement or experience is not considered analytical data.

"Appropriate local jurisdiction" means the incorporated city where the Quadrex unit will be operated, or the county, if the Quadrex unit will be operated outside the boundary of an incorporated city.

"Business hours" means 8:00 a.m. to 5:00 p.m., local time on weekdays except United States Government Holidays.

"Change in scale" means: (a) a doubling or more of the volume of Waste Feed notified to be treated at a site, if the increase is greater than 2000 gallons; or (b) for amounts of PCBs to be treated at a site greater than 5 pounds, an increase of the amount of PCBs to be treated by one order of magnitude or more.

"Day" means a calendar day, unless otherwise specified.

"Double Pass" means the original waste feed is distilled and the resulting distillate shall be distilled a second time until the second distillate meets the concentration level of < 2 ppm.

"Duplicate analysis" means two gas chromatographic analyses of the analyte prepared from one sample of MODEF or other material.

"Frequent site changes" means site changes at a rate of more than once per week.

"High PCB levels" means PCBs at a concentration greater than 6,300 parts per million (ppm).

"Job" means all Quadrex disposal operations for a single customer within fifty road miles of a central location. A job may consist of Quadrex disposal operations at several different sites for a single customer.

"Lifetime exposure risk" means the risk to an average adult individual who is exposed to a stated average concentration of a toxic material daily over the course of a 70 year lifetime.

"Lost time injury" or "Lost workday injury" means an injury related to the operation of the Quadrex process which results in an employee not performing his/her normal assignments during the workday and/or any successive workday(s) following the day of the injury.

ajor modification" means any change to capacity, design, or ficiency of the Quadrex unit or process, change of waste type, or any other changes significantly affecting overall performance or environmental impact.

"Minimal" with regard to an amount of PCB wastes means less than ten percent (10%) of total wastes treated.

"Mobile operations" means those operations where the Quadrex mobile unit remains at a site for less than 180 consecutive days.

"Operations" means the process of treating PCBs, including set up and take down of the Quadrex unit as well as actual treatment.

"OTS" means the Office of Toxic Substances, United States Environmental Protection Agency (TS-798); (202) 382-3933; Facsimile (202) 382-7883.

"PCB" means polychlorinated biphenyls as defined in 40 CFR 761.3.

"PCB release" and "PCB spill" have the same meaning as "spill" as defined in EPA's PCB Spill Cleanup Policy in 40 CFR 761.123.

"Permanent operations" means those operations where the Quadrex mobile unit remains at a site for at least 180 consecutive days or longer.

rocess Failure" means the inability of the Quadrex unit to treat the feedstock for reasons other than contaminants in the MODEF or other oil (such as chlorinated solvents).

"Single Pass" means the original waste feed is distilled and the distillate does not need to be treated again provided it meets the concentration level of < 2 ppm.

"Site" means the geographically contiguous property unit (such as a single manufacturing plant) at which the Quadrex disposal operations are conducted. More than one transformer may be serviced at a single site.

"Site location" means a street address or a directional description which would allow a site to be found by an EPA inspector.

"Year" means 365 days.

CONDITIONS OF APPROVAL

1. Advance Notification

a. Overview.

Quadrex shall provide a nonconfidential, advance written notification of intent to operate to be received by the addressees (as described below) prior to the conduct of a permitted PCB disposal activity. The addressees shall include, at a minimum: EPA Headquarters' Office of Toxic Substances (Mail Code: TS-798), the appropriate EPA Regional Office, the appropriate State Agency, and the appropriate local jurisdiction.

The written advance notification requirements are divided into 2 categories based on the length of time Quadrex is at a single site. In general, categories are defined below and advance written notification requirements follow:

Mobile Operations

Those operations where the Quadrex unit remains at a site for less than 180 consecutive days.

Permanent Operations

Those operations where the Quadrex unit remains at a site for at least 180 or more consecutive days or longer.

The information which must be included in the advance written notification for each category is described in sections 1.b.- d. below. Advance notification requirements may be waived at Superfund sites according to Comprehensive Environmental Response Compensation and Liability (CERCLA) provisions.

b. Mobile Operations

The following information must be included in a 30-day advance written notification to the addressees required to be notified under 1.a. The information is provided for public information purposes and for facilitating scheduling of government compliance monitoring and oversight of PCB disposal operations.

(1) Company identification: Quadrex's and client contacts' name and telephone number.

(2) Names, titles, addresses, and telephone numbers of the addressees required to be notified by 1.a.

(3) The nature of the PCB disposal activity, including estimates of the amount and type (e.g., MODEF, hydraulic oil, heat transfer oil) of PCB material to be treated and estimates of the concentration of PCBs in the material. The estimates shall be based on any one or combination of the following:

(A) analytical data or the results of analytical data provided by the customer;

(B) Quadrex analytical data; or

(C) a statement that the customer has applied the "assumption rule" codified at 40 CFR 761.3 defining PCB- Contaminated Electrical Equipment.

(4) The site location(s) and a telephone contact(s).

(5) The time(s) and date(s) the PCB disposal activity is scheduled to take place.

An acceptable sample form for the 30-day advance written notification of intent to operate under mobile operations is included as Appendix III A.

For Quadrex operations under Mobile Operations where there e frequent site changes, the following additional notification -s required:

(6) Every week, Quadrex shall provide by telephone facsimile transmission a two-week activity schedule to the OTS and the EPA Regional Contact for each Region where a PCB disposal activity will occur. This two-week activity schedule shall include for each job:

(A) EPA Region where the Quadrex unit will be located;

(B) most probable date that the Quadrex unit will be performing PCB disposal activities;

(C) the time(s) and date(s) the PCB disposal activity is scheduled to take place;

(D) the expected number of sites; and

(E) either:

(1) the county or counties where PCB disposal activities will occur, or

(2) a notice that the Quadrex unit will operate within a 50-mile radius of a specific location identified by a client telephone contact and client address.

An acceptable sample form for the two-week activity schedule under mobile operations is included as Appendix III B.

(7) If a change in the most probable operating date or a change in scale for a job is made more than 2 days in advance of the most probable operating date as stated in the most recent two-week activity schedule transmitted to EPA, Quadrex must send a telephone facsimile message noting the change to the appropriate EPA Regional contact at least 2 days in advance of the most probable operating date as stated in the two-week activity schedule.

If the change in the most probable operating date or the change in scale is made 2 days or less in advance of the most probable operating date as stated in the most recent two-week activity schedule transmitted to EPA, then the next scheduled telephone message update shall include the change.

(8) Quadrex shall operate a recorded message system accessible 24 hours a day by EPA Regional Compliance Monitoring staff and OTS staff. The recorded message must include the following information for each of Quadrex's operations in the United States:

A. site location (street address or directional description), client contact and phone number;

B. scheduled completion date of current job; and

C. company identification and scheduled start date of next job.

The message shall be updated daily between 7:30 a.m. and 8:30 a.m. EST/EDT and between 4:30 p.m. and 5:30 p.m. EST/EDT on weekdays (except for official U.S. Government holidays). If this recorded message is considered confidential business information, the message may be accessed by a code distributed to the EPA Regional Contacts and OTS officials below.

Samples of acceptable forms for the required notifications under Mobile Operations are included in Appendix III. Other forms providing equivalent information may be used.

EPA REGIONAL CONTACTS

Name, Region Number	Telefax Number	and Contact
Winston Lue, EPA Headquarters	(202) 475-7724	/ (202) 382-3962
Tony Palermo, Region I	(617) 565-4939	/ (617) 565-3279
Dan Kraft, Region II	(201) 321-6788	/ (201) 321-6669
Ed Cohen, Region III	(215) 597-3156	/ (215) 597-7668
Carin Debenedictis, Region IV	(404) 347-1681	/ (404) 347-3222
Dr. Sheldon Simon, Region V	(312) 886-2591	/ (312) 886-6087
Donna Mullins, Region VI	(214) 655-2164	/ (214) 655-7244
Bob Jackson, Region VII	(913) 551-7065	/ (913) 551-7020
Dan Bench, Region VIII	(303) 293-1229	/ (303) 293-1443
Greg Czajkowski, Region IX	(415) 974-6612	/ (415) 974-7295
Bill Hedgebeth, Region X	(206) 442-0110	/ (206) 442-7369

c. Permanent Operations

Quadrex must submit an advance written notification of permanent operations to the addressees at least 180 days in advance of the proposed Permanent Operations at a site. When a adrex unit is to be operated at a site for 180 consecutive days more, the following information must be included in the notification and verified by EPA to conform to the informational requirements before the 180-day review period can begin. This advance written notification shall include a site evaluation and must include the following:

(1) All information required under items 1.b.(1)(A) through (E) of Mobile Operations.

(2) Additional information presented below:

(A) estimates of fugitive emissions of PCBs and any other hazardous materials;

(B) amounts of waste generated during the entire operation and how that waste will be disposed;

(C) plans of action in case of an emergency (including arrangements with local fire fighters, law enforcement personnel, and public health officials);

(D) site-specific spill prevention control and countermeasures (SPCC) plan or containment installations and procedures; and,

(E) site cleanup or restoration procedures and copies of any bonds which may be required by a state or local authority or by the client for the Quadrex operations.

(3) Details of the Site Evaluation

The following information must be submitted to the OTS and the appropriate EPA Region as part of a notice of intent to operate a permitted mobile disposal unit (MDU) at a site for 180 consecutive days or longer. A public notice will not be published until a complete submission of these requirements has been received and approved by EPA.

There are a number of details which were submitted to EPA as part of the original PCB disposal permit application which must be updated or revised. All of these details are directly or indirectly related to the site of operations.

(A) Project Personnel

A list of names and an organizational chart, brief job description, and responsibilities for all staff to be employed by the permittee at the proposed site. In addition, names, mailing addresses, and telephone numbers of primary Quadrex contacts with EPA, such as environmental affairs managers or government liaison contacts. Job qualifications and training, including the time, frequency and content, must be included.

(B) Facility Description

The facility description shall include details of the disposal operations as they apply to the physical layout at the disposal site. To be included are (1) a site layout, to scale, of the location where operations will occur, and (2) the location of: safety equipment, including but not limited to fire protection equipment, disposal equipment, supplies, waste handling equipment, waste loading and unloading points for transportation, flood proofing protection structures, security structures.

If the disposal operation will be at a previously developed site, in addition to the above requirements, other site modifications must be described and justified. Buildings for personnel, construction, maintenance and laboratories are exempted, unless there are discharges from operations of a mobile unit to the environment. Laboratory vents, sewer discharges from the laboratory or any area that may be associated with any contact with PCBs or any hazardous waste

handled or generated as the result of PCB disposal must be discussed. Also, discussions of all storage facilities and their containment, process water systems, and other waste stream processing shall be included.

(C) Disposal Activities to Be Conducted On-Site

A summary of the process operations which are described in detail in the original permit application shall be submitted, not to exceed one typewritten single spaced page. The permittee shall discuss activities and the amount of time involved in setting up and taking down disposal operations of the MDU at the site. Also, the permittee shall provide a discussion of monthly and annual: amounts and concentrations of waste and amount of PCBs to be processed; amounts and concentrations of PCBs and other hazardous materials stored on site; amounts and concentrations of contained, controlled, and fugitive emissions of toxic and non-toxic materials and how contained materials will be disposed of; proposed hours of operations; and expected duration of disposal activities at the site.

(D) Safety Measures

The permittee must describe systems and/or structures for the detection and/or containment of leaks and hazardous wastes/by-products must be described, including process shutdowns resulting from automated monitoring of process emissions. A brief discussion of the automatic process controls, such as those which control extreme temperature and pressure fluctuations or departure from a permitted range, must be included. The location and action plans for all other emergency equipment shall be provided. Maintenance plans and schedules shall be provided. Safety and/or quality control/quality assurance inspection schedules, procedures, and recordkeeping must be detailed.

(E) Emergency Preparedness and Contingency Plans

Emergency preparedness plans must be submitted to local authorities and approved by the EPA Region. These plans shall include (1) exactly what actions take place for each level of problem, (2) the names of the persons responsible for handling expected problems, and (3) facility personnel names and appropriate phone numbers for 24-hour a day contact in the event of an emergency. Frequent problems and reasonable worst case problem scenarios such as: spills during processing, storage, and transportation; fires; floods; and equipment malfunction resulting in personal injury must be addressed. The information shall include (1) names and phone numbers of fire, police, medical emergency contacts, and (2) training sessions, documents, or other information provided to these services.

(F) Transportation Routes and Volumes to be Transported to the Site

Transportation route information shall be detailed if such routes include any roads other than interstate highways. Information shall include residential or commercial areas associated with the roads to be used by hazardous waste transporters. Amounts, volumes, and locations of off-site PCB materials which are proposed to be transported to the PCB disposal site shall be listed. Information on the off-site and on-site storage of the off-site materials (including but not restricted to location, brief description of the release control/containment measures at the storage facility, and the estimated time to be stored at the location), shall also be listed.

(G) Financial Assurance and Closure

The permittee shall summarize the financial assurance and closure provisions from the permit application including what situations are covered by insurance or other financial assurance and the amount of the assurance. Additional financial assurance and closure provisions for the time of extended PCB disposal operations at the site must be described in detail.

(H) Exposure Assessment

An exposure and risk assessment shall be provided for activities included in normal operations and in the event of reasonable worst case accidents/problems. The exposures shall include those resulting from: storage; contained and fugitive emissions; handling and processing PCBs and other hazardous waste/process materials; operation of industrial equipment; and transportation related releases such as spills and collisions.

The information shall include an assessment of risk to the public from:

(1) lifetime exposure to process operations;

(2) the transport of PCB waste to the site; and,

(3) on-site storage of PCB waste for disposal.

Situations which are not considered reasonable worst case situations, are a double tornado, a terrorist attack, a nuclear strike, a plane crash into the facility, a meteor strike, and damage from an earthquake when there is not an active major geological fault near enough to expect major plant facility damage and release of PCB material.

Public Participation

Quadrex shall provide public notice (sample form included in Appendix IIID) in the local newspaper initiating a 30-day comment period for public review of appropriate permit related documents (such as the sanitized (non-confidential business information) permit application, any existing PCB disposal permit, any existing draft revised PCB disposal permit, and the site evaluation). The notice shall also advise that a public meeting will be held on a specified date and at a specified place and time not more than 45 days after the initial public notice, if EPA determines that there is sufficient public interest for a public meeting. A public notice will not be published until a complete submission of requirements under Item (3)(A) through (G) above has been received and approved by EPA.

The public meeting will be hosted by the EPA Region. OTS and the EPA Region may collectively determine what the schedule and the agenda for the public meeting shall be. After Quadrex has given the EPA Regional Office, the State agency, and the local jurisdiction a notice of intent to operate at a site for at least 180 consecutive days or more, and once OTS and the local EPA Region are satisfied that the site specific information submitted in this notice meets the requirements set forth in \ragraphs (1), (2) and (3) above, a 180-day public notification ıd review process shall begin.

Based on the comments and questions received during the 30-day comment period, the EPA Region will determine whether a public meeting is necessary. The public meeting shall be held: (a) to discuss comments made by the public during the 30-day comment period and notification for the public meeting; (b) to allow the public to make comments on the proposed operations and site; and (c) to allow the public to ask questions of EPA representatives on the proposed operations.

Not more than 150 days after the close of the public comment period, EPA shall make a decision on the authorization of Permanent Operations and on what additional conditions, if any, shall be imposed on the Quadrex Permanent Operations. The decision will be based on review of comments during the 30-day comment period, and comments made during the public meeting. The decision could be that Quadrex may begin operations without additional permit conditions, or the decision could be made to require additional site-specific permit conditions which must be met before Permanent PCB Disposal Operations may begin at the site.

e. Requirements for Changing From Mobile Operation Mode to Permanent Operation Mode

Quadrex must proceed as follows whenever a unit, which was originally projected to be located at a single site for less than 180 consecutive days as Mobile Operations, at some point before 180 consecutive days into the operations, is determined that the unit will be located at the site for 180 consecutive days or longer:

(1) Quadrex must immediately provide written and telephone notification of this change to the EPA Headquarters' Office of Toxic Substances (OTS) and the appropriate EPA Regional Office.

(2) Upon submission of this notification, Quadrex shall cease PCB disposal operations after the 180th consecutive day unless Quadrex provides OTS and the EPA Regional Office a site evaluation, which includes all information prescribed in sections c.(1) - (3) above. The information must include updated material for the operation in question, including any modifications, to allow EPA to consider operations for the time period beyond the 180 consecutive days.

(3) Upon review and acceptance of the site evaluation, Quadrex must provide for public notice of the application for approval and a 30-day comment period along with an opportunity for a public meeting or hearing as described in section 1.d. above.

(4) When the comment period is concluded, OTS and the Regional Office will determine, in its discretion, that operations may proceed beyond 180 consecutive days. EPA will notify Quadrex in writing of its approval to operate beyond 180 consecutive days.

2. Agency Approvals or Permits

Prior to commencing operations, Quadrex must obtain any necessary Federal, State or local permits or approvals. During the course of operations, Quadrex shall comply with all conditions and requirements of such permits or approvals. Copies of such permits shall be forwarded to the Chief, PCB Disposal Section (TS-798) EPA Headquarters. Waste materials containing PCBs in the concentration range of approximately 200 ppm of PCBs may also contain levels of hexachlorobenzene at levels regulated for disposal under the Toxicity Characteristic Revisions (55 Federal Register, 11796, March 29, 1990 of the Resource Conservation and Recovery Act (RCRA) regulations.

Authorized Use of the Quadrex mobile PCB disposal system

The Quadrex mobile PCB disposal systems have been authorized to use the solvent Freon 113™ and the proprietary solvents QPS and QPS-2 for three distinct functions. Descriptions of these three functions follow. Distillates of these solvents recovered from the Quadrex alternate disposal process must contain less than 2 microgram PCBs per gram before use, with quantitation based on the original formulation of PCBs in the material rinsed (Aroclor™ quantitation). The still bottoms containing the PCBs removed from the solvents must be disposed of in accordance with 40 CFR 761.60.

a. The Quadrex mobile PCB disposal systems are authorized to use Freon 113™, QPS, or QPS-2 to rinse individual, drained transformers that had contained PCB askarel or MODEF, and to rinse drained systems that had contained heat transfer and hydraulic fluid.

Prior to treatment, the systems or transformers must be drained of all free-flowing fluids. The drained fluids must be disposed of in accordance with 40 CFR 761.60. In addition, Quadrex must advise its customers that transformers treated with the Quadrex process and returned to service cannot be reclassified unless the replacement dielectric fluid is tested following a minimum of ninety days of in-service use. In-service use is defined as use under electrically loaded conditions in which the dielectric fluid is raised to a minimum of 50°C.

b. The Quadrex mobile PCB disposal systems are also authorized to use Freon 113™, QPS, or QPS-2 to spray clean the following items that have been surface contaminated with PCBs. The decontamination criteria for these items shall be consistent with the EPA Spill Clean-Up Policy.

(1) to clean paper, file folders, and other cellulose-based documents and small document containers (excluding cardboard boxes) surface contaminated with askarel transformer fluids,

(2) to clean office equipment such as telephones, desk calculators, typewriters, tools, metal parts, printed circuit boards, and other similar articles when these items have become surface contaminated with askarel transformer fluids,

(3) to clean industrial, institutional, and commercial hardware and equipment contaminated by a PCB spill, use, fire, release, contact or proximity to a PCB device, and

(4) to clean components of equipment used in PCB decontamination activities, such as decontamination systems and equipment, miscellaneous fittings, valves, electrical components, tools, and other hardware.

c. The Quadrex mobile PCB Disposal Systems are authorized to use Freon 113™, QPS, or QPS-2 to clean natural gas pipeline air compressor systems, which include the compressors themselves, the compressed air receiver tanks, the piping between the air compressor and the compressed air receiver tanks, and the piping between the receiver and other natural gas pipeline compressor station equipment such as instruments and tools driven by compressed air. The use of the Quadrex process to clean natural gas pipeline air compressor systems and associated parts is an alternative to disposal of the systems in a TSCA-approved incinerator or TSCA-approved landfill. This authorization is in accordance with procedures documented in applications to EPA dated January 11, 1988, February 1988, and March 22, 1989. Decontamination criteria for compressor systems are described in Condition 4 below.

d. The Quadrex mobile disposal systems are authorized to use water decontamination units. Decontamination criteria for the water decontamination unit are described in Condition 6 below.

e. Quadrex is authorized to use the air cooled version of the Transform unit at concentration of PCBs for QPS and QPS-2 as described in Condition 7 below.

f. The Quadrex mobile disposal systems are authorized to use QPS-2 to clean natural gas pipeline, miscellaneous valves, controllers, meters, couplings, bolting, and appurtenances associated with natural gas pipeline. The use of the Quadrex process to clean natural gas pipeline systems and associated parts is an alternative to disposal of the systems in a TSCA-approved incinerator or TSCA-approved landfill. Decontamination criteria for natural gas pipeline and appurtenances are described in Condition 4 below.

This authorization is in accordance with procedures documented in applications to EPA dated January 11, 1988, February 1988, March 22, 1989 and July 17, 1990. Decontamination criteria for gas pipeline systems are described in Condition 5 below.

4. Authorized use to clean natural gas pipeline pipe(six inch and less diameter) and natural gas air compressor systems.

In Condition 3 (c), the Quadrex mobile PCB disposal system is authorized to use the solvent Freon 113 $_{TM}$ and the proprietary solvent QPS-2 and QPS to clean natural gas air compressor systems. In Condition 3 (f), the Quadrex mobile PCB disposal system is authorized to use the proprietary solvent QPS-2 to clean natural gas pipe (six inches and less inner diameter) systems. In order for these air compressor systems and natural gas pipelines to be unregulated for: (a) further distribution in commerce and use as air compressor systems for natural gas pipeline compressors, or (b) disposal, residual surfaces must be cleaned to below 100 micrograms per 100 square centimeters, which is the same as one microgram per one square centimeter (1 $\mu g/1$ cm^2). Failure to clean to the 1 $\mu g/1$ cm^2 level, or to lower levels, subjects the equipment to TSCA requirements based on the measured concentration of PCBs in the air compressor systems prior to contamination. This is true even though it is acknowledged that the measured concentration may have resulted from dilution of the original PCB-containing materials used in the system. It is recognized, however, that an EPA consent agreement/decree may require or allow other surface levels or other residual PCB levels in a solvent rinse. The procedure for determining whether or not the Quadrex clean-up process has met the 1 $\mu g/1$ cm^2 surface level requirement follows.

a. For Quadrex to determine whether the Quadrex process has cleaned an AIR COMPRESSOR RECEIVER TANK to 1 $\mu g/1$ cm^2, the efficacy of the process must be verified with a surrogate sampling procedure. The surrogate sampling procedure must be used because standard EPA wipe sampling procedures, based on representative sampling, cannot be carried out without cutting or damaging the equipment.

In the Quadrex process, receiver tanks are spray-rinsed under pressure with a solvent. This spray rinsing under pressure dislodges rust, scale and solids. Quadrex will continue this spray cleaning until visual inspection of the rinsate shows the presence of a minimal quantity of suspended solids. When Quadrex decides from the visual appearance of the solvent to end the spray cleaning process, the surrogate sampling procedure will begin.

(1) In the surrogate sampling procedure, the theoretical volume of solvent allowable for use in the final rinse pass of the equipment is first calculated. The purpose of the theoretical calculation is to ensure that the PCB concentration of the rinse solvent is never diluted below the Limit of Quantitation (4 ppm) for PCB analysis with Gas Chromatography.

(2) Quadrex shall calculate from the following equation the maximum amount of solvent with a minimum theoretical concentration of 4 ppm PCBs allowable for use in the final rinse pass:

$$\frac{4\ \mu g/g = (ESA)(1\mu g/1cm^2)}{(Wrs)}$$

Where,

(ESA) is the estimated interior surface area of the receiver tank being rinsed, and

(Wrs) is the total maximum weight in grams of the solvent allowable for use in the final rinse pass.

(3) When Quadrex has calculated from Equation (2) the weight of solvent allowable for use in the final rinse pass, the amount of solvent to be used can be weighed directly, or the weight can be converted to volume by dividing by the density. Any theoretical PCB concentration of 4 ppm or higher can be substituted in Equation (2), with any increase in the PCB concentration correspondingly lowering the amount of solvent allowable in the rinse pass. Whatever theoretical PCB concentration is chosen will then become the "target" PCB concentration when definitive GC analysis of a representative sample of the rinse is carried out. However, no amount of solvent can be used that will lower the theoretical PCB concentration below the 4 ppm Limit of Quantitation unless the solvent is concentrated after the rinse pass and during chemical analysis to once again allow quantitation of PCBs with the Gas Chromatograph

In the event that (W_{rs}) is smaller than the total amount of solvent needed for the Quadrex system to operate to decontaminate certain small pressurized tanks/bottles in air compressor systems associated with natural gas pipeline compressors Quadrex shall use the alternative performance-based procedure in (7) below.

(4) Once the amount of solvent to be used in the final rinse pass has been determined with the use of the selected "target" concentration in Equation (2), Quadrex shall drain any previous wash/flush solvents from a receiver tank and the Quadrex processing system. Next Quadrex shall make one pass through a receiver tank with the calculated amount of solvent containing less than 2 ppm PCBs. A rinse pass is defined by the procedures described in the Quadrex application, and includes spraying the solvent under high pressure on all interior surfaces of a receiver tank. Quadrex shall then take a representative sample of the flush solvent according to the procedures in (5) below.

(5) A representative sample of the rinse solvent may be collected for definitive GC analysis using either one of the two sampling procedures that follow.

-- In one acceptable procedure, collect all of the rinse in a single container. Circulate the solvent by pumping out of the bottom of the container and into the top until at least three total volumes of the solvent have been pumped. Stop the pumps and immediately sample the solvent.

-- In the other acceptable procedure, continuously sample small portions of the solvent over the entire time of the rinse. This is accomplished by using a small peristaltic pump and continuously sampling the solvent at the point where the solvent flows out of the receiver into the pump. The sample shall be collected before any filters and the peristaltic pump shall be operated so that the rate of the pump allows for production of a sample of proper size for use with the Quadrex analytical procedure.

(6) The collected, representative samples must be analyzed with Gas Chromatography. The analytical procedures used are described in Quadrex applications on file at the EPA.

If the definitive GC analysis shows that a sample is less than the "target" theoretical PCB concentration used in Equation (2), the receiver tank is unregulated for distribution in commerce, use or disposal. If the definitive GC analysis of a sample shows that the PCB concentration of the rinse solvent is equal to or greater than the "target" PCB concentration used in Equation (2), Quadrex shall rerinse a receiver tank clean in increments with additional rinse passes until the PCB concentration is less than the "target" concentration when measured with Gas Chromatography. Each additional rinse pass, as defined in the Quadrex application, shall be sampled representatively, and analyzed with GC until the concentration of a rinse pass measures less than the "target" PCB concentration.

(7) This alternative performance based procedure includes rinsing the interior surface with no less than three successive rinse cycles using either Freon 113™, QPS-1 or QPS-2. For each rinse cycle, all of the following conditions apply:

(A) The total volume of solvent sprayed over the surface of the small pressurized tank/bottle must be equal to or greater than ten percent of the volume of the tank.

(B) This volume shall be passed/sprayed, using a high pressure spray nozzle, over the entire surface of the tank at least twice. The spraying shall occur according to the procedures documented in the Quadrex permit application relevant to the decontamination of air compressor tanks.

(C) The solvent to be used in the rinse cycle must contain less than 2 parts per million (ppm) PCBs at the beginning of the rinse cycle.

(D) The total solvent volume in #3 (above) may be a constituted of a smaller volume which is recycled within a rinse cycle, as long as the smaller volume is recycled to the extent of rinsing with a total rinse-solvent volume equivalent to 10% of the total tank volume.

For example, for a total required rinse volume of 200 gallons (that is, to be used to treat a 2,000 gallon tank), only 100 gallons of solvent may be sprayed over the interior surface of the tank/bottle repeatedly until at least a total of two hundred gallons had been circulated. That is, all 100 gallons shall be sprayed at least twice during at least two passes over the entire surface of the tank/bottle (according to #1 and #2 [above]). For this example, the volume must be used at least twice and the shall be sprayed at least twice. For the solvent to be reused within a rinse cycle, the recycling loop must contain a particulate filter which shall be disposed of as containing greater than 500 ppm PCB liquids.

Following the completion of a rinse cycle, the PCBs in the solvent used in that rinse cycle shall be removed in accordance with the approved Quadrex PCB disposal process to the extent that the residual PCBs in the solvent for all reuses shall be less than 2 ppm.

Quadrex shall keep in its PCB disposal records relevant calculations demonstrating that the surrogate sampling process cannot achieve the 4 ppm requirement because the amount of solvent needed to conduct a rinse operation exceeds the maximum allowed by the calculation is practically impossible to apply; and that the alternative rinse process has been used.

b. For Quadrex to determine whether the Quadrex process has cleaned natural gas pipeline pipe (six inches inner diameter and less)and parts of air compressor systems other than receiver tanks to the 1 $\mu g/1\ cm^2$ level, the surrogate sampling procedures are somewhat different. OTHER PARTS OF THE COMPRESSOR SYSTEM include the air compressors themselves; the

piping between the receivers and the air compressors; and other natural gas pipeline compressor station equipment such as instruments and tools driven by compressed air. The differences in the surrogate sampling procedures arise because the cleaning process involves filling the natural gas pipeline pipe (six inches inner diameter and less) or air compressor piping system and the Quadrex processing equipment with solvent and pumping all of this solvent through the systems. This solvent will rinse surfaces of the Quadrex processing equipment not originally contaminated and invalidate the use of Equation A(2) to calculate the PCB concentration of the solvent. Therefore, Quadrex shall use the following procedure for verification that the natural gas pipeline pipe (six inches inner diameter and less) and air compressor systems are clean and can be deregulated.

(1) Quadrex shall flush natural gas pipeline pipe (six inches inner diameter and less) or the entire air compressor system, exclusive of the receiver tanks, in increments, with solvent containing less than 2 ppm PCBs and circulating pumps. After each flush, Quadrex shall drain the flush solvent. Quadrex may then continue this flushing for as long as it deems necessary before draining prior to the verification rinse required in (2) below.

(2) In the verification rinse or flush, Quadrex shall refill the natural gas pipeline pipe (six inches inner diameter and less) or entire air compressor system, exclusive of the receiver tank or tanks, with solvent containing less than 2 ppm PCBs. The entire volume of solvent in the filled system shall be recirculated by pumping long enough for three times the total volume to pass through the closed system or for 15 minutes, whichever is <u>longer</u>. For example, if the total volume of the system is 1,000 gallons and the pump rate is 500 gallons per minute, then the recirculation time would be 6 minutes (3 times 1,000 gallons divided by 500 gallons per minute). In this example case the circulation time would be 15 minutes.

(3) Quadrex shall drain the solvent used in the verification rinse from natural gas pipeline pipe (six inches inner diameter and less) or the air compressor system and obtain a representative sample for GC analysis using either one of the two sampling procedures that follow.

-- In one acceptable procedure, collect all of the rinse in a single container. Circulate the solvent by pumping out of the bottom of the container and into the top until at least three total volumes of the solvent have been pumped. Stop the pumps and immediately sample the solvent.

-- In the other acceptable procedure, continuously sample small portions of the solvent over the entire time of the rinse. This is accomplished by using a small peristaltic pump and continuously sampling the solvent at the point where the solvent flows out of the receiver into the pump. The sample shall be collected before any filters and the peristaltic pump shall be operated so that the rate of the pump allows for production of a sample of proper size for use with the Quadrex analytical procedure.

(4) The collected samples of solvent must be analyzed with definitive Gas Chromatography.

(5) If the PCB concentration of the solvent is 4 ppm or greater, the verification rinse must be repeated. The verification rinsing procedure must be repeated as many times as necessary to bring the PCB concentration in the solvent to less than 4 ppm when measured with Gas Chromatography. If the PCB concentration of the solvent is less than 4 ppm, the air compressor system cleaned is decontaminated and unregulated for further distribution in commerce, use or disposal.

(6) If the final rinse sample was of a segment of an entire system, the PCB concentrations found in the rinse samples of each segment of a continuous system can be averaged using weighted averaging to verify the level of residual contamination remaining in the entire system. The formula for calculating the weighted average for a system that is flushed in segments follows.

$$\text{system ppm} = \frac{W_{RS1} \times ppm_1 + W_{RS2} \times ppm_2 + \ldots + W_{RS} \times ppm_n}{W_{RS1} + W_{RS2} + \ldots + W_{RSn}},$$

where,

WRS_n is the weight (in grams) of the rinse solvent used to flush the n^{th} segment and

ppm_n is the measured PCB concentration in the rinse solvent after flushing the n^{th} segment.

If the result of this calculation shows that the overall system average is greater than 4 ppm, selected individual segments can be cleaned by repeating the verification rinse procedure on the individual segments until the overall weighted system average is less than 4 ppm.

If the system concentration from this calculation is less than 4 ppm, the overall system and all components cleaned in these procedures will be considered decontaminated and unregulated for further distribution in commerce, use, or disposal.

5. Authorized use to clean natural gas systems

In Condition 3 (c), the Quadrex mobile PCB disposal system is authorized to use the the proprietary solvent QPS to clean natural gas pipeline pipe(six inches and greater in inner diameter and no greater than 40 feet in length) and appurtenances. In order for these natural gas systems to be unregulated for: (a) further distribution in commerce and use as natural gas pipeline, or (b) disposal, residual surfaces must be cleaned to below 100 micrograms per 100 square centimeters, which is the same as one microgram per one square centimeter (1 $\mu g/1$ cm^2). Failure to clean to the 1 $\mu g/1$ cm^2 level, or to lower levels, subjects the equipment to TSCA requirements based on the measured concentration of PCBs in the natural gas pipeline pipe and appurtenances prior to decontamination. This is true even though it is acknowledged that the measured concentration may have resulted from dilution of the original PCB-containing materials used in the system. It is recognized, however, that an EPA consent agreement/decree may require or allow other surface levels or other residual PCB levels in a solvent rinse. The procedure for determining whether or not the Quadrex clean-up process has met the 1 $\mu g/1$ cm^2 surface level requirement follows.

Pipe (six inches and greater) and equipment which have been verified to meet the designated 1 $\mu g/cm^2$ cleanup levels, but are above 0.1 $\mu g/cm^2$, shall be unregulated for disposal, but regulated for distribution in commerce, when such distribution would result in long term dermal contact with the interior surface of the pipe or equipment.

In the Quadrex process, 1) the bottom of the pipe in its installed condition is marked; 2) the ends are closed off, and the pipe is sloped to facilitate draining; 3)the spray solvent is allowed to drain at the low end of the pipe; 4) provisions for the spray head and the solvent feed pipe are made at the high end. Only those portions of the pipe that are exposed to pressure spraying are deemed to be processed. Extension pieces may be installed at both ends to effect full exposure of the pipe segments. The pipe shall be sprayed such that the spray fan passes over the entire internal area of the pipe. Quadrex shall

spray until visual inspection of the rinsate shows the presence of minimal quantity of suspended solids. When it is determined to end the process by from visual inspection of the liquid, Quadrex shall begin the wipe sampling procedures.

The following wipe sampling procedures shall be used:

1) A standard 100 cm^2 wipe sample shall be taken at the bottom of both ends of the pipe.

2) The samples shall be analyzed with Gas Chromatography. The analytical procedures used are described in Quadrex applications on file at EPA Headquarters.

3) If the analyses indicate the pipe is contaminated with PCBs at levels less than 1 $\mu g/cm^2$, the pipe shall be unregulated for disposal but the pipe is regulated for distribution in commerce.

4) If the analyses shows that the pipe is contaminated with PCBs at a surface concentration of greater than or equal to 1 $\mu g/cm^2$, Quadrex shall continue the spraying process until the desired surface concentration is met.

The wipe sampling procedure shall be used to determine the efficacy of the Quadrex spray process for decontamination of natural gas pipeline appurtenances such as valves, controllers, meters, and other pipeline equipment contaminated by PCBs from natural gas pipeline liquids. The appurtenances to be cleaned are disassembled as necessary to expose all surfaces for cleaning, placed in an enclosed chamber and sprayed with QPS-2 by an operator via glove ports. The operator shall spray clean the item until it is determined that the entire area of the item is cleaned. The part shall be wipe sampled as follows:

1) A standard 100 cm^2 wipe sample shall be taken at the item's surface at the location where PCBs would have accumulated the most.

2) The samples shall be analyzed with Gas Chromatography. The analytical procedures used are described in Quadrex applications on file at EPA Headquarters.

3) If the analyses indicate the item is contaminated with PCBs at level less than 1 $\mu g/cm^2$, the PCB item shall be unregulated for disposal but the pipe is regulated for distribution in commerce. If the surface concentration is less than 1 $\mu g/10\ cm^2$, it is unregulated under TSCA.

4) If the analyses shows that the PCB item is contaminated with PCBs at a surface concentration of greater than or equal to 1 $\mu g/cm^2$, Quadrex shall continue the spraying process until the desired surface concentration is met.

For Quadrex to determine whether the Quadrex process has cleaned small miscellaneous valves, controllers, meters, and other pipeline equipment contaminated by PCBs found in natural gas pipeline, the efficacy of the process is determined by a surrogate wipe sampling process. In this process, the items to be cleaned are disassembled as necessary to expose all surfaces for cleaning, and placed in a tank as described in the permit application which is on file at EPA Headquarters. The items are placed in such a way that their internal and external surface areas are exposed to a laminar mixing. During tank loading, two surrogate samples shall be placed in corners of least turbulence. These surrogate samples are plates of at least 100 cm^2, which have been dipped in a solvent spiked with PCBs, allowed to dry and placed in a piece of pipe closed at one end. One side of the plate is permanently marked. After the solvent is dried, the permanently marked side of the plate is wiped sampled. The tank is then filled with QPS-2 to a depth of at least 1 inch greater than the height of the items and sealed to prevent volatile organic emissions. Any vapors shall be vented through a carbon adsorber canister. For a period of at least two hours, a continuous high volume recirculating flush shall be established by an external pump, filter circuit. At the end of the soak/flush cycle the tank shall be drained and the parts removed, and the surrogate sample pieces sampled as follows:

1) A standard 100 cm^2 wipe sample shall be taken at each surrogate sample's side which is not permanently marked.

2) The samples shall be analyzed with Gas Chromatography. The analytical procedures used are described in Quadrex applications on file at EPA Headquarters.

3) If the analyses indicate the surrogate sample's side which is not permanently marked is contaminated with PCBs at a level less than 1 $\mu g/cm^2$, the processed batch shall be unregulated for disposal but the processed batch is regulated for distribution in commerce. If the surface concentration is less than 1 $\mu g/10\ cm^2$, it is unregulated under TSCA.

4) If the analyses shows that the surrogate contaminated with PCBs at a surface concentration of greater than or equal to 1 $\mu g/cm^2$, Quadrex shall repeat the soak/flush process until the desired surface concentration is met.

6. Authorized use for water treatment system

The Quadrex mobile PCB treatment process has been authorized for separating PCBs from a water based matrix, which contains other contaminants such as surfactant cleaning agents and oils. Prior to conducting the treatment process, Quadrex must conduct a test to determine the appropriate coagulant to use for the specific water matrix. Quadrex shall only treat a batch of maximum volume of 165 gallons and a maximum concentration of 50 ppm of PCBs.

A sample of each batch of treated wastewater must be drawn, and analyzed in duplicate by gas chromatography for the concentration of PCBs at each site where the Quadrex PCB treatment process is being used. The PCB concentration in the treated effluent shall be less than 3 ppb prior to release of the wastewater. In the event that the treated effluent is found to be greater than or equal to 3 ppb, the effluent shall be recirculated through a filtering system until the concentration of PCBs is less than or equal to 3 ppb.

If the quality control testing reveals that the PCBs have not been adequately removed after repeated processing, then a reevaluation of the wastewater matrix shall be conducted to include the coagulant selection testing, before further treatment may be conducted.

7. Feedstock Quality and Restrictions

The PCB concentration of the Freon 113™ mixture to the still with the refrigerant cooled condenser shall not exceed the following levels:

- MODEF, 920 ppm total PCBs;
- Heat transfer fluid, 3,100 ppm total PCBs;
- Hydraulic fluid, 3,100 ppm total PCBs; and
- Askarel dielectric fluid, 5,000 ppm total PCBs.

The PCB concentration in the QPS mixture to the still with the refrigerant cooled condenser shall not exceed the following levels:

- 920 ppm Aroclor 1242
- 4,200 ppm Aroclor 1260
- A total of not more than 5,120 ppm Aroclors 1242, 1254, and 1260, where the total Aroclor 1242 and Aroclor 1254 concentrations combined is no more than 920 ppm and the Aroclor 1260 concentration is no more than 4,200 ppm.

The PCB concentration in the QPS-2 mixture in the still with the refrigerant cooled condenser shall not exceed the following levels:

- 8,100 ppm Aroclor 1242
- 15,300 ppm Aroclor 1260
- A total of not more than 23,400 ppm Aroclors 1242, 1254, and 1260, where the total Aroclor 1242 and Aroclor 1254 concentrations combined is no more than 8,100 ppm and the Aroclor 1260 concentration is no more than 15,300 ppm.

The PCB concentration in the QPS-2 mixture in the still with the air cooled condenser doing a single pass shall not exceed the following levels:

- o 8,100 ppm Aroclor 1242
- o 30,000 ppm Aroclor 1260
- o A total of not more than 38,100 ppm Aroclors 1242, 1254, and 1260, where the total Aroclor 1242 and Aroclor 1254 concentrations combined is no more than 8,100 ppm and the Aroclor 1260 concentration is no more than 30,000 ppm.

The PCB concentration in the QPS mixture in the still with the air cooled condenser doing a double pass shall not exceed the following levels:

- o 920 ppm Aroclor 1242
- o 100,000 ppm Aroclor 1260
- o A total of not more than 100,920 ppm Aroclors 1242, 1254, and 1260, where the total Aroclor 1242 and is no more than 920 ppm and the Aroclor 1260 concentration is no more than 100,000 ppm.

Prior to treatment, samples of the Freon 113™, QPS, or QPS-2 feedstocks must be obtained from the still and analyzed using gas chromatography procedures specified in EPA-approved procedures outlined in the following documents:

"Guidelines for PCB Destruction Permit Applications and Demonstration Test Plans for PCB Disposal by Non-Thermal Alternative Methods," August 21, 1986;

"Recommended Analytical Requirements for PCB Data Generated On-Site During Non-Thermal PCB Destruction Tests," USEPA, March 19, 1986 (Draft);

"Quality Assurance and Quality Control Procedures for Demonstrating PCB Destruction in Filing for PCB Disposal Permit," USEPA, June 28, 1983 (Draft); and

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, Office of Research and Development, USEPA, December 29, 1980.

Should Quadrex Environmental Company successfully demonstrate to EPA through controlled experimentation or actual demonstration that the Quadrex process is capable of treating higher concentrations of PCBs in a particular fluid, this condition may be modified accordingly. Authorized EPA representatives may witness the demonstration and obtain split samples for verification of analytical results.

8. Process Control

A sample from each batch of treated Freon 113™, QPS, or QPS-2 must be drawn and, analyzed in duplicate (i.e., duplicate analysis) by gas chromatography for the concentration of PCBs where the Quadrex Process is being used. If the concentration of PCBs in the treated sample is 2 ppm or greater per resolvable gas chromatographic peak (as calculated by comparison to an external standard homolog peak having the nearest retention time to each appropriate PCB peak to be quantified), the fluid must be reprocessed and analyzed until less than 2 ppm per resolvable gas chromatographic peak (according to the aforementioned method and procedures) before the next run is begun or the fluid must be disposed of as if it contained PCBs at the level in the original fluid.

When Aroclor patterns are detected in the chromatograms of treated MODEF or oil, then if the concentration of PCBs in the treated sample is 2 ppm or greater per resolvable gas chromatographic peak (as calculated by comparison to an external standard homolog peak having the nearest retention time to each appropriate PCB peak to be quantified) or if the Aroclor level (total PCBs concentration) is greater than 2 ppm, the fluid must be reprocessed and reanalyzed to show less than 2 ppm per resolvable gas chromatographic peak (according to the aforementioned method and procedures) and per Aroclor level (total PCBs concentration) before the next run is begun or the fluid must be disposed of as if it contained PCBs at the level in the original fluid.

9. Mobile Unit Decommissioning/Malfunction

If the quality control testing, as described in Condition 6, reveals that PCBs in the feedstock have not been adequately removed after repeated processing (not to exceed three times the estimated theoretical time necessary for complete reaction), the affected unit shall cease operation and Quadrex must resort to the condition "or the fluid must be disposed of as if it contained PCBs at the level of the original fluid," then Quadrex must notify the EPA Regional PCB Disposal Coordinator in the applicable EPA Region prior to moving the unit off site. Quadrex shall determine if the unsuccessful processing is due to contaminants in the fluid or process failure. If the unit successfully processes all the fluid from the next three consecutive passes, the cause of the unsuccessful processing shall be assumed to be contaminants in the fluid and not process failure. If repeated incidence of process failure occurs, the affected unit must cease operation and Quadrex must notify the Chief, PCB Disposal Section at (202) 382-3964, as well as the Regional Coordinator during the next business day, and file with each of them a written report within 7 days. Repeated process failures are signs of process malfunction and must be reported so that EPA is able to maintain accounting of working commercial

units. The affected unit shall not resume operation until the problem has been corrected to the satisfaction of the Chief, PCB Disposal Section. A unit which has been decommissioned must also be reported immediately to the Chief, PCB Disposal Section and at EPA Headquarters the Regional PCB Coordinator for the EPA Region in which such unit is decommissioned.

10. Process Waste Restrictions

a. All wastes generated by the Quadrex process shall be treated or disposed of as if the waste stream contained the PCB concentration of the original feedstock or pipe, valves , fittings and appurtenances as required by the "dilution rule" at 40 CFR 761.1(b). However, still bottoms produced as a result of the distillation process shall be sent to a TSCA approved incinerator.

11. Process Monitor/Recordkeeping

Provisions must be made to assure that the following information is suitably monitored and recorded for PCBs processed, such that materials harmful to health or the environment are not inadvertently released:

a. name, address, and telephone number of the Quadrex disposal unit operator and supervisor;

b. the name and business address of the person or firm whose PCB containing transformer, natural gas air compressor system or pipeline pipe and appurtenances, PCB containing wastewater are being processed;

c. the location, manufacturer, rated capacity and identification (serial) number of the transformer, heat transfer system or hydraulic system, natural gas pipeline appurtenances;

d. a description of the air compressor system, natural gas pipeline pipe and appurtenance including the estimated dimensions of all receivers and the estimated dimensions of the air compressor system exclusive of the receivers, including the diameter and length of all the pipe in the system;

e. a copy of all calculations used in surrogate sampling procedures and verification rinses for air compressor systems and natural gas pipeline pipe;

f. the date the transformer/system is received by Quadrex, the date(s) processed, and the date returned to the custody of the owner (if applicable);

g. estimated quantity and PCB concentration of solvent charged into the transformer, heat transfer system, hydraulic fluid system, and/or air compressor system, natural gas pipeline and appurtenances;

h. estimated quantity and PCB concentration of treated solvent and other treated materials produced;

i. date, time and duration of treatment per transformer or system or batch of wastewater;

j. a copy of the gas chromatogram and/or other records from tests conducted to determine the final concentration of the treated solvent or wastewater;

k. estimated quantity and quality of wastes produced, the method of disposal and location of the disposal facility for each waste must be documented; and

l. temperature of separation process in at least one-half hour intervals.

m. estimated quantity of wastewater to be treated

Disposal recordkeeping documents must be compiled within 60-days of the testing date, must be kept at one centralized location, and must be made available for inspection by authorized representatives of the EPA. Such documents shall be maintained for at least five years. Quadrex must also maintain the records required by 40 CFR 761.180(f). If Quadrex or its authorized agents terminate business, these records or their copies must be submitted to the Director of the Exposure Evaluation Division.

In addition, Quadrex must maintain, aboard the mobile unit, a record of the PCB disposal services performed by the unit during the previous month. These records must be available for inspection by authorized representatives of EPA.

12. PCB Releases

In the event Quadrex or an authorized field supervisor of the Quadrex mobile unit believes, or has reason to believe, that a release of PCBs has or might have occurred from the unit during processing, Quadrex must inform the appropriate EPA Region by telephone within 2 business hours from the time of discovery. Cleanup shall begin immediately and must comply with the TSCA PCB Spill Cleanup Policy (52 FR 10688, April 2, 1987).

A written report describing the incident must be submitted to the appropriate EPA Regional Contact, the Regional Administrator, and the Director, Exposure Evaluation Division of OTS by the close

f business on the regular business day following the incident. No PCBs may be processed in that facility until the release problem has been corrected to the satisfaction of the appropriate EPA Region.

13. PCB Spills

Any spills of PCBs or other fluids shall be promptly controlled and cleaned up as provided in the Quadrex Spill Prevention Control and Countermeasure Plan, and in accordance with the TSCA PCB Spill Cleanup Policy (52 FR 10688, April 2, 1987). In addition, a written report describing the spill, operations involved, cleanup actions and changes in operation to prevent such spills in the future must be submitted to the appropriate EPA Regional Contact, Regional Administrator, and Director, EED of OTS within 5 business days.

PCB spills must be reported in accordance with the spill reporting requirements prescribed under Section 311 of the Clean Water Act for discharges to navigable waters and under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) for discharges to other media.

14. Safety and Health

Quadrex shall comply with all applicable safety and health standards, as required by Federal, State and local regulations and ordinances. Any lost time injury must be reported to the appropriate EPA Regional Contact, Regional Administrator, and Director, EED of OTS by the end of the next business day.

15. Facility Security

The Quadrex mobile unit shall be secured (such as a fence, alarm system, or barricades, as appropriate) at each site to restrict or control public access to the area.

16. Any reports required by Conditions (7), (9), (10), and (12) are to be submitted by telephone to the appropriate regional PCB Disposal Site Coordinator within the time frame specified. In addition, Quadrex shall file written reports with the Regional Administrator of the appropriate EPA region, and the Director of the Exposure Evaluation Division within the time frame specified in the aforementioned conditions.

17. Personnel Training

Quadrex shall be responsible for ensuring that the supervisory personnel directly involved with the handling or disposal of PCB contaminated fluid using the Quadrex Process are demonstrably familiar with the general requirements of this approval. At a minimum, this must include:

a. the type of fluid which may be treated using the Quadrex PCB Destruction Process, and the upper limit of PCB contamination which may be treated;

b. basic recordkeeping requirements under this approval and the location of records;

c. notification requirements;

d. waste disposal requirements for process and by-product wastes generated during the operation of the Quadrex Process; and,

e. reporting requirements.

In this regard, Quadrex must maintain on-site during the operations of its mobile unit(s) a copy of this approval; the spill prevention and cleanup plan; and sampling and analytical procedures used to determine PCB concentrations in untreated and treated materials.

18. Equipment Transport

PCB-contaminated equipment (i.e., reactors, tanks, etc.) and untreated liquids on the mobile unit may be transported off-site, in accordance with 40 CFR Section 761.40 and the U.S. Department of Transportation (USDOT) requirements of Title 49 Part 172. Such requirements include placarding the mobile facility and labeling all PCBs. Quadrex must comply with placarding vehicles requirements unless:

Process equipment (i.e., reactors, pumps, feed hoses, pipes etc.) on the mobile unit must be decontaminated in accordance with the procedures described in Quadrex's permit application and test plan, prior to transporting off-site

19. The carbon entrapment canister must be replaced every six (6) months or immediately after 600 hours of unit operation.

20. All wastes generated by the Quadrex PCB Disposal Process, other than the successfully cleaned Freon 113™, QPS or QPS-2 solvent, (i.e., filter media, sludges, water or other effluents, etc.) must be disposed of as if it contains the original PCB feedstock concentration. EPA will consider amending this condition only after such waste has been fully characterized to determine all components, and gas chromatography analysis of the waste demonstrates that the PCB concentration is below 2 ppm.

21. Financial Assurance

Quadrex shall incorporate financial assurance of closure and liability coverage provisions into its closure plan. These provisions must be equivalent to those specified in 40 CFR Part 264, issued under Subpart H of the Resource Conservation and Recovery Act (RCRA), and provide funds for:

a. proper closure of the mobile PCB disposal units and support operations; and

b. compensating others for bodily injury and property damage caused by accidents arising from operations of the mobile disposal units.

Quadrex has filed with the Director, Exposure Evaluation Division Administrator documentation of compliance with these requirements. Quadrex must submit annual updates to the Director, Exposure Evaluation Division of the financial assurance of closure and liability coverage provision described herein.

22. Additional Unit

Quadrex must file a written pre-operation report with the Director of the Exposure Evaluation Division within thirty (30) days from the date of manufacture of each additional Quadrex mobile unit which is to be operated in the United States. This report shall contain the following information:

a. date of manufacture of the unit;

b. identification and/or serial number of the new Quadrex mobile unit;

c. certification by an independent, registered professional engineer to the effect that the Quadrex mobile unit is substantially identical to the original unit in terms of engineering design, hardware, process capacity, quality and workmanship;

d. certification by the chief executive officer of Quadrex Environmental Company signifying that the Quadrex mobile unit construction has been completed in such manner; and

e. a list of all substantive and nonsubstantive changes made to the design and construction of any new Quadrex mobile unit which is not identical to the original Quadrex mobile unit.

23. Process/Equipment Modifications

No major modifications may be made to the Quadrex unit design, as described in the application and demonstration plan for this approval, without written approval of the Director of the Exposure Evaluation Division.

24. Ownership Transfer

Quadrex must notify EPA at least 30 days before transferring ownership of the Quadrex PCB Process. Quadrex must also submit to EPA, at least 30 days before such transfer, a notarized affidavit signed by the transferee which states that the transferee will abide by Quadrex's EPA approval. Within 30 days of receiving such notification and affidavit, EPA will issue an amended approval substituting the transferee's name for Quadrex's name, or may require the transferee to apply for a new PCB disposal approval. In the latter case, the transferee must abide by Quadrex's approval until EPA issues the new approval to the transferee. Should Quadrex fail to provide EPA with the required written documentation of the transfer or to provide this documentation within the specified time frame, this approval shall be null and void.

25. Approval Severability

The conditions of this approval are severable, and if any provision of this approval or any application of any provision is held invalid, the remainder of this approval shall not be affected thereby.

26. Approval Expiration Date

This approval shall expire on July 5, 1991. For an approval renewal, EPA may require additional information and/or testing of the Quadrex Process. To continue the effectiveness of this approval pending EPA action on reissuance, Quadrex must submit a renewal request in writing to EPA at least 90 days, but not more than 180 days, prior to the expiration date of this approval.

27. Quadrex shall comply with all applicable requirements of the Federal PCB Regulation, 40 CFR Part 761, in the operation of the mobile Quadrex PCB Disposal unit(s). Particular note shall be given to:

a. 40 CFR, section 761.65 - storage for disposal;

b. 40 CFR, section 761.79 - decontamination; and

c. 40 CFR, section 761.180 - records and monitoring.

d. 40 CFR, section 761, Subpart J, PCB waste disposal-Records and reports

28. This approval shall supersede all previous U.S. EPA Headquarters and/or U.S. EPA Regional PCB disposal approvals or amendments for the Quadrex PCB Disposal Process.

APPROVAL

1. Approval to dispose of PCBs is hereby granted to Quadrex Environmental Company of Quadrex Corporation, Gainesville, Florida, subject to the conditions expressed herein, and consistent with the materials and data included in the permit application filed by the company. EPA reserves the right to impose additional conditions when it has reason to believe that the continued operation of the Quadrex mobile unit presents an unreasonable risk to public health or the environment. Any such proposed additional conditions shall be preceded by reasonable advance notice to Quadrex and opportunity for Quadrex to comment on the proposed modifications.

   Any departure from the conditions of this approval or the terms expressed in the application must receive prior written authorization of the Director, Exposure Evaluation Division of the Office of Toxic Substances. In this context, "application" shall be defined as all data and materials which have been received by EPA from Quadrex regarding the Quadrex Process.

2. This approval to dispose of PCBs does not relieve Quadrex of the responsibility to comply with all applicable Federal, State and local regulations. Violations of any applicable regulations may be subject to enforcement action, and may result in termination of this approval. This approval may be rescinded at any time for failure to comply with the terms and conditions herein, failure to disclose all relevant facts, or for any other reasons which the Director, Exposure Evaluation Division deems necessary to protect public health and the environment.

3. Quadrex shall be responsible for the actions of any authorized Quadrex Process employees when those actions are within the scope of operating or moving the equipment related to performance of the process, and Quadrex shall assume full responsibility for compliance with all applicable Federal, State and local regulations including, but not limited to, any advance or emergency notification and accident reporting requirements.

4. EPA reserves the right for its employees or agents to inspect Quadrex PCB disposal activities at any location or reasonable time.

1/14/91
Date

for Elizabeth F. Bryan
Joseph J. Merenda, Director
Exposure Evaluation Division

APPENDIX I
TO THE QUADREX APPROVAL TO DISPOSE OF POLYCHLORINATED BIPHENYLS

BACKGROUND

Section 6(e)(1)(A) of the Toxic Substances Control Act (TSCA) requires that EPA promulgate rules for the disposal of polychlorinated biphenyls (PCBs). The rules implementing section 6(e)(1)(A) were published in the Federal Register on May 31, 1979 (44 FR 31514) and recodified in the Federal Register of May 6, 1982 (47 FR 19527). Those rules require, among other things, that various types of PCBs and PCB Articles be disposed of in EPA-approved landfills (40 CFR 761.75), incinerators (40 CFR 761.70), high efficiency boilers (40 CFR 761.60), or by alternative methods (40 CFR 761.60(e)) that demonstrate a level of performance equivalent to EPA-approved incinerators or high efficiency boilers. The May 31, 1979 Federal Register also designated Regional Administrators as the approval authority for PCB disposal facilities.

On March 30, 1983, EPA issued a procedural rule amendment to the PCB rule (49 CFR 13181). This procedural rule change transferred the review and approval authority of mobile and other PCB disposal facilities that are used in more than one region to the Office of Pesticides and Toxic Substances (OPTS). The purpose of the amendment was to eliminate duplication of effort in the regional offices and to unify the Agency's approach to PCB disposal. The amendment gives the Assistant Administrator authority to issue nationwide approvals (i.e., approvals which will be effective in all ten EPA regions) to mobile and other PCB disposal facilities that are used in more than one region.

On April 15, 1988, this nationwide approval authority was delegated from the Assistant Administrator of OPTS to the Director of the Exposure Evaluation Division of the Office of Toxic Substances with another procedural amendment (53 FR 12524).

On November 17, 1984, Quadrex HPS, Incorporated, now known as Quadrex Environmental Company (Quadrex) submitted to EPA a permit application and demonstration test plan for nationwide approval to treat the interior of drained mineral oil dielectric fluid (MODEF) transformers, heat transfer fluid and hydraulic fluid systems containing PCBs. The demonstration test plan was approved by the Director of the Office of Toxic Substances on April 19, 1985. The trial demonstration took place at the Quadrex facility in Gainesville, Florida April 22-26, 1985, with EPA personnel on site to witness the demonstration, to verify Quadrex's on-site chemical analyses, and to obtain split samples for subsequent analysis and verification by EPA.

In the April 1985 demonstration, the Quadrex process successfully removed PCBs from a Freon 113 test matrix that included hydraulic fluid, heat transfer fluid, or MODEF containing PCBs. As a result, the EPA found that the Quadrex

process is equivalent to a 40 CFR Section 761.70 incinerator or a 40 CFR 761.60 high efficiency boiler, and that the operation of the Quadrex PCB disposal unit does not present an unreasonable risk of injury to human health or the environment. Quadrex was issued a final nationwide PCB disposal approval on July 5, 1985.

On September 4, 1985, EPA received a demonstration test plan from Quadrex outlining procedures for demonstrating the process to remove PCBs from solid surfaces and a liquid matrix. Specifically, Quadrex proposed to use its decontamination/disposal method to clean PCB-contaminated office items and to process the PCB/Freon solvent matrix generated during the cleaning operations. The demonstration was conducted September 12-13, 1985 at the New Mexico State Highway Department General Office Building in Santa Fe, New Mexico.

On August 4, 1986, EPA received a demonstration test plan from Quadrex for the separation of PCBs from an additional proprietary solvent (QPS). The demonstration was performed on August 25-29, 1986 at the Quadrex facility located in Gainesville, Florida. EPA personnel witnessed the September 1985 and August 1986 demonstrations to monitor the Quadrex operations and verify the on-site chemical analysis of the treated materials. In addition, split samples were obtained for subsequent analysis and verification by an EPA laboratory.

EPA received an application dated January 11, 1988 from Quadrex for a permit to clean air compressor pipeline and air compressor pressurized receiver tanks associated with natural gas pipeline compressor stations. EPA also received from Quadrex supplemental procedures on February 5, 1988. From January 26-28, 1988 and from February 12-14, 1988 Quadrex demonstrated the process on air compressor pipelines and on air compressor pressurized tanks at a United Gas Pipeline natural gas compressor station in Sligo, Louisiana. This demonstration was evaluated on-site by EPA technical specialists.

At a compliance monitoring inspection conducted by EPA Region VI before the demonstration, the condensate in the pressurized tanks was measured at approximately 1,000 parts per million (ppm) PCBs. The Office of Toxic Substances (OTS), after consultation with the EPA Regions, then established a cleanup level of less than one hundred micrograms per one hundred square centimeters on the surfaces on which Quadrex used the rinse process. EPA collected split samples of the treated and untreated rinse solvent to verify the analytical results from the off site Quadrex laboratory in Gainesville, Florida.

On April 12, 1989, EPA received a demonstration test plan from Quadrex for the separation of PCBs from an additional proprietary solvent (QPS-2) and to demonstrate its polychlorinated biphenyl (PCB) water decontamination unit. The demonstration was performed on April 24-27, 1989, at the Quadrex facility located in Gainesville, Florida. EPA personnel

witnessed the April 1989 demonstration to monitor the Quadrex operations and verify the on-site chemical analysis of the treated materials. In addition, split samples were obtained for subsequent analysis and verification.

On February 20, 1990, Quadrex petitioned EPA to vary the surrogate sampling procedure required to verify that a decontaminated surface has been cleaned to a designated residual surface PCB contamination. Quadrex maintains that for certain small pressurized tanks/bottles in air compressor systems associated with natural gas pipeline compressors, condition 4 in the Quadrex December 8, 1989 PCB Disposal permit is practically impossible to apply. The Quadrex assertion is based on the fact that the amount of liquid necessary to fill its cleaning process equipment/apparatus is greater than the amount of liquid which would be the maximum allowed under this condition.

On July 13, 1990, EPA received a demonstration test plan from Quadrex, and in subsequent discussions, and with Quadrex agreement, granted a demonstration approval for 1) the separation of PCBs at higher concentrations from QPS and QPS-2 solvents using the Quadrex physical separation unit with an air condenser version of Transform machine; 2) for the removal of Polychlorinated biphenyls from natural gas pipelines, valves, controllers metering equipment and fittings. The demonstration was performed on August 6-10, 1990, at the Columbia Gas Transmission Corporation facility in Downingtown, Pennsylvania. EPA personnel witnessed the August 1990 demonstration to monitor the Quadrex operations and verify the on-site chemical analysis of the treated materials. In addition, split samples were obtained for subsequent analysis and verification.

Pipe larger than six (6) inches in diameter were cleaned during the demonstration by pressure spray rinsing with clean (<2 ppm PCBs) QPS-2. Pipe 6" in diameter and smaller were cleaned by flushing with clean (<2 ppm PCBs) QPS-2. Miscellaneous equipment such as valves, controllers, meter fittings of various sizes were cleaned in a fully enclosed glove box chamber with QPS-2 served by high pressure pumps and spray wands. The above miscellaneous equipment cleaning was also demonstrated by using a low volume soaking/flush protocol.

The findings presented below are for the Quadrex PCB disposal demonstrations conducted during April 1985, September 1985, August 1986, January 1988, February 1988, April 1989 and August 1990. Complete, acceptable demonstration test reports for all of these demonstrations are in EPA's files.

APPENDIX II
TO THE QUADREX APPROVAL TO DISPOSE OF POLYCHLORINATED BIPHENYLS

FINDINGS

1. Quadrex Environmental Company of Gainesville, Florida, has demonstrated a solvent extraction process whereby items and equipment contaminated with PCB askarel are washed with a solvent, trichlorotrifluoroethane (Freon 113™), and PCBs are subsequently removed from the solvent using filters and a distillation method. In addition, Quadrex has demonstrated removal of PCBs from proprietary solvents QPS and QPS-2 using filters and a distillation method. This distillation method is effective in removing PCBs from the Freon 113™ or proprietary solvents to a concentration of PCBs less than 2 parts per million (ppm) (total concentration). The concentrated PCB still bottoms are then prepared for removal and sent to an EPA-approved PCB disposal facility. The distillation process has already been approved by EPA for treatment of office equipment, MODEF transformers, heat transfer, hydraulic fluid systems, and compressed air systems using Freon 113™ and the proprietary solvents QPS and QPS-2.

2. The ability of the solvents QPS and QPS-2 to spray clean any items, air compressor systems, or other equipment contaminated with PCBs has not been demonstrated, and the EPA takes no responsibility for any damage that these solvents might cause to any items or equipment during the cleaning process. Also, Quadrex may not redistill and reuse any solvent that, after the spray-cleaning process, contains substances that interfere with the operation of the distillation process or with the GC analyses to determine the concentration of the PCBs in the solvents.

3. Only operation of the Quadrex solvent extraction process by Quadrex personnel has been demonstrated to the EPA. Therefore, this permit only applies to PCB decontamination/disposal units operated by Quadrex personnel. Quadrex-manufactured PCB decontamination/disposal units under lease to other companies or persons are <u>not</u> approved for operation under this permit.

4. The Quadrex PCB decontamination/disposal unit is a completely enclosed, mobile process that is designed to prevent release of PCBs to air, water, or to surfaces. The Quadrex PCB decontamination/disposal unit was developed by Quadrex and is analogous to similar units developed for clean-up of radioactive materials. From the results of demonstrations conducted during April 1985, September 1985, August 1986, January 1988, February 1988, April 1989, and August 1990, the distillation process is effective in removing PCBs from either Freon 113™ or from the proprietary solvents to below the level of 2 ppm total concentration, as compared to an external standard.

5. In the September 1985 demonstration, PCB-contaminated items (e.g., typewriters, computers, tools, and other equipment) were placed on a movable table in a closed cleaning chamber. The table was rotated back and forth as Freon 113™ was sprayed on the items. In the August 1986 demonstration, the proprietary solvent QPS was spiked with PCB askarel fluid and reclaimed successfully. In the January 1988 and February 1988 demonstrations, Freon 113™ was high-pressure sprayed on the interior surfaces of pressurized tank vessels and flushed through pipes running from air compressors to the pressurized tanks. In the April 1989 demonstration, another proprietary solvent, QPS-2, was spiked with PCB askarel fluid, and reclaimed. The PCB-contaminated Freon 113™ generated from the cleaning operations or PCB-contaminated proprietary solvents were filtered first for PCB removal via canistered filtration media and/or placed in a distillation unit where the temperature was elevated to permit the Freon 113™ or proprietary solvents to vaporize. The Freon 113™ or proprietary solvents were then cooled and allowed to return to the liquid state for reuse. After complete distillation of the Freon 113™ or proprietary solvents, the distillation unit was thermostatically turned off and the remaining PCB material was drained and packaged for disposal at an EPA-approved incinerator. Filtration canisters were also prepared for transfer to a disposal site (incineration). Further details of the methods and equipment used in distillation for the separation of PCBs from Freon 113™ and from proprietary solvents are included in the permit application and process demonstration test plans on file [illegible] Headquarters. In the August 1990 demonstration, an air condenser version of the Transform machine was used to separate PCBs from QPS and QPS-2 at higher concentrations than those demonstrated in April 1989.

6. In the April 1989 demonstration, the treatment was conducted in relatively small tanks (165 gallon capacity). Prior to treatment, three waste streams were combined into one matrix and subjected to a jar test to determine the most effective coagulant to be used in the treatment process. The water decontamination process consists of the following steps: mixing, flocculation, settling, air stripping, and absorption. The separated floc and absorbent was packaged for disposal and treated by a permitted PCB disposal facility. The initial water concentration was be less than 50 ppm, Water was treated to less than three parts per billion total PCB concentration.

7. The Quadrex PCB decontamination/disposal unit operates as a batch process. The unit uses a variable amount of Freon 113™ or of proprietary solvents to remove PCBs from actual surfaces and from PCB liquids such as askarel, MODEF, heat transfer fluid or hydraulic fluid which adhere to surfaces. As the process has been demonstrated to the EPA, after the PCB items are cleaned, either with Freon 113™ as demonstrated, or with QPS or QPS-2, the solvents are run through the distillation process until Quadrex personnel determine through GC analysis that the total PCB concentration in the solvent is less than 2 ppm. PCB

analyses were carried out on-site in five demonstrations and off-site in three demonstrations when the samples were sent to the lab in Gainesville, Florida for analysis. The Freon 113™ or proprietary solvents recovered were then ready for reuse. PCB still bottoms were removed, along with any contaminated filters, for disposal by incineration. All records of chemical analysis conducted during the demonstrations were submitted *to EPA in accordance with the procedures and schedules outlined in the process demonstration test plans.

8. The Quadrex decontamination unit is designed for safety. The Quadrex decontamination unit has shut-off valves at key locations and has other safety features that will act to prevent spills into the environment. The decontamination/disposal unit is under low pressure, and is designed with automatic shut-off devices should pressure or temperature exceed specified safety limits.

9. The Quadrex decontamination/disposal unit is a closed system and does not emit harmful materials into the air, water, soils, or other surfaces. The process demonstration test plans state that operators of the unit, and persons conducting sampling of the unit use specified safety procedures and have proper protective clothing to minimize worker exposure. Liquid still bottom residues will be drained, then packaged in Department of Transportation (DOT) and EPA acceptable packaging to include appropriate liquid transport drums of 55 gallon or 30 gallon size and/or 1 to 5 gallons placed in an overpack 55 gallon or 30 gallon drum with absorbent materials sufficient to absorb twice the volume of the liquid present. These liquid wastes will be disposed of by incineration at an EPA-approved disposal site.

10. The Quadrex disposal process was shown to have a level of performance equivalent to that of thermal destruction methods (incinerators and high efficiency boilers). Under EPA regulations (40 CFR 761.60(e)) many factors are used to determine the appropriate destruction equivalency goals for alternate PCB destruction methods. Submissions from Quadrex during the permit application process have indicated that the decontamination method used to remove PCBs from Freon 113™ and proprietary solvents meet the standards set by EPA for equivalence to an approved incinerator or high efficiency boiler, in terms of the efficiency of removal. Furthermore, the Quadrex PCB decontamination/disposal unit is designed to protect workers from PCB exposure and precludes any apparent release of PCBs to the environment.

11. The Quadrex PCB disposal unit is applicable for cleaning surfaces contaminated with PCBs to acceptable levels without destruction of those surfaces. Therefore, EPA finds that the Quadrex PCB disposal method is equivalent to a 40 CFR 761.70 incinerator or 40 CFR 761.60 high efficiency boiler and that operation of the Quadrex PCB disposal unit does not pose an unreasonable risk of injury to human health or the environment.

TO THE QUADREX APPROVAL TO DISPOSE OF POLYCHLORINATED BIPHENYLS

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SAMPLE Quadrex PROCESS 30-DAY ADVANCE NOTIFICATION FORM

Client Name:
Client Address:

Contact:
Phone:

Quadrex Contact:
Phone:

Type of PCB Disposal Activity:

Amount and Type of PCB Material:

PCB Concentration Range:

Scheduled Time(s) and Date(s):

Contacts and Phone:

EPA - Wash., D.C.	EPA Region	State Agency	Local
Winston Lue 401 "M" St., S.W. Wash., D.C. 20460 202-382-3962			

Site Locations:

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APPENDIX III B

TO THE QUADREX APPROVAL TO DISPOSE OF POLYCHLORINATED BIPHENYLS

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SAMPLE QUADREX PROCESS TWO WEEK ACTIVITY SCHEDULE FORM

Period Covered:

EPA Location & Region	Most Probable Operating Date	Scheduled Date(s) & Time(s)	No. of Sites	County(s) of Operation or Central Contact Phone No.
Week No. 1:				
Week No. 2:				

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APPENDIX III C

TO THE QUADREX APPROVAL TO DISPOSE OF POLYCHLORINATED BIPHENYLS

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SAMPLE THIRTY DAY NOTIFICATION FORM FOR CONDITION NO. 1

Company Name, Address, Phone Number, and Contact Person:

Person, Organizational Affiliation/Title, and Phone Number for:

EPA Regional Contact:

State Contact:

Local (Town/City/County) Contact:

Nature of the Disposal Activity:

Kind of PCB Disposal Process:

Kinds of Material Containing PCBs:

Numbers and Sizes of Pieces of Equipment Containing PCBs:

Quantity of Solids and/or Volume of Liquid(s) Containing PCBs:

Concentration(s) of PCBs in the Material Treated:

Location

Street Address or Other Identifier for All Sites:

Telephone Contact and Address for Site Manager:

Time of Processing

Date(s):

Time(s):

****

APPENDIX IIID

NOTICE OF INTENT TO OPERATE AND PUBLIC MEETING

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA

Date of this notice: December 26, 1993
Public Notice No: TSCA 1002

The Company XYZ, which is located at 12345 Main Street, Anytown, PA 67890 proposes to commence permanent operations for the storage and destruction PCBs wastes. A TSCA permit was granted to XYZ, Inc. on June 1, 1992 under the authority of the Toxic Substances Control Act.

Persons wishing to comment on the intent to commence permanent operation must submit in writing. Written comments must be sent to United States Environmental Protection Agency, 6th and Walnut Streets, Philadelphia, PA 19106, Attention: Joe Green (3TS9) and must be received by EPA on or before January 25, 1994.

If the written comments warrant a public meeting, then it will be held by EPA to receive such comments on February 10, 1994 in the JFK High School located at 1 Eagle Way, Chester, PA at 7:00 p.m.

All comments should address the appropriateness of the decision to grant permanent operations to XYZ. All comments must raise ascertainable issues and should be accompanied by all reasonably available arguments, factual grounds and supporting material. It is EPA' intent to limit comments at the meeting to a maximum of five minutes per speaker so persons wishing to participate in the hearing are encouraged to prepare written material to be submitted along with any oral comments.

All written comments received by the above date and all comments received at the meeting will be considered in the formulation of final determination regarding permanent operations. After considering all comments and the requirements and policies in TSCA and its implementing regulations, the EPA Regional Administrator will make a decision regarding permanent operations.

The administrative record, including the application, all data submitted by the applicant, the fact sheet, the approval, maps showing the exact facility locations and comments received and copied at EPA Region III, 6th & Walnut Streets, Philadelphia, PA 19106, between the hours of 8:30 a.m. and 4:30 p.m. Monday through Friday. A copying machine will be provided for public use at a charge per page. Any person desiring further information, copies of portion of the administrative record, or an appointment

to review the record should contact Joe Green at the above address or call (215) 597-1234.

An additional copy of the application, approval and fact sheet will be available for review at the Pennsylvania Department of Environmental Resources, Solid Waste Division, 123 Main St., Philadelphia, PA 19111.

APPENDIX D

EMERGENCY CONTACT NUMBERS

LOCAL SOURCES OF ASSISTANCE:

Hospital:

Name _____

Address _____

_____

Phone _____

Contact _____

Directions:

_____

_____

_____

_____

	Phone Number
Ambulance:	_____
Fire:	_____
Local Police:	_____
State Police:	_____

Job Site:

Contact _____

Phone _____

EMERGENCY CONTACT NUMBERS

LOCAL SOURCES OF ASSISTANCE:

Hospital: Name: Knoxville Community Hospital

Address: 1002 S. Lincoln

Knoxville, IA. 50138

Phone: (515) 842-2151

Directions:

Exit Compressor Station I98 headed directly north 3.25 miles. Turn left (west on old Rte. 92. Travel 3 miles to the town of Knoxville. Turn left (south) on 3rd Street two (2) blocks to Knoxville Hospital.

	Phone Number
Ambulance:	(515) 842-2151
Fire:	(515) 842-6703
Local Police:	(515) 828-2220
State Police:	1-800-525-5555

Job Site: Contact: Bob Hackley

Phone: (515) 765-4242