**U.S. Department of Energy
Washington, DC 20585**

**Environment, Safety and Health
Office of Environmental Audit**

**Environmental Survey
Preliminary Report**

**Pinellas Plant
Largo, Florida**

November 1987

MASTER

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PREFACE
TO
THE DEPARTMENT OF ENERGY
ENVIRONMENTAL SURVEY PRELIMINARY REPORT
FOR THE PINELLAS PLANT

This report contains the preliminary findings based on the first phase of an Environmental Survey at the Department of Energy (DOE) Pinellas Plant located at Largo, Florida. The Survey is being conducted by DOE Office of Environment, Safety and Health.

The Pinellas Survey is a portion of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey is one of a series of initiatives announced on September 18, 1985, by Secretary of Energy John S. Herrington, to strengthen the environmental safety and health programs and activities within DOE. The purpose of the Environmental Survey is to identify, via a "no-fault" baseline Survey of all the Department's major operating facilities, environmental problems and areas of environmental risk. The identified problem areas will be prioritized on a Department-wide basis in order of importance in 1988.

The findings in this report are subject to modification based on the results from the Sampling and Analysis phase of the Survey. The findings are also subject to modification based on comments from Albuquerque Operations Office concerning the technical accuracy of the findings. The modified preliminary findings and any other appropriate changes will be incorporated into an Interim Report. The Interim Report will serve as the site-specific source for environmental information generated by the Survey, and ultimately as the primary source of information for the DOE-wide prioritization of environmental problems in the Final Survey Report.

November 1987
Washington, D.C.

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PRELIMINARY

EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Pinellas Plant, conducted May 11 through May 22, 1987.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Pinellas Plant. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the Pinellas Plant, and interviews with site personnel.

The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by a DOE National Laboratory or a support contractor. When completed, the results will be incorporated into the Environmental Survey Interim Report for the Pinellas Plant. The Interim Report will reflect the final determinations of the Pinellas Plant Survey.

Site Description

The Pinellas Plant occupies a 97-acre area which is located in the center of Pinellas County, Florida. The county is a peninsula bordered on the west by the Gulf of Mexico and on the east and south by Tampa Bay. The facilities at the Pinellas Plant are operated by the General Electric Company - Neutron Devices Department (GENDD) for DOE. The primary function of the Pinellas Plant is the small volume production of selected high technology nuclear weapons components such as neutron generators for the national defense effort.

A limited amount of hazardous and radioactive (principally tritium) waste is generated by the Pinellas Plant activities. The accumulated releases of these wastes into the environment over the last 30 years of operation have resulted in contamination of soil, surface water and groundwater from various discharges and disposal units. The Pinellas Plant management has initiated a number of ongoing actions intended to address these conditions.

Summary of Findings

The major preliminary findings of the Environmental Survey at the Pinellas Plant are:

- The shallow groundwater has been contaminated on- and off-site with solvent chemicals, tritium, and anions. The contamination is a result of the past site activities and practices at a number of areas. The areas include the 4.5 acre site (i.e., private property sold by GSA in the early 1970s, at the northwest corner of the plant, which is known as the resin drum disposal site), the area in the vicinity of the East and West Ponds, and the old health physics tanks.
- Groundwater flow in the shallow aquifer has not been adequately characterized and the direction of migration of contaminants is not well understood.
- Wastewater discharges containing organic chemicals, heavy metals and tritium may have contaminated soils and sediments in a ditch at the southwest corner of the plant. These contaminants may have migrated off-site as a result of erosion and leaching into the surface water.
- Numerous areas of potential contamination exist which either have not been included in the CEARP Phase I Report, or have not been identified as waste/spill areas requiring further investigation. These areas, which include fuel storage tank locations, former septic tank locations, a potential methylene chloride disposal area, several off-site commercial disposal facilities, etc., could serve as sources of groundwater contamination.

- Vapor blaster sludges that may potentially be contaminated with RCRA-hazardous and/or radioactive constituents are disposed of as non-hazardous solid waste in the county sanitary landfill.
- Toxic substances are potentially being released in the combined industrial and sanitary wastewater discharge which could result in disruption of the Pinellas County Publicly Owned Treatment Works (POTW), cause the POTW sludge to be toxic, or pass through the POTW untreated and be discharged to the environment.

Overall Conclusions

The Survey found no environmental problems at the Pinellas Plant that represent an immediate threat to human life. The environmental problems identified at the Pinellas Plant by the Survey do confirm that the plant is affected by a number of chronic environmental concerns. These problems vary in terms of their magnitude and risk, as described in this report. Although the sampling and analysis performed by the Pinellas Plant Survey will assist in further identifying environmental problems at the plant, a complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Response actions currently underway or planned at the plant will contribute toward meeting this requirement.

Transmittal of Result

The findings of the Environmental Survey of the Pinellas Plant were shared with the DOE Albuquerque Operations Office, the Pinellas Area Office and General Electric - Neutron Devices Department, at the Survey close out briefing held May 22, 1987. As a result of the formal closeout discussion, PAO & AL were asked to provide a copy of any correspondence relating to near-term corrective actions in response to Category IV findings. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey final report and the DOE-wide prioritization.

Within the Office of Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring

environmental compliance and the status of the Pinellas Plant Environmental Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through the program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1988.

PRELIMINARY

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, conducted May 11 through 22, 1987, at the United States Department of Energy (DOE) Pinellas Plant in Largo, Florida. As a Preliminary Report, the contents are subject to revisions, which will be made in a forthcoming Interim Report, based on Albuquerque Operations Office review and comments on technical accuracy, the results of the sampling and analyses, and other information that may come to the Survey team's attention prior to issuance of the Interim Report. The Pinellas Plant is currently operated for DOE by the General Electric Company-Neutron Devices Department (GENDD).

The Pinellas Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The Pinellas Environmental Survey was conducted by an interdisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from the DOE Office of Environmental Audit. A complete list of Survey participants and their affiliations is included in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols in the DOE Environmental Survey Manual. Substantial use of existing information and of interviews with knowledgeable field office and site-contractor personnel accounted

for a large part of the on-site effort. A summary of the site-specific Survey activities is presented in Appendix B, and the Survey Plan is presented in Appendix C.

The preliminary Survey findings, in the form of existing and potential environmental problems, are presented in Sections 3.0 and 4.0. Section 3.0 includes those findings that pertain to a specific environmental medium (e.g., air or soil, surface water and groundwater), whereas Section 4.0 includes those that are non-media-specific (e.g., waste management, direct radiation, and quality assurance). Because the findings are highly varied in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections 3.0 and 4.0.

The criteria for placing a finding into one or more of the four categories are as follows:

Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.

Category II findings encompass one or more of the following situations:

- Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.
- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the timeframe of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other environmental management practices.
- Noncompliance with significant regulatory procedures, i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits.

Category II findings include those environmental problems where the risk is high but the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, more discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.
- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this category, the range of alternatives available for response, and the corresponding timeframes for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases as well

as multiyear budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a concentration that presents a concern for local populations or the environment that is sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations, even though below those established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term environmental problem is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I-III. Such findings can be based upon any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further

evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate Program Office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another between media categories is not appropriate or valid. The categorization and listing of findings in order of significance within each media category in this report is only the first step in a multistep iterative process to prioritize DOE problems.

The next phase of the Pinellas Survey is sampling and analysis (S&A). Battelle, Columbus Division (Battelle), the S&A team for the Pinellas Plant, will begin taking samples in summer 1987. Prior to sampling, an S&A Plan will be prepared by DOE and Battelle in accordance with the protocols in the DOE Environmental Survey Manual. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey, and to fill existing data gaps or weaknesses.

An Interim Report will be prepared 6 to 8 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve as the site-specific source for information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems.

It is clear that certain findings and observations contained in this report, especially those in Category II, can and should be addressed in the near term (i.e., prior to the DOE-wide prioritization effort). It is also clear that the findings and observations in this report are highly varied in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective action. The

information in this Preliminary Report will assist the Albuquerque Operations Office in the planning of these near-term responses.

PRELIMINARY

2.0 GENERAL SITE INFORMATION

2.1 Site Setting

The Pinellas Plant is in the approximate center of Pinellas County, Florida. The county itself is a peninsula bordered on the west by the Gulf of Mexico and on the east and south by Tampa Bay. Figure 2-1 is a general location map. The site covers approximately 100 acres of land originally acquired by the General Electric Company in 1956. The plant is owned and controlled by the U.S. Department of Energy (DOE) and operated by the General Electric Company-Neutron Devices Department (GENDD). Construction commenced in 1956 and operation in January 1957.

The plant is bordered on the east by Belcher Road (County Road 27), the south by Bryan Dairy Road (County Road 135), the west by the Seaboard Coastline Railroad tracks, and the north by light industry. The closest residential areas are approximately 0.4 kilometer (1/4 mile) from the plant.

Pinellas County contains 24 municipalities in which 73 percent of the population resides. Largo, 6.3 miles northwest of the plant, and Pinellas Park, 3.5 miles southeast, are the closest to the plant site. The county, and the Tampa Bay area in general, have experienced dramatic increases in population over the last 30 years. When the plant was originally built in 1956, the central area of Pinellas County, where it is located, was largely a lightly populated farming area. Now, land use is mainly mixed residential/light industrial. During the 1960s, the county population increased by an average of 12,300 persons per year; the 1970s saw an increase of 20,600 per year. Based on the 1980 census, Pinellas County is the most densely populated county in the State of Florida; it has 3064 residents per square mile. The April 1986 population estimate is 816,015 residents. Many of the new residents are retirees. The 1980 census showed the county employment was 215,750, exclusive of government, railroad, and self-employed individuals. In addition to the permanent residents, Pinellas County is also a tourist center. It has been estimated that the number of tourists visiting the county has averaged over 3 million per year over the last three years. Major population centers and their locations with respect to the plant are shown in Figure 2-2. The population distribution of county residents is shown in Table 2-1.

GENERAL LOCATION OF PINELLAS PLANT

FIGURE 2-1

LOCATION AND POPULATION OF FIVE LARGEST
CITIES IN PINELLAS COUNTY

FIGURE 2-2

TABLE 2-1
PINELLAS COUNTY POPULATION DISTRIBUTION

Direction	Distance From Plant Site (miles)							
	0-3	3-6	6-9	9-12	12-15	15-18	18-22	Total
N	6,182	22,313	31,924	31,775	12,278	11,962	7,062	123,496
NNE	5,867	9,655	1,218	9,783	2,758		871	41,252
NE	4,156	3,177	265					7,598
ENE	2,309	2,499						4,808
E	2,212	4,204	6,755					13,171
ESE	7,358	14,953	27,254	6,269				55,834
SE	7,880	20,015	46,672	29,845	752			105,164
SSE	5,940	27,161	45,196	37,354	8,196			123,847
S	8,968	16,746	22,758	6,966	265			51,703
SSW	2,721	10,223	2,570					15,513
SW	2,313	16,639						18,951
WSW	4,600	12,294						16,894
W	5,376	22,551	929					28,856
WNW	5,571	19,775	2,396					27,742
NW	4,929	18,402	3,286					26,617
NNW	4,539	25,378	29,875	6,655	616			66,963
TOTAL	75,819	245,885	232,198	128,047	25,865	11,962	7,933	728,409

Source: DOE, 1986.

Pinellas County has a subtropical marine climate, with extended humid summers and short, mild winters. Average summer temperatures range from the low 70s to low 90s Fahrenheit, and winter temperatures from the low 50s to low 70s. Snow is very rare, as freezing temperatures occur only once or twice a year or not at all. Local temperatures are moderated throughout the year by the gulf and bay waters surrounding Pinellas County. Rainfall is frequent, especially in the summer, and hurricanes and tornadoes are not uncommon.

The outstanding feature of the local climate is the summer thunderstorms. On the average, thunderstorms occur 90 days a year, mostly in the late afternoons during June, July, August, and September. These storms account for about 30 inches of the normal annual rainfall of 49 inches. April and November are the two driest months of the year, averaging 2.10 and 1.79 inches of rainfall, respectively. The spring of 1987 proved to be an unusually wet one; 12 inches of rainfall in the month of March. The wettest year on record was 1959, when 76.57 inches of rain were recorded at the Tampa Weather Station. In the driest year, 1956, 28.29 inches of rain fell. The highest 24-hour rainfall, 12.11 inches, occurred in July 1960 (DOE, 1986a).

Prevailing winds are from the north and northeast during the winter months; east and south winds predominate during the remainder of the year. Given the fact that westerly sea breezes occur commonly in the summer, there is a roughly uniform distribution of wind directions. The average wind speed is 8.8 miles per hour.

Tornadoes and hurricanes are possible in the Pinellas County area. The frequency of a hurricane's passing within a 50-mile radius of the plant is one every 8.5 years. The probability of a tornado strike in Pinellas County is 4.3×10^{-4} per year. Central and southern Florida are in a "no-damage" earthquake area (seismic map zone zero).

2.2 Overview of Major Site Operations

The Pinellas Plant was designed for the manufacture of neutron generators, a principal component of nuclear weapons. Until 1966, such generators were the only product manufactured at the plant. Although they remain the major production item, a number of specialty products are also manufactured. Process development

studies are also conducted in a number of laboratories in cooperation with Sandia National Laboratories--Albuquerque (SNLA). Numerous services in support of plant operations, including product testing, waste management, utilities, security, and materials storage are provided by the plant. Major products, development operations, and support services are described below.

2.2.1 Products and Development Operations

Neutron Generators

A neutron generator is a miniaturized linear ion accelerator. A pulsed electric power supply accelerates tritium and/or deuterium to create a controlled source of neutrons. The central component of the neutron generator is the neutron tube, which contains the tritium and deuterium. The tube is made of glass, metal, and ceramic construction and features glass-to-metal and metal-to-ceramic seals. Elemental metals are deposited as vapor into ceramic or metal target material in the tubes. Tritium and/or deuterium are then deposited on the metal surface of the target, forming a metal hydride. The generator tubes are then assembled with power supplies and other components. Power supplies consisting of either discrete electronic components or ferroelectric ceramics may be used. Electromagnetic devices such as high-voltage pulse transformers and solenoids are manufactured on-site. Ceramic and ferroelectric ceramic parts may be manufactured on-site or obtained from vendors. Neutron generator parts and assemblies are encapsulated with phenolic resins and/or foam parts to provide electrical or mechanical insulation.

Radioisotopically Powered Thermoelectric Generator

The radioisotopically powered thermoelectrical generator (RTG) consists of a plutonium-238 oxide heat source and thermopile, which converts the heat to electric power. The present design produces 25 milliwatts of power at 2 volts for longer than 25 years.

The radioactive heat source (triple-sealed) is developed by Los Alamos National Laboratories (LANL), but the thermal-to-electric-energy converter is produced entirely within Building 400 at the Pinellas Plant. Elemental silicon and germanium

are melted in a furnace and combined to form semiconductor materials. Wafers of the materials are then created with fused glass and assembled into a thermopile (i.e., a group of thermocouples electrically in series and thermally in parallel). Semiconductor material preparation involves vacuum metal casting, powdering, sintering, and wafering. Tungsten sputtering and photolithography techniques are used in the configuration of electrical connections.

Electromagnetic Devices

Electromagnetic devices are used in neutron generators and other weapons components for such functions as pulse shaping, filtering, voltage and current conversion, current monitoring, and activation of mechanical devices.

Electromagnetic products produced include transformers, inductors, and solenoids. These devices vary widely in operational parameters and construction methods. The physical configurations vary from the single-layer solenoids of a few turns to devices with very complex winding geometries. Programmable microprocessor-controlled linear and torodial winding machines are used in the construction of the winding. Some operations are performed by hand at workstations.

Most electromagnetic devices are encapsulated for mechanical stability. A number of resin systems, filled and unfilled, are used to satisfy specific electrical, mechanical, and environmental requirements of the application. The encapsulation process is usually performed at low pressure to minimize voids.

Specialty Capacitors

More than a dozen types of specialty capacitors are produced at the plant for use in neutron generators and weapons firing sets. They fall into two design categories: "wrap-and-fill" or "liquid-filled." For either design the basic capacitor element is produced by winding a roll of interleaved aluminum foils and Mylar films. In the wrap-and-fill design, the aluminum-Mylar roll is sealed with a polymer resin and used in both neutron generator and firing set applications.

In the liquid-filled design, the capacitor roll is hermetically sealed within a stainless-steel enclosure, evacuated and dried, and then filled with Fluorinert,* a dielectric liquid.

Ceramics

Most ceramic parts used in weapons production are purchased from vendors. Specialty and classified parts are manufactured in a formulation and machining facility dedicated to the fabrication and inspection of 94-percent alumina ceramics, cermet feedthroughs, and glass ceramic parts and materials. (Cermet is a mixture of molybdenum and aluminum oxide that produces a ceramic material with electrical properties.) Ceramic powders are mixed, dried, and pressed into green (uncured) parts. These are dried and then finished by grinding and lapping. Generally, parts are small, with many pieces to a handful.

Ferroelectric Ceramics

Ferroelectric ceramics, composed primarily of the oxides of lead, zirconium, and titanium, are used to power neutron generators. Ferroelectric materials are activated in the power supply by an explosive charge. Such activation destroys the structure of the material. Production quantities of these materials are purchased from commercial sources. The Pinellas Plant maintains the laboratory facilities necessary to characterize materials at all stages of production.

Thermal Batteries

A thermal battery is a group of primary electrical cells in which the electrolyte is a solid (i.e., a "frozen" substance) at room temperature. Although in this state the battery is inactive--that is, it produces no power--it does not deteriorate because it has a very long shelf life. A lithium/silicon alloy, calcium chromate, and other materials are used to form the electrolyte wafers. The battery is activated as the electrolyte melts by an exothermic reaction between iron powder and potassium

*Trademark, 3M Company.

perchlorate. These materials are pressed together to provide heat sources in the form of wafers which are integral parts of the cell.

LAMB Batteries

In addition to producing thermally activated batteries, Pinellas supports the SNLA in their work on long-life ambient cells. Since the bulk of this present effort involves the use of lithium in an ambient-temperature operation, the acronym LAMB has been coined. At this time, LAMB cells are procured from two commercial sources, acceptance-tested, and built into battery assemblies at the Pinellas Plant.

Foam Support Pads

Foam support pads are used to protect weapon components within the weapon assembly. Support pads are made from synthetic foam utilizing a urethane elastomer and are molded into two separate sections that envelop the component. The pads, designed by the LANL, are produced in the resin casting-encapsulation area.

Frequency Control Devices

Crystal resonators and clock oscillators for various weapon applications are produced at the Pinellas Plant Quartz Crystal Fabrication Facility (QCFF). The crystal resonator consists of a quartz wafer that has been cut, ground, etched, and electrolytically gold-plated to a specified frequency. This crystal is mounted in an alumina ceramic enclosure, which is sealed by a gold diffusion bonding process. Final processing, which includes cleaning by ultraviolet radiation, gold plating to frequency (in two steps), and sealing of the enclosure, is accomplished in a vacuum.

Resonant Accelerometer

The resonant accelerometer is a cantilevered beam rigidly mounted at one end and supporting a small mass on the other. Acceleration produces a corresponding force on the mass, thereby bending the beam, and ultimately produces a change in output frequency proportional to acceleration. The beam is composed of two

double tuning forks etched from quartz. Proper electroding provides a means for exciting the forks to resonance through the piezoelectric effect.

Lightning Arrester Connector

The lightning arrester connector (LAC) protects the weapon against accidental detonation in the event of a lightning strike. For protection against voltage surge, each conductor in the LAC is passed through a hole in a heavy metal plate within the connector. The plate is held at ground potential and the conductors are separated from that plate by well-packed granules of rutile (titanium dioxide) or varistor material. Connectors are purchased from vendors and assembled and packed at the Pinellas Plant.

2.2.2 Product Testing

Mechanical and electrical testing of products, including the destructive testing of neutron generators, is conducted in Building 200. A typical regimen includes tests of vibration, acceleration, temperature and pressure cycling, and mechanical shock. Such testing ensures compliance with product specifications.

The target assessment facility located in Building 800 was originally established to evaluate the performance of neutron generator targets. It consists of a 200-keV ion accelerator and two experimental sample chambers equipped with various detectors, target manipulators, and surface analysis instruments. It is contained within a monolithic concrete building which provides radiation shielding.

The facility is presently equipped to make the following kinds of measurements:

- Deuterium and tritium
- Distribution
- Neutron output
- Secondary electron emission
- Rutherford backscattering

2.2.3 Support Services

Heated and chilled water, deionized water, compressed air and emergency electric power are supplied from units in Building 500. This building houses a deionized-water plant, six refrigerated-water chillers, three heat-pump-type water heaters, three diesel generator sets, three air compressors, and a small, oil-fired boiler used as a backup to the heat pumps. Caustic and sulfuric acid for deionized-water production are stored in aboveground tanks outside the building. Fuel oil is stored in a 20,000-gallon underground tank near the building. Six cooling tower cells outside the building are used to dissipate heat from plant operations.

2.3 State and Federal Concerns

Representatives of the Survey team met with members of the Pinellas County Health Department and Pinellas County Sewer System on April 1, 1987, as part of the pre-Survey visit to the plant. The Survey Team Leader subsequently telephoned the Environmental Protection Agency Region IV and the Florida Department of Environmental Regulation to solicit information on environmental concerns about the Pinellas Plant. The issues of concern raised by representatives of these agencies include

- The impact of heavy metals in liquid effluents on the County Water Treatment Facility
- Liquid and atmospheric releases of biocides used in the cooling towers
- The adequacy of tritium and other radioactive release data and health assessments
- The past operation of the spray irrigation and collection system as part of the liquid effluent treatment process
- The absence of a monitoring program to ensure that the liquid waste from the neutralization system meets pretreatment limits before combining with sewage system effluents and other waste streams
- The release of krypton-85

3.0 MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

3.1 Air

The Pinellas Plant is a source of criteria and toxic air pollutants regulated by the State of Florida, and radioactive air emissions regulated by the Environmental Protection Agency (EPA). Discussion in the following sections relates to the ambient air quality in the Pinellas County area, air emissions sources and controls, the plant environmental monitoring program, and findings and observations related to air emissions.

Pinellas County operates a network of air quality monitoring stations for sulfur dioxide, carbon monoxide, ozone, total particulates, and lead. Air quality in Pinellas County conforms to ambient standards for criteria pollutants. The area of Pinellas and Hillsborough Counties is designated a nonattainment area for ozone.

The Pinellas Plant uses approximately 5000 different chemicals and trade name products. The major class of compounds emitted to the atmosphere from the plant is volatile organic compounds (VOCs); about 53 tons of VOCs were emitted in 1986. Emissions that year also included about 200 curies of tritium. The plant also emits, or has the potential to emit, acids, toxic metals, and resin compounds.

Air emission sources and controls are discussed by process and area as follows:

- Ceramics manufacturing
- Metalizing, plating, chemical processing, and furnace firing
- Neutron generator tube manufacturing
- Resin casting
- General assembly, final preparation, and flame spraying
- Tool room and machine shop
- Magnetics manufacturing
- Thermal battery manufacturing and engineering
- Manufacturing of radioisotopically powered thermoelectric generators (RTGs)
- Plant services (utilities)
- Engineering areas

- Volatile organic compound emission

A summary of major plant areas is included in Table 3-1.

The neutron generator tube production process is discussed from ceramic fabrication through final preparation and finishing. Engineering areas are discussed in relation to the neutron tube production process, as many of these operations support or parallel production processes. Plant services (utilities) and RTG manufacturing are discussed individually. Emissions of VOCs are discussed by process or area within the general discussions. A separate section on VOC emissions is included, with particular emphasis on state reporting requirements related to the nonattainment status of Pinellas County for ozone. Emissions control systems and monitoring of radionuclides are discussed in Section 4.3. The plant does not monitor for toxic or criteria air pollutant concentrations. The Pinellas Plant does not have any air permits for its emissions.

3.1.1 Background Environmental Information

The Pinellas Plant is located in Largo, Florida, in the Tampa/St. Petersburg/Clearwater metropolitan area. The area is primarily urban/suburban in nature and thus has a high population density and numerous mobile and industrial sources of air pollutants. Table 3-2 presents the Federal and Florida State Ambient Air Quality Standards (AAQS) for criteria pollutants (PCDEM, 1986). Air quality in Pinellas County generally conforms to state standards. The Pinellas/Hillsborough County area is presently designated a nonattainment area for ozone, despite the fact that air monitoring data show ozone levels in Pinellas County to be lower than the standard. Pinellas and Hillsborough Counties are considered a single airshed by the EPA, and as ozone concentrations in Hillsborough County exceed the standard, the entire area is designated a nonattainment area for ozone.

TABLE 3-1

**MAJOR AREAS ASSOCIATED WITH THE STORAGE OR
USE OF CHEMICAL OR RADIOACTIVE MATERIALS**

Area No.	Area Name	Major Processes
103	Test Equipment Construction	Chemical Conversion Coating Paint spray booth Plating
104	Machine Shop	Degreasing Machining, grinding Soldering, brazing
105	Ceramics	Formulating ceramic powders
106	Tool Room	Degreasing Machining, grinding Soldering, brazing
108	Tube Exhaust	Loading tritium onto parts Product engineering Equipment maintenance
109	Final Inspection	Krypton-85 leak test
110	Magnetics	Production involving polymers, resins and other chemicals
110	Flame Spray	Flame spraying tube assemblies
111	Timer Room	Assembly of Drivers/Detonators
112	Generator Assembly	Degreasing and cleaning of parts
114	Paint, Ink & Misc.	Paint spray booth
115	Graphic Services	Photographic developing equipment
117	Metallize and Plating	Application of metal slurry Plating
124	Maintenance Shop	Welding Wood working equipment
132m	Tritium Recovery System	Stack Effluent Control System (SECS)
138	Final Preparation	Machining Welding Degreasing
139	Resin Casting	Application of polymers in various product lines
140	Furnace Room	Hydrogen furnaces, ceramics firing
143	Chemical Processing	Chemical treating of metals Degreasing and cleaning of parts

TABLE 3-1

**MAJOR AREAS ASSOCIATED WITH THE STORAGE OR
USE OF CHEMICAL OR RADIOACTIVE MATERIALS (continued)**

Area No.	Area Name	Major Processes
145	Ceramics Machining	Machining and cleaning of ceramics parts
146	Ceramics Fabrication	Preparation of raw ceramics
155	Chemistry Laboratory	Chemical analyses
156	Chemical Analysis Lab	Chemical analyses
157	Gas Analysis Laboratory	Chemical analyses
158	Gas Analysis Laboratory	Chemical analyses
160	Chemistry Laboratory	Chemical Analyses
162	Metallurgy Laboratory	Metallurgy
163	Process Technology Shop	Degreasing Plating Welding Glass blowing
176	Environmental Chemistry	Chemical and radiological analyses
176	LAC, Glass, RTG Laboratory	Engineering activities
180	Capacitor Laboratory	Flame spraying
181	Tube Developing Engineering	Parts degreasing and cleaning
182	Tube Developing Engineering	Tritium loading
183	Generator Development	Flame spraying
185	Materials Engineering	Engineering of polymers, resins
192	Ceramics Laboratory	Formulating and machining of ceramics
194	Ferroelectric Laboratory	Formulating and machining of ferroelectric materials
200	Environmental Test Facility	Product quality testing
307	Engineering Dry Room	Thermal battery development
313	Chemical Cleaning	Parts cleaning and degreasing
315	Ceramic Processing	Small plating operation
316	Power Sources Dev.	Use of polymers

TABLE 3-1

**MAJOR AREAS ASSOCIATED WITH THE STORAGE OR
USE OF CHEMICAL OR RADIOACTIVE MATERIALS (continued)**

Area No.	Area Name	Major Processes
325	Maintenance Shop	Parts degreasing
349	Manufacturing Dry Room	Thermal battery manufacturing
350	Lithium Ambient Battery	Parts cleaning Casting of polymers
351	Cal/Maint Tube/Resonator	Chemical treatment of metal Degreasing
351	Resonator, Osc, Clock	Cleaning of parts with ozone
353	Iron Disulfide Processing	Cleaning and milling of iron disulfide
400	Thermoelectric Facility	Assemble RTGs Chemical treating of parts
500	Plant Services	Emergency power, plant heating/cooling
600	Chemical Storage Facility	Bulk storage of chemicals
700	Vehicle Storage Facility	Spray paint booth
800	Accelerator Facility	Engineering laboratory Work involved with tritides
1000	Waste and Drum Storage	Radioactive waste warehouse
1040	Hazardous Waste Building	Waste Chemical packaging
1200	Security Building	Firing range

Source: GE, 1987a.

TABLE 3-2

FEDERAL AND FLORIDA STATE AMBIENT AIR QUALITY STANDARDS FOR
CRITERIA POLLUTANTS

Pollutant	Florida State	Federal Primary	Federal Secondary
Suspended particulates (ug/m ³)			
24 hours	150	260	150
Annual geometric mean	60	75	60
SO ₂ (ug/m ³)			
3 hours	1,300	1,300	1,300
24 hours	260	365	--
Annual arithmetic mean	60	80	--
NO _x (ug/m ³) Annual arithmetic mean	100	100	100
Lead (ug/m ³) Calendar quarter mean	1.5	1.5	1.5
Ozone (ug/m ³)	235 (equivalent to 120 ppb)	235	235
Carbon Monoxide (mg/m ³)	10 (9 ppm)	10	10
8 hour	40 (35 ppm)	40	40
3 hour			

Source: PCDEM, 1986.

3.1.1.1 Regional and Local Meteorological Data

The Pinellas Plant is in roughly the center of Pinellas County. It obtains meteorological data from the Tampa International Airport, located approximately 15 miles east-northeast. Real-time data obtained from the airport is available on computer at the plant. Although the Tampa International Airport is close to Pinellas County, it is separated from it by Tampa Bay, a major body of water. The meteorology of Pinellas County may therefore differ from that of Tampa. Meteorological data for Pinellas County are not available, and the plant does not operate a fully-instrumented meteorological tower. The plant's meteorological tower is discussed in Section 3.1.3.1.

Based on Tampa airport observations, prevailing winds are from the north and northeast during the winter months. During the remainder of the year, they are predominantly from the east and south. A westerly seabreeze is common during the afternoons in the summer months associated with the summer thunderstorms. These conditions result in a fairly uniform distribution of wind directions. A summary of 10 years of hourly observations at the Tampa weather stations is presented as Table 3-3. The overall average windspeed is 8.8 miles per hour, and the highest windspeed recorded was 84 miles per hour in September 1935. Table 3-4 shows the percentage occurrence of various windspeed ranges. Inversion conditions occur in the plant area about 12 days per year, primarily in the winter months.

Hurricanes and tornadoes may occur in the Pinellas County area. Based on records from 1866 through 1985, the frequency with which a hurricane passes within a 50-mile radius of the plant site is once every 8.5 years. The probability of a tornado strike in any point in Pinellas County, as determined from data from the National Severe Weather Forecast Center for the period 1950 through 1980, is 4.3×10^{-4} per year (DOE, 1983a; GE, 1986).

TABLE 3-3

PERCENTAGE FREQUENCIES OF WIND DIRECTION AND SPEED OVER A 10-YEAR PERIOD - TAMPA INTERNATIONAL AIRPORT

Direction	Frequency (%)	Average Speed (Miles per Hour)
N	8	8.7
NNE	8	9.2
NE	8	8.4
ENE	9	8.9
E	10	8.2
ESE	6	8.5
SE	5	8.4
SSE	5	9.2
S	6	10.0
SSW	4	10.3
SW	4	8.9
WSW	5	9.6
W	5	9.9
WNW	5	10.6
NW	4	10.0
NNW	4	9.5
Calm	3	-

Source: DOE, 1983a.

TABLE 3-4
PERCENTAGE OCCURRENCE OF WIND SPEEDS -
TAMPA INTERNATIONAL AIRPORT

Range (Miles per Hour)	Frequency (%)
0-4	15.6
5-14	74.1
15-24	9.9
25 and above	0.4

Source: DOE, 1983a.

PRELIMINARY

3.1.1.2 Ambient Air Quality Data and Attainment Status

The Pinellas County Air Division operates a network of air quality monitoring stations. The locations of these stations with respect to the plant are shown in Figure 3-1. The closest stations to the plant are Motor Pool and Honeywell. The monitoring network provides data for sulfur dioxide, ozone, carbon monoxide, lead, and particulates. Air quality data for sulfur dioxide, ozone, and particulates for Pinellas County for 1982, 1983, and 1984 are summarized in Table 3-5. Data for 1985 and 1986 have not been published by the County. Air quality in Pinellas County was better than state air quality standards in 1982, 1983, and 1984, with the exception of high ozone concentrations at stations in the vicinity of the plant in 1983 and high particulate concentrations at two stations, one in the vicinity of the plant. The state ozone standard of 120 parts per billion (ppb) was exceeded in 1983, but not in 1982 or 1984 (PCDEM, 1986).

Pinellas County and Hillsborough County are considered one airshed by the EPA. The ozone concentration in Hillsborough County exceeds the ozone standard. Therefore, both Pinellas and Hillsborough Counties have been designated to be in nonattainment (or above standard) for ozone even though air quality data for Pinellas County indicate that the standard is not exceeded there. The northwest portion of Pinellas County and southeast portion of Pasco County, which is directly north of Pinellas County, are presently designated nonattainment areas for sulfur dioxide. The EPA has informed the Pinellas County Air Division that a Federal Register notice reclassifying the area as attaining for sulfur dioxide will be published in 1987 (Hessling, 1987). The County is in attainment of the particulate standard and "cannot be classified" for nitrogen oxides and carbon monoxide (EPA, 1987). This means that although there are insufficient data, EPA considers the area to be in compliance with the standard.

In 1984 no exceedances of the ozone standard were recorded. In 1983, ozone levels exceeded the standard for a total of 4 hours on 3 days. Two of the hourly exceedances occurred during a 10-day atmospheric temperature inversion. During this unusually long period of sunny days and no wind, pollutants accumulated in the atmosphere, but once the inversion dissipated, ozone levels returned to more normal concentrations.

LOCATION OF PINELLAS COUNTY
AIR QUALITY MONITORING STATIONS

FIGURE 3-1

TABLE 3-5
SUMMARY OF AIR QUALITY DATA FOR PINELLAS COUNTY FLORIDA - 1982 - 1984 DATA

Station	Ozone Data (ppb)						SO ₂ Data (µg/m ³)						TSP Data (µg/m ³)											
	Maximum 1 Hr			2nd-Highest 1-Hr			Number of Days Exceeded Standard			3 Hr Maximum			24 Hr Maximum			Annual Average			24 Hr Maximum			Annual Generic Mean		
	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984
Tarpon Springs										367	175	127	52	84	36	10	9	9	110	124	135	46	46	51
E Lake Tarpon	115	144	115	110	122	110	0	1	0	203	341	196	63	67	54	11	12	11						
Clearwater JC	115	136	115	115	133	100	0	0	0										75	111	122	35	36	37
Sheriff's																			76	65	78	37	38	40
Motor Pool*																			147	111	157**	51	49	53
Resource Recovery										301	485	354	88	88	98	15	14	13						
Derby Lane										642	489	424	205	152	114	24	21	22	67	65	80	33	35	36
Azalea Park	110	128	120	110	123	100	0	1	0										102	99	77	42	43	45
Woodlawn																			150	103	163**	45	47	53

* Site relocated from Gross Trailer Park in 1983

** Exceeded State Standard of 150 (µg/m³)

Source: PCDEM, 1986.

Other than during the July 1983 inversion, Pinellas County has not recorded a violation of the ozone standard since 1978. According to calculations of the expected number of future exceedances from past air quality data, Pinellas County meets the national AAQS for ozone. The county is nonetheless designated a nonattainment area for ozone, because the EPA considers Hillsborough and Pinellas Counties to be a single airshed. As Hillsborough County does not meet the ozone standard, the EPA has not redesignated Pinellas County as an attainment area (PCDEM, 1986).

The area of Pinellas County where the plant is located was primarily agricultural land when the plant was constructed in 1957, but it is now zoned mixed residential/industrial. Pinellas County is very densely populated, with over 3000 persons per square mile (Fox, 1987). The nonattainment status of the Pinellas/Hillsborough County area is in large part the result of mobile source emissions.* High ambient ozone concentrations are a problem in urban areas throughout the United States. The counties in which the cities of Miami and Jacksonville, Florida, are located are also classified as nonattainment for ozone (EPA, 1987).

3.1.2 General Description of Pollution Sources and Controls

The Pinellas Plant uses approximately 5000 different chemicals and trade name products in manufacturing, engineering, and plant services operations. In general, a rather small number of compounds are used in large quantities in production operations, while a greater number of compounds are used in smaller quantities in manufacturing, engineering, and plant services operations. A fairly small number of compounds (e.g., ethyl alcohol-3A) are in general use in large quantities throughout the plant.

*About 60 percent of the estimated total emissions of VOCs in Pinellas County in 1984 were from mobile sources (PCDEM, 1986).

Major plant buildings, and specific areas within Building 100 and area 300, are identified in Figure 3-2. The majority of the air emission sources at the plant are in Building 100 and area 300, which encompass most of the manufacturing and engineering areas at the plant. A study of the ventilation system for these buildings conducted in 1981 identified over 250 individual air emission points, including the main stacks and numerous process vents and laboratory hood exhausts (DOE, 1983a). The Building 200 environmental testing laboratory and the Building 800 accelerator are primarily sources of tritium emissions. The Building 400 RTG production is also a source of solvent emissions from one main stack and several process vents and laboratory hood exhausts. Building 500 houses several combustion units (boilers, diesel generators) that are sources of criteria pollutant emissions. The chemical storage, vehicle storage, and waste management areas (Buildings 600, 700, and 1000/1040) also have roof vents and are minor sources of emissions from solvent evaporation.

The major class of compounds emitted to the atmosphere from the plant is VOCs, including trichloroethylene, ethyl alcohol, 1,1,1-trichloroethane, amyl acetate, and acetone, all of which are ozone precursors. Several types of chlorofluorocarbons, methylene chloride and 1,1,1-trichloroethane, and organic compounds that are not ozone precursors are also emitted from the plant. Other major types of compounds emitted or potentially emitted include particulate metals, including lead and chromium and rare earths; mineral and organic acids (e.g., nitric acid and acetic acid); and resin compounds, which may include urethanes, toluene diisocyanate (TDI), epichlorohydrin, and methylene dianiline (MDA).

With certain exceptions, emissions of toxic and criteria air pollutants are not controlled at the process exhausts and roof vents by add-on control systems but rather are controlled at the point of generation. Solvent emissions from manufacturing and engineering areas, with the exception of vapor degreaser emissions, are generally fugitive in nature and exhausted through local ventilation systems without emission controls.

FIGURE 3-2

PLANT AREAS BY SECTION—FIRST FLOOR
NEUTRON DEVICES DEPARTMENT PLANT, PINELLAS PLANT

PLANT AREAS BY SECTION—SECOND FLOOR & MEZZANINES
NEUTRON DEVICES DEPARTMENT PLANT, PINELLAS PLANT

FIGURE 3-2 Continued

3.1.2.1 Ceramics Manufacturing 105-Area and 145-Area

In 105- and 145-Areas, ceramic parts are fabricated from raw materials. These parts are used in the fabrication of neutron tubes. Raw materials, primarily aluminum oxide (alumina), are mixed as dry powders in a hood and then mixed with water in a ball mill. The alumina slurry is then pressurized and dried in a spray dryer. The dry ceramic powder is formed into "green" (uncured) parts in powder presses. The green ceramic parts are machined and then may be metallized (see the discussion of 117-Area). The ceramic parts are fired in one of two types of furnaces. An air furnace is used to cure nonmetallized parts and a hydrogen atmosphere furnace to cure metallized ones. Some of the parts receive an organic dye, which is removed before final machining by vapor degreasing. The cured parts are then finished by grinding and machining. The ceramic parts are held in place on metal plates by wax during the grinding process. This wax is eventually removed from the finished parts by vapor degreasing.

Spray Dry Room: 105-Area

The raw material mixing hood, ball mill, and spray dryer cyclone separator are located in the spray dry room. Raw materials are batch-mixed and weighed in a hood. The hood exhausts through a cartridge-type dust filter, which controls emissions of the dry powder materials. The filter is periodically removed and cleaned by the maintenance department. The dry powder is mixed with water in a ball mill, which is enclosed and not a potential source of air emissions. The slurry is pressurized and fed to a spray dryer, where it is atomized using compressed air and dried to a powder with hot air from a natural-gas-fired burner. Dry ceramic powder is collected from the bottom of the spray dryer chamber and also from a cyclone collector immediately downstream from the spray dryer chamber. The cyclone chamber is exhausted by a fan to a roof vent. There is no additional filtration of the exhaust after the cyclone chamber.

Operation of the spray dryer was not observed and thus emissions were not visually evaluated. Nevertheless, as commercial spray dryer/cyclone units are generally greater than 99 percent efficient in solids collection, significant particulate emissions are not expected from the unit. The dry powder collected from the unit is respirable and therefore classified by the plant as a hazardous material. However

its major ingredient, aluminum oxide, is generally considered a "nuisance dust" with no specifically defined toxic effects. Combustion of natural gas in the burner produces carbon monoxide and nitrogen oxides.

Powder Press/Analytical Room: 105-Area

The stokes (punch-and-die) and isostatic (wet-process) presses used to form the dry powder into green ceramic parts are located in the powder press/analytical room of 105-Area. The stokes press is used to form parts on the order of 0.5 to 1 inch in diameter, whereas the isostatic press is used to form large parts. Analysis of the properties of the ceramic materials is also performed in this area.

Ceramics Machining Room: 105-Area

Green ceramic parts are machined by computer-controlled machine tools in the ceramics machining room of 105-Area. That machining process generates very finely divided ceramic dust. The cutting area of each machine is partially enclosed and equipped with a local exhaust that vents to a roof fan and dust collector. Specifically designed for the collection of submicron-size particulates, the dust collector contains cartridge-type fiber filter media. The filters are consecutively cleaned by reverse air flow using compressed air (Donaldson Company, Inc., 1985). The collected dust discharges to a drum located in the analytical room and is disposed of as nonhazardous solid waste. Dust collectors of this type are generally greater than 99 percent efficient in collecting fine dust. The pressure drop across the filter was about 2 inches of water at the time of the Survey.

Ceramics Firing Room: 145-Area

Green ceramic parts are cured in two types of furnaces in 145-Area. Nonmetallized parts are cured in an air furnace, and parts that have been metallized--i.e., painted with metal paint (see the discussion of 117-Area)--are cured in a hydrogen atmosphere furnace. The hydrogen furnace maintains a low-oxygen reducing atmosphere and thus prevents oxidation of the metal. The furnaces are electrically heated and the hydrogen continuously burned off in external hoods, which exhaust heat and combustion products (nitrogen oxides) to roof vents. Each furnace has a separate fan and roof vent. The plant uses about 23 to 25 million cubic feet of

hydrogen annually, mostly in furnaces in 145-, 140-, and 192-Areas. Emissions of nitrogen oxides from the combustion of hydrogen are small because of the rather low consumption of hydrogen. No offgassing of the ceramic parts occurs during the curing process, and no particulate or solvent emissions result from the furnace operations.

Ceramics Machining Room: 145-Area

Cured ceramic parts from the furnaces are subject to additional machining and grinding operations in 145-Area. The machine tools are equipped with local exhausts, but these exhausts do not vent to a dust collector as in 10-Area. Machining operations observed during the Survey did not generate visible dust emissions. Grinding operations are conducted in water-flooded grinders, which are fully enclosed and are not air emission sources. For grinding purposes the cured ceramic parts are sealed to metal plates by wax, and after grinding the wax is removed by cold cleaning and by vapor degreasing with 1,1,1-trichloroethane. The vapor degreaser is of refrigerated design and is about 1 by 2 feet in surface area. A second refrigerated degreaser, also about 1 by 2 feet in surface area and also using 1,1,1-trichloroethane, is used to remove organic dye applied to some types of ceramic parts. The dye is hand-painted on the parts in a hood in the ceramics firing room. Neither degreaser was in use at the time of the Survey. Vapor degreasing operations and plant VOC emissions are discussed in Section 3.1.2.12.

3.1.2.2 Metallizing, Plating, Chemical Cleaning, and Furnace Firing: 117-, 143- and 140-Areas

Ceramic parts are painted with metal paint in 117-Area. The painted parts are fired in hydrogen atmosphere furnaces located in 140-Area and then plated. Parts may be either hand-painted or screen-painted (i.e., spray-painted through a stencil). One type of ceramic part is manually sprayed with metal paint in a spray booth. After firing, and after subsequent cleaning in 143-Area (chemical processing facility), the ceramic parts are plated with nickel and gold. Aqueous plating and acid baths are used in the plating process. One type of epoxy part is copper-plated and hand-painted with resist material in this area.

Metallizing Room: 117-Area

Ceramic parts are painted with metal paint in the metallizing room. The paint is a mixture of molybdenum and manganese (Mb/Mn) and amyl acetate. Hand-painting of the parts is done at laminar-flow air benches. Each bench contains a small amount of paint in 2-ounce jars. As the parts are painted, the amyl acetate solvent evaporates into the room and is exhausted through the room ventilation system. Screen painting of parts is done at ventilated workstations. The metal paint used for screen-painting is not stored at the workstations but rather in a hood. Screen print paint contains amyl acetate and acetone, and screen print stations have slot vents that permit the uncontrolled exhaust of amyl acetate and acetone solvent fumes to the roof. Vacuum pumps are used to screen-paint hollow parts. The pumps exhaust to the roof without emission controls.

An ultrasonic degreaser that uses amyl acetate and some methylene chloride is located in a laboratory hood in the metallizing room. The degreaser is uncovered, but it is not filled with solvent unless it is in use. An enclosed and ventilated spray booth used for the manual spraying of one type of part with metal paint is located in the metallizing room. Both units exhaust to the roof without emission controls.

The primary air emissions from the metallizing room are organic solvents, primarily amyl acetate and lesser amounts of acetone and methylene chloride. The plant purchased about 5900 pounds of amyl acetate in 1986 (Slack, 1987), and the fugitive nature of the emissions of this solvent indicates that the main portion is evaporated through the various ventilation systems to the atmosphere. The plant uses about 80 kilograms of metal paint annually. The molybdenum/manganese in the paint is primarily incorporated onto the ceramic parts. Some emissions of particulate metals (primarily molybdenum and manganese) are expected, particularly from the screen print station and the spray booth. The potential for entrainment of metal particulates in the vacuum and hood exhausts has not been assessed by the plant. Neither molybdenum nor manganese is a highly toxic metal and neither is a regulated air pollutant.

Plating Room: 117-Area

Ceramic and epoxy parts are plated with nickel, gold, or copper in the plating room. The plating baths are mounted on benches around the perimeter of the room; each is approximately 1 by 1.5 feet in surface area. A copper electrodeless bath, followed by potassium permanganate bath and copper electroplating baths, is used to plate the epoxy parts. The copper bath is an aqueous solution of copper pyrophosphate. A nickel "WATS" bath, an aqueous solution of nickel sulfate and boric acid, is used to nickel-plate ceramic parts. The plating solutions are heated to 120°F and are not vented, but are exposed to the room atmosphere. A 2:1 mixture of phosphoric acid (85 percent) and butyl alcohol is also used in this room.

Gold-plating of ceramic parts is done in this room in a gold cyanide plating bath that contains arsenic. The bath is approximately 1 by 2 feet in surface area and is kept covered when not in use. The bath is heated and agitated and is equipped with a slot exhaust vent. The vent is located beneath the cover and exhausts to a central duct and stack. The exhaust from the heater and agitator motor cabinets is vented to the same duct. Gold is stripped from returned parts in a hood. The stripping solution (technostrip) contains cyanide, and the hood is enclosed and ventilated. An electropolish bath (hydrochloric acid) is used to remove metal from parts. All solutions containing gold are reclaimed. No controls are applied to the cyanide exhausts.

Written procedure requires local ventilation of all plating and stripping operations involving gold cyanide and covering of plating baths when not in use (GE, 1987c). No assessment of the cyanide concentration in the exhaust has been performed by the plant. According to plant chemists, at a pH greater than about 5, the cyanide in the plating solution is complexed to the gold and little cyanide vapors are given off. Lowering the pH of the solution would cause the active generation of cyanide fumes. Written procedures therefore require the adjustment of plating solutions only by chemistry laboratory personnel and the exclusion of acids from the stripping operation area.

Fugitive emissions of butyl alcohol and mineral acids are expected from the plating room, as well as some evaporation of the plating solutions. Local ventilation is provided only in areas where cyanide solutions are used, and these are the primary

Industrial hygiene concern in the area. Emissions from the other acid and plating baths in the room are expected to be low. None of the components of the nickel or copper baths are highly toxic, and none are regulated as hazardous air pollutants.

Hydrogen Furnace Room: 140-Area

Four electrically heated hydrogen atmosphere furnaces are located in 140-Area. These are used to fire metallized ceramic parts. A positive pressure hydrogen atmosphere is maintained inside the furnaces, and the hydrogen is continually burned off in external hoods, which exhaust heat and combustion products (nitrogen oxides) to individual roof vents. A retort hydrogen furnace is used to fire gold-plated parts. Parts are fired at 1400°C for about 2 hours and are moved through the furnace manually.

A robot-controlled spray booth in the furnace room is used to spray neutron tubes with molybdenum/manganese/titanium hydride paint. The parts are turned by a robot arm and automatically sprayed. The amyl acetate and acetone solvent in the paint evaporates into the hood and is exhausted to the roof without emission controls. The potential for emissions from the spray booth is similar to that of the manual spray booth in 117-Area. Total emissions are expected to be higher, as this hood is more heavily used than the manual unit, the latter used for only one type of part. None of the metals exhibit high toxicity, and none are regulated as hazardous air pollutants.

Chemical Processing Facility: 143-Area

Ceramic and metal parts are etched and cleaned in 143-Area. Metal parts are cleaned in a series of heated tanks containing mineral and organic acids. These include 50 percent hydrochloric acid (pickle solution), an acetic acid/nitric acid mixture (bright dip), and 30 percent nitric acid. A mixture of permanganate and sulfuric acid is used with molybdenum parts. Vaporization of the pickle solution, which is maintained at its boiling point, is minimized by covering the tank surface with plastic balls (the ping pong type), which reduce the area of solution-air interface. Other tanks, which are maintained below the boiling point or at room temperature, are not controlled in this manner. Detergent solutions and cold 50 percent nitric acid are used to clean ceramic parts. Acid tanks are hooded and

exhausted through polyvinyl chloride (PVC) ductwork to a water-spray scrubber located on the roof of Building 100.

Visual inspection of the roof scrubber during the Survey showed it to be in good condition, with no visible corrosion. Visual inspection of the scrubber internals was not possible, as processes requiring ventilation were in progress in the chemical processing facility. The scrubber is of horizontal cross-flow design and is packed with plastic saddles. It is rated at 16,000 cubic feet per minute (cfm) and maintains a water flow rate of 76 gallons per minute (gpm) through a 1.5-inch pipe and liquid distributor (Harrison Company, 1978). The scrubber is not equipped with a water pressure or water flow meter. Scrubber water is continuously recirculated from a 252-gallon sump, which overflows to the chemical drain system. Scrubbers of this type are generally greater than 90 percent efficient in removing soluble acids such as hydrochloric acid. The scrubber vents through a mist eliminator and fan to a separate stack extending 20 feet above the roof.

Metal parts may be cleaned in either a vapor degreaser or ultrasonic cleaner before being acid-cleaned or etched. A water-cooled vapor degreaser using trichloroethylene, about 2 by 3 feet in surface area, is used to clean heavily contaminated parts. Ultrasonic degreasers in a separate clean room are used to clean less heavily contaminated parts. The ultrasonic degreasers are hooded and exhausted separately from the acid tanks and vapor degreaser. Ultrasonic degreasers at the plant are generally filled with solvent only when in use. Used solvents are stored in containers for transport to the waste management area. Acetone, methylene chloride, ethyl alcohol, and chlorofluorocarbons are used for ultrasonic degreasing in this area.

3.1.2.3 Neutron Generator Tube Manufacturing: 107-, 108-, 126- and 351-Areas

Tube Processing and Tube Assembly: 126- and 107-Areas

Neutron generator tube target material, which may be ceramic or molybdenum metal, is coated with titanium and erbium metal by vapor deposition. The target material is loaded into an electron beam vacuum evaporator. The evaporator is evacuated to high vacuum with a sorption pump that exhausts to the area ventilation system, and eventually to the main stack. A small amount of titanium or

erbium metal is then evaporated from a crucible by an electron beam. The metal vapor is then deposited onto the target and the targets are baked in a vacuum oven to remove any gas and water. Leak checks of the vacuum systems in 108- and 126-Areas are performed with trifluoromethane (CFC-23). Gold-bonding of parts under vacuum is done by laser welding in the 107-Area clean room. Hydrogen plasma welding is also used in the clean room. Ethyl alcohol-3A is used in both areas to clean equipment.

Emissions of very small amounts of titanium and erbium metal are expected from the vacuum evaporator sorption pump exhausts. The amount of metal used in the evaporation process is measured in grams, and the total amount of metal emitted from both the sorption pumps and welding operations is small. None of the metals exhibit high toxicity and none are regulated as hazardous air pollutants. Fugitive emissions of solvents from this area are small, as solvents are only used for equipment cleaning and testing.

Tube Exhaust: 108-Area

Neutron generator tubes are loaded with tritium and deuterium in 108-Area by means of vacuum systems. The tritium forms a metal hydride with erbium and other metals that have been evaporated onto target material. The major emission from this area is tritium, from both the vacuum systems and hood exhausts. Tritium emission sources and controls are discussed in Section 4.3.

Several organic solvents are used during equipment maintenance and waste handling operations conducted in several rooms in 108-Area. Kanne chambers and vacuum system components are cleaned with ethyl alcohol-3A or methylene chloride in Room 24 of 108-Area. Solvents from these cleaning operations become contaminated with tritium and are allowed to evaporate in exhaust hoods that vent to the main stack. Trichloroethylene is used in 1-quart batches to clean the outside of vacuum system valves in Room 23. The used solvent is not tritium-contaminated. Rooms 20 and 21 contain metal hydride development laboratories. These laboratories handle small quantities of rare earths, as well as erbium, titanium, and other metals. The metal hydride system hoods exhaust to the main stack. Tritium vacuum systems are exhausted to the tritium recovery system.

Tube Calibration and Maintenance: 351-Area

Vacuum equipment used in 108- and 132-Areas (tube exhaust and tritium recovery system) is maintained and cleaned in 351-Area. Molecular sieve cartridges for the tritium recovery system (TRS) are also made up in this area. No radioactive equipment or materials are handled in 351-Area.

Two dry sandblasters in 351-Area are used to clean parts. Each is exhausted to a dust collector with permanent filter elements that remove the sand from the exhaust. The dust collectors are periodically cleaned by the Maintenance Department. Five 150-gallon acid tanks are used to clean vacuum systems and components. The five tanks contain nitric acid (one), hydrochloric acid (two), and a mixture of hydrochloric, hydrofluoric, and nitric acids (two). The tanks are enclosed, and parts are moved from one tank to the next by an overhead rail and crane. Each tank is hooded and exhausts through a central duct to the roof. The exhaust is equipped with an acid scrubber. A smaller tank (2 feet by 2 feet in surface area) is located in a separate hood. The tanks are maintained at room temperature and covered when not in use, but they are not emptied. Exhausts are operated continuously. Acid mists are emitted through the acid tank hood exhaust through the scrubber, which is exhausted to the atmosphere. The acid tanks are not heated, and do not have the potential to generate concentrated fumes as in the chemical processing facility (143-Area).

Parts are degreased in a large vapor degreaser using 1,1,1-trichloroethane before acid cleaning. The degreaser is completely enclosed and hooded, and is water-cooled. A new ultrasonic degreaser (already purchased) will replace the existing unit. The new unit will also use 1,1,1-trichloroethane.

3.1.2.4 Resin Casting: 139-Area

Neutron generator tube assemblies and other parts are encapsulated with epoxy resin in 139-Area. The parts are placed in metal molds into which various liquid resin mixtures are poured. The liquid fills the mold and surrounds the part. Resins are generally poured under vacuum to remove air bubbles. The molds are then heated in ovens, which solidifies and cures the resin. The encapsulated parts are

then removed from the molds and subjected to machining and finishing operations in the final preparation area (138-Area).

Resin Dispensing: 139-Area

Resin mixtures consist of a one- or two-part resin, a curing agent, and, for some types of resins, a solid filler material. EPON 828 and CTBN, both phenolic resins containing epichlorohydrin, are the most heavily used resins; they are used to encapsulate tube assemblies. Aluminum oxide (Alox) and glass microballoons (GMB) are solid filler materials used with the phenolic resins. The Alox is used with EPON 828 and GMB with CTBN. The Alox is a fine powder that is stored in a hood. The GMB is stored in boxes near the hood area. Both materials are mixed with resins in a hood. The mixtures are degassed in vacuum cabinets and then loaded into one of two resin dispensing machines (two backup dispensing machines are to be installed in 139-Area). The machines dispense the resin mixture and curing agent under vacuum into molds containing the part to be encapsulated. The Alox mixture is cured with EPON Z and the GMB mixture with diethanolamine. The resin-filled molds are preheated for 2 hours and then cured for 36 hours at 71°C in electrically heated ovens. The molds are disassembled by hand and the encapsulated parts are removed for finishing and testing.

Waste resin materials containing EPON 828, CTBN and GMB, or Alox are stored in paper containers. These wastes are heated in an oven until solidified before being disposed of, as the disposal of liquid materials in solid waste containers is contrary to plant procedures. Both mixtures are extremely viscous and have negligible vapor pressures at atmospheric conditions, according to the Material Safety Data Sheets (MSDSs) for the materials. Reacted resin material contains less than 10 parts per million (ppm) of free epichlorohydrin, as the unreacted compound is detrimental to product quality.

The vacuum pumps used to draw vacuum on the resin storage boxes and dispensing machines use vacuum pump oil, which is recirculated through a filter system and returned to the vacuum pumps. The Maintenance Department is responsible for changing the pump oil. The vacuum pumps are exhausted to the roof. The exhausts are not equipped with filters to collect any entrained vacuum oil.

The curing ovens and solids storage and mixing hoods are exhausted without emission controls to roof vents. In 139-Area, the dispensing machine room has been contaminated by dust particulates from the powder storage area. Construction of an enclosed powder storage room in 139-Area, where the Alox and GMB will be stored, is in progress. This is expected to mitigate the dust problem.

Resin dispensing machines are also used in 139-Area to encapsulate tube transformer assemblies. A two-part HYSOL mixture (resin base and hardener) is used. The process is similar to that used to encapsulate the generator tube assemblies. Two types of foam, referred to as lock foam and sunshine foam, are used in a separate room from the EPON 828. The lock foam is a two-part mixture used to encapsulate the generator body. This mixture is not poured under vacuum but rather in a hood. The lock foam is cured in an oven. Sunshine foam (uralite) is mixed with GMB in a hood and poured into molds. The molds are degassed in vacuum boxes and oven cured. The vacuum boxes and curing ovens exhaust uncontrolled to roof vents. The cured foam is removed from the molds and machined in 138-Area. The finished sunshine foam parts are used in the assembly of finished units to provide protection against mechanical shock.

Mold Cleaning Room: 139-Area

Metal molds used to hold parts for encapsulation are cleaned with methylene chloride in four large tanks, each about 9 square feet in area, in the mold cleaning room. The methylene chloride is at room temperature, and the tanks are enclosed and hooded. The tanks are kept covered when not in use and are not emptied after each use. Used methylene chloride is recovered in a distillation unit also located in this room. About four 55-gallon drums of methylene chloride are used per month in mold cleaning operations. The hoods exhaust to the roof without emission controls.

Methyl pyrrolidone (C_5H_9NO), a nonaromatic ring compound, is being used experimentally in the mold cleaning room. According to the area operators, this compound is a more effective mold cleaning agent than methylene chloride, but it must be heated to 60°C to be effective. If the development effort is successful, methylene chloride will be replaced with methyl pyrrolidone for mold cleaning.

The present estimated use of four 55-gallon drums (approximately 2500 pounds) of methylene chloride per month is divided between liquid waste from the recovery still bottoms and evaporation through the tank hood. Given the high vapor pressure of methylene chloride, it is assumed that a significant portion evaporates. The plant purchased 36,080 pounds of methylene chloride in 1986 (Slack, 1987). Replacement of methylene chloride with methyl pyrrolidone in this process will significantly decrease the overall emissions of methylene chloride from the plant, and it is expected to result in emissions of methyl pyrrolidone. Actual emissions of methyl pyrrolidone will depend on operating procedures, ventilation rates, and whether or not the plant requires the use of condensers or other controls systems to minimize emissions. No estimate of emissions from the proposed use of methyl pyrrolidone is available. Methylene chloride is not a reactive hydrocarbon and is not an ozone precursor. Methyl pyrrolidone has not been identified as a nonreactive hydrocarbon and is regulated as a VOC.

Abrasive Blasters: 139-Area

Two abrasive blasting machines that use a glass abrasive and compressed air to blast surfaces of parts are located in 139-Area. One machine is used to prepare unit surfaces for metal spray coating (see the discussion of 138-Area). A second machine is used to clean tooling and fixtures used in the resin casting operation. Both machines are exhausted to filter cabinets containing permanent filter elements that collect the used abrasive. The filters are cleaned routinely by the operator. No failures of the filter elements have been reported by the operator.

Plant Resin Compound and Mold Release Compound Use

A review of MSDSs for 139-Area was conducted during the Survey. Many of the resin bases and curing agents used in the resin casting operations contain toxic substances including epichlorohydrin, TDI, MDA, urethanes, and various amines. A list of some resin compounds used in resin casting, the toxic substances listed in the MSDS, and 1986-1987 purchases by the plant are listed in Table 3-6. These compounds do not contain volatile constituents, according to the MSDS. The

TABLE 3-6
RESIN COMPOUNDS USED IN 139-AREA RESIN CASTING

Compound Name	MSDS Listed Components	1986-May 1987 Purchases
EPON 828 (Resin Base)	Epichlorohydrin Bis Phenol A	10,000 lbs (1987) 5,000 lbs (1986)
CTBN (Resin Base)	Epichlorohydrin Acrylonitrile Copolymer	8,676 lbs (1987) 7,200 lbs (1986)
EPON Z (Curing Agent)	Methylene Dianiline	10 gal (1986)
Stapanfoam (Foam Base)	Toluene Diisocyanate Prepolymer	90 lbs (1987)
Uralite 312S (Foam Base)	Diisocyanate/urethane	625 gal (1987) 400 gal (1986)
EN 7 Conathane (Foam Base)	Toluene Diisocyanate	25 gal (1987) 25 gal (1986)
Lock Foam (Foam Base)	Diisocyanate/urethane	50 gal (1987) 120 gal (1985-86)

Source: Slack, 1987.

resin bases and curing agents are primarily incorporated into the products being encapsulated. However, as they are handled under vacuum and cured in ventilated ovens, some potential exists for volatilization of the resin bases and curing agents and/or generation of decomposition products containing cyanides, urethanes, or amines.

The plant has not conducted any monitoring or characterization of the oven or vacuum exhausts. It is aware that some potential for emissions exists and the Pinellas County Air Division expressed some concern about potential emissions of toxic substances from resin casting operations following a plant inspection in 1982 (GE, 1982). The County requested and received additional information from the plant concerning resin casting at that time, but it has not taken any further action.

Organic compounds are also used in the resin casting process as mold release agents or primers. Mold release agents may contain chlorofluorocarbons, alcohols (e.g., isopropyl alcohol), or aliphatic compounds (e.g., heptane). The plant reports the emissions of mold release compounds as part of the annual VOC inventory. It reported purchases of three mold release agents in the 1986 inventory, and a total of 3233 pounds purchased in 1986 (Richardson, 1987). Some types of parts require the application of a primer before encapsulation. The primer is primarily isopropyl alcohol and butyl alcohol, and it contains zinc chromate and phosphoric acid. The part is hand-painted or dipped and air-dried or baked. Primers are used in small quantities. Emissions of organics are also generated by some types of HYSOL (trade name) resin materials, which contain small percentages of volatile components.

3.1.2.5 Generator Assembly, Final Preparation and Flame Spray: 112-, 138-, and 110-Areas

Generator Assembly Room: 112-Area

Generator tubes and parts are cleaned with ethyl alcohol-3A and other solvents in 112-Area. Tubes and parts are soldered and assembled into finished generator units. Two vapor blast machines in 112-Area use a sand/water slurry to blast generator tubes and parts. The sand is filtered and disposed of after one use. The wet blasters vent to the roof without emission controls.

Shop Room: 138-Area

Encapsulated generator assemblies and parts are machined in 138-Area, with belt sanders, band saws, and lathes. After encapsulation, generator units have burrs that must be machined off before final assembly. The machines are equipped with local ventilation, and the resin dust is exhausted to filters. These filters are periodically cleaned by the Maintenance Department. A manually operated deburring station is hooded and also exhausts to a filter. Sunshine foam parts fabricated in 139-Area are cut on saws and sanded to the proper shape. Small amounts of methylene chloride are used to clean equipment in a small dip tank in this area. The tank is kept empty when not in use.

Flame Spray Machines: 110-Area

Two metal spray machines in this area are used to coat generator units and parts with metal. One machine, which is robot-operated, is used for spraying parts and units with aluminum, and another, manually operated, is used for spraying units with zinc. Each machine feeds a metal wire through an acetylene/oxygen flame, which atomizes the metal into a fine spray. The unit or part is turned manually or automatically in front of the flame spray. The robot-operated unit is in an enclosed room. Both machines are hooded and exhausted to water scrubbers, which control metal fume emissions. The scrubbers vent to the roof. The water is continuously recirculated through sumps and the scrubbers produce no liquid effluent. The water is emptied from each machine weekly and drummed for disposal. A development project is presently under way to replace the manually operated machine with a robot-operated unit.

A sandblasting machine is used to prepare unit surfaces for the flame spray. The machine uses dry sand and compressed air to blast the unit surface. The sand is collected in an external filter with permanent filter elements and recycled. The recycled sand degrades with use and is periodically replaced. The filter elements are manually cleaned.

Vapor Blast Room: 138-Area

Finished generator units and sunshine foam parts are vapor-blasted and/or abrasive-blasted in 138-Area. Two dry abrasive blasters (one using glass, one using sand) recirculate the abrasive through a filter. They are similar to the ones previously described. The wet blaster continuously removes the used wet sand onto a belt press, which discharges to a hopper. Abrasives are disposed of as nonhazardous wastes. The wet and dry blasters vent to the roof. The wet blaster exhaust is not filtered.

Paint Room: 110-Area

Finished units are painted with a solvent-based paint in 110-Area. Metal test panels are also painted. The paint room is a walk-in spray booth where units and panels are suspended on racks and hand-sprayed by an operator. Filtered air is used to ventilate the paint room, and the room exhausts through a water curtain to the roof. Water is continuously recirculated from a sump that overflows to a process drain. Painted units are air-dried in the paint room. Panels are dried in an oven which is vented to the roof.

Particulate emissions from the paint spray areas are controlled by the water curtain, and emissions are small. Solvents are emitted from the paint spray room. The water curtain is effective in controlling paint fumes; however, the rather low solubility of paint solvents and the continuous recirculation of the water allows for the evaporation of solvents into the exhaust. Some evaporation of solvent also occurs from the drying oven. Small amounts of solvent-based paints are used in comparison with emissions of VOC from manufacturing and engineering operations.

3.1.2.6 Tool Room and Machine Shop: 104- and 106-Areas

Parts used in manufacturing and engineering operations are fabricated from metals and other materials in 104- and 106-Areas. Machine tools in both areas are equipped with local ventilation, and they exhaust to dust collectors located in each area. The filters are cleaned periodically by Maintenance, and they exhaust back into the rooms. No lead or toxic metals are machined in these areas. Aqueous

cutting oil or water is used as a coolant; it is sprayed on metal parts as they are machined. Fiberboard, a phenolic resin material, and graphite are machined in 106-Area. Both these materials generate dust when machined. A water-soluble oil spray mist is used to minimize fiberboard dust generation. Graphite dust is controlled with a vacuum system. A special containment area for graphite machining operations is planned for installation in 106-Area.

Small, cold cleaners, each about 1 by 2 feet in surface area, are used with alcohol and a trade name solvent containing perchloroethylene and methylene chloride in 104- and 106-Areas, respectively. These are covered when not in use, and they do not have local ventilation. The cold cleaners are not always emptied when not in use. One open-top and one large, conveyorized degreaser, both of which use trichloroethylene, are located in 106-Area. They are used to clean parts.

Two sand blasters are used in 104-Area. The exhaust of one, a dry blaster, flows to a baghouse; that of the other, a wet blaster, is not filtered. A deburring table used to finish machined parts is vented to a filter. A braze unit used with gold or silver braze material is used to bond metal parts. This unit is vented to the roof uncontrolled. Small amounts of silver solder containing cadmium are used periodically in the braze unit. Fluxes containing fluorides or zinc are occasionally used. This machine is used infrequently.

Normally, about eleven 55-gallon drums per year of trichloroethylene are used in degreasing operations in 106-Area. Most of the emissions from this operation pass to the atmosphere through the degreaser hood exhaust. Approximately 220 gallons of the perchloroethylene-containing cold cleaning solvent are used annually (GE, 1987d). The amount that evaporates is not known, as the plant does not keep records of the amount of individual wastes recovered. Particulate emissions sources in 104- and 106-Area processes are controlled, and the emissions are small.

3.1.2.7 Magnetics Manufacturing: 110-Area

Electromagnetic devices such as inductors, coils, and transformers are manufactured in 110-Area. Coil bobbins are formed from glass-reinforced epoxy resin. Glass fiber and resin are mixed in an enclosed cabinet and pelletized in an enclosed and filtered press unit. The press dies are heated in the press with a recirculating heat transfer

fluid. Pressed parts are cured in a curing oven. Wire stripping and winding of magnetics parts is in large part a hand operation performed at ventilated workstations. Finished magnetics parts are encapsulated with resins. EPON 828, HYSOL, and some CTBN are used. Resins are mixed in hoods and degassed in a vacuum chamber. The magnetics part is placed in a mold in an encapsulation machine. The curing process requires both pressure and heat. Nitrogen gas is used to pressurize the encapsulation machine. The parts are then oven cured. Parts are cold-cleaned with acetone in a hood. The acetone bath is covered when not in use, but not always emptied. This hood is also used to store waste resin until the mixture hardens, after which it is disposed of as a solid waste.

Materials handled and procedures used in this encapsulation process are similar to those previously described for resin casting (139-Area), although the encapsulation machine used here is operated under pressure rather than in a vacuum. There is a similar potential for the emission of resin components and/or degradation products from this area.

3.1.2.8 Thermal Battery Manufacturing and Engineering: 349-, 307-, and 353-Areas

Thermal batteries are manufactured using a lithium/silicon (Li/Si) alloy, iron disulfide (FeS_2), potassium perchlorate, and other powder materials. Some types of batteries are formulated with calcium metal and calcium chromate (CaCrO_4). The reactivity of the Li/Si alloy is such that it must be stored and handled in a low-humidity environment. Both the 307- and 349-Area dry rooms are supplied with dry air (3 percent humidity) from a dehumidifier system outside the building. As dehumidified air is expensive to manufacture, the number of air emission points and their exhaust rates are kept low to minimize the loss of dry air from the rooms.

Thermal battery manufacturing involves powder processing; pelletizing the powders into heat pellets, as well as anode, cathode, and separator pellets; and hand-assembling the pellets into batteries. Iron disulfide, Li/Si, and/or calcium chromate are mixed in powder processing air curtain hoods. The air from these hoods is not exhausted; it is recirculated into the hoods through filters. The filters are changed periodically by Maintenance. The powder materials are formed into pellets in 1000-gram batches in pellet presses. Ventilated ovens are used to dry and

fuse the pellets. The exhaust rate of the ovens is 50 cfm. Some powder materials are processed in a micropulverizer. This unit is fully enclosed in a cabinet for the purposes of noise and dust control. An electrolyte grinder, which vents to a vacuum system, is not presently used. Heat powder, an iron/potassium perchlorate mixture, is pelletized in powder presses and vacuum-dried at 75°C. The pellet materials are hand-assembled into batteries and wired at work benches.

A refrigerated-vapor degreaser approximately 1 by 2 feet in surface area is located in 349-Area. The unit uses 1,1,1-trichloroethane to clean electrical components. It is kept covered when not in use and is not equipped with local ventilation. Local ventilation is not generally required for refrigerated units.

Each battery contains on the order of 30 to 60 grams of heat powder, Li/Si, and iron disulfide. The maximum Li/Si alloy processed is about 20 pounds per month, most of which is incorporated into the batteries. Calcium chromate batteries are not presently being manufactured, but production is scheduled to resume in late 1987. About 40 pounds of calcium chromate is expected to be processed in the period 1987-1988 (Slack, 1987). The chromium compound is primarily incorporated into the batteries.

The low process throughput and ventilation requirements of the dry rooms minimize the potential for particulate emissions, and actual emissions are expected to be small. Calcium chromate is a toxic substance that may be regulated in the future as a toxic air pollutant. Other materials used are reactive/corrosive, but they do not exhibit high toxicity. Emissions of 1,1,1-trichloroethane from the degreaser are expected to be small, given the small size of the machine.

Iron disulfide used in thermal battery production is processed in 353-Area. The iron disulfide is processed in a vibratory mill to reduce the particle size and treated with a mixture of hydrofluoric and nitric acids to remove impurities. The acid treatment is performed in small, hooded tanks, which vent to acid-resistant fans on the roof of the facility. The tanks are kept empty when not in use. The tank exhaust is not equipped with a scrubber. The vibratory mill is enclosed, and the only exhaust in the mill area is room ventilation. There is also a graphite lathe and several other machine tools located in this area. The graphite lathe is equipped with a local

exhaust, which is filtered and vented back into the room. The other machine tools do not have local exhausts.

Particulates from machine tooling and iron disulfide processing and particles of hydrofluoric and nitric acids are emitted in small quantities from this facility. The low process throughput of this facility minimizes the potential for particulate emissions and actual emissions from the facility are small. Iron disulfide does not exhibit significant toxic effects and is not a regulated substance. Because of the low throughput, acid mist emissions from the facility are expected to be lower than the emissions from other facility operations. This facility was not in operation during the Survey.

3.1.2.9 RTG Manufacturing: Building 400

Radioisotopically powered thermoelectric generators (RTGs) are manufactured in Building 400. These devices consist of a sealed plutonium-238 oxide heat source and a thermopile, which converts the heat to electrical energy. The thermopiles are fabricated in the western half of the building, and the thermopiles and heat sources are assembled into finished units in the eastern half. The eastern half of the building is vented to a HEPA filter system and stack; the western half has individual roof exhausts similar to those in some areas of Building 100.

Thermopiles are fabricated in the western half of Building 400 from silicon/germanium (Si/Ge) semiconductor material. Silicon and germanium are melted in 6-ounce batches in a furnace, which is hooded and exhausted to the roof. The Si/Ge alloy ingot is powdered in a grinding unit, which is also hooded and exhausted. This unit is scheduled to be moved to a new area of the western half of Building 400 on the installation of a new ventilation system. The Si/Ge powder is melted in a vacuum induction furnace in a helium atmosphere. An oil vacuum pump and dry vacuum pump are both used to evacuate the induction furnaces. The Si/Ge alloy is wafered by slicing machines that use a water-based coolant. Fused glass made in a vacuum glass furnace is used to assemble the wafers into a thermopile.

Several operations are conducted in a clean room in the western half of Building 400. Wafers and finished thermopiles are cleaned in acid and solvent hoods.

Methylene chloride and alcohol are the solvents used. Two tungsten sputtering machines exhausted by oil and dry vacuum pumps are used to form electrical connections. Furnaces used for wafer oxidation and glass burnout are also located in the clean room. The clean room exhausts to the roof. Acid resistant PVC ductwork is used in this area.

Two large oil vacuum pumps located outside Building 400 provide vacuum for the sputter machines and other equipment. Other vacuum pumps are located within the building. The oil pumps are being replaced by dry pumps in order to reduce the potential for contamination of process areas with vacuum oil. Some vacuum oil is entrained with the vacuum exhaust.

Annual consumption of Si/Ge powder is approximately 10 pounds. Solvents and acids are used in reagent quantities in the clean room. Particulate emissions from operations in the western half of Building 400 are small, and potential sources are not filtered because of the low process throughput. Emissions of acid mists and solvents from this area are small compared with those of other plant operations.

Thermopiles and heat sources are assembled into finished units in the eastern half of Building 400. Epoxy fittings are applied to the outside of finished units and cured overnight in ovens. Reagent quantities of chlorinated solvents and alcohols are used in this area.

3.1.2.10 Plant Services: Building 500

Chilled water, deionized water, compressed air, heated water, and emergency power are supplied from units in Building 500. Heated water is supplied by three heat pumps, which use CFC-114 as a heat transfer fluid. One dual-fuel-fired (natural gas/number 2 oil) boiler rated at 10.2 million Btu per hour is used as a backup to the heat pumps. The boiler, installed in 1968, burns fuel oil at a maximum rate of 74.5 gallons per hour (gph). The plant has been replacing heated-water capacity with electric water heaters to some extent. These are presently used in area 300 and Buildings 100, 200, 400, 500, 600, and 700 (DOE, 1986).

Emergency power is provided by three diesel generators. Two of the units, installed in 1984, are rated at 44 kilowatts electric output; the other unit, installed before

1980, has a slightly lower rating. Total fuel consumption (including that of the backup boiler) is approximately 15,000 gallons per year.

Chilled water is produced by six 900-ton (10.8-million-Btu-per-hour) water chillers, which use CFC-114 refrigerant cycles. Water is supplied to the plant at 45°F. Each chiller has a separate water pump. Redesign of the pumping system minimized variation of cooling water temperature around the plant, which was previously a concern. Refrigerant is pumped out of the chillers and stored when the chillers are serviced. Refrigerants CFC-11 and CFC-12 are also used in Building 500.

A cooling tower with six cells is used to dissipate heat from the plant. The unit can evaporate up to about 80,000 gallons per day (gpd) of water through four cells and circulate 2700 gpm through each cell. The exhaust rate of each 25-horsepower cooling tower fan is 100,000-150,000 cfm (DOE, 1986).

Emissions from Building 500 include small quantities of sulfur oxide and nitrogen oxides from fuel combustion equipment, chlorofluorocarbons from the evaporation of leaks in the water chillers and heat pumps, and organic biocides through cooling tower evaporation. Sulfur and nitrogen oxide emissions are on the order of 0.25 ton per year, based on emission factors for fuel combustion. Chlorofluorocarbon losses are reported to plant environmental management. Approximately 4000 pounds of chlorofluorocarbons have been added to plant air conditioning and refrigeration units over the past 3 years (GE, 1987e).

3.1.2.11 Engineering Areas

Engineering areas, where products are developed and tested versus being manufactured in large numbers, generally parallel the associated manufacturing areas in the materials and equipment used. With some exceptions, engineering areas have the same potential for emissions as similar manufacturing areas. The actual emissions tend to be lower in most cases than manufacturing areas, as the engineering areas and development activities are not generally continuously operated. Major engineering areas are described in this section.

Engineering Ceramics Laboratory: 192-Area

Operations in 192-Area are similar to those in ceramics production (105- and 145-Areas). A spray dryer/cyclone unit is used to prepare ceramic materials. These are formed in presses and machined. Machines are locally ventilated and exhaust to a dust collector on the roof similar to that in 105-Area (Bennett Company, 1981). The area contains hydrogen atmosphere furnaces, a belt furnace (conveyorized), and three electric glass melt furnaces. A refrigerated vapor-degreaser using 1,1,1-trichloroethane is used to dewax ceramic parts.

Tube Development: 182-Area

Operations in 182-Area correspond to the manufacturing operations in 108- and 126-Areas (tube exhaust and tube processing, respectively). Processes include titanium/erbium metal evaporation onto tube target material, tube assembly, and loading of the tubes with tritium in vacuum systems. Metal evaporators are exhausted by a vacuum system. Tritium is exhausted from vacuum systems and ventilation hoods in the tube loading area. Tritium emission sources and controls are discussed in Section 4.3. Metal brazing is conducted in several hydrogen atmosphere furnaces in this area and in one room in 162-Area. Small amounts of gold/copper braze material (generally a few mils thick) are applied to ceramic parts, which are then heated in the furnaces. These operations are similar to those conducted in the 140-Area (furnace room). Small amounts of solvents are used in this area.

Tube Engineering: 181-Area

Tube parts are cleaned and plated with gold or nickel in 181-Area. Parts for clocks are also gold-plated. Plating and cleaning operations are conducted at a plating console in a clean room. Plating baths are similar to those used in 117-Area (metallizing and plating). Hydrochloric, sulfuric, nitric, and acetic acids are used for cleaning parts. Plated parts are dried in argon atmosphere ovens. The exhaust from the plating console is uncontrolled. About 5 gallons of acid are used weekly. A hydrogen atmosphere furnace in this area is used for glass/metal bonding. The furnace is hooded to provide heat exhaust. Two wet-sand vapor blasters are used to remove oxides from glass and metal parts. The exhaust of these blasters to roof

vents is not filtered. A small, ultrasonic degreaser that uses ethyl alcohol-3A and methylene chloride is located in a hood in the furnace room. This degreaser is kept empty of solvent when not in use.

Active Ceramics Laboratory: 194-Area

Ferroelectric material (active ceramic) is prepared in 194-Area. This area has no analog in manufacturing operations. The primary ingredient in ferroelectric powder is lead oxide (PbO). Titanium, zirconium, and occasionally niobium oxide are added to the lead oxide and may make up 10 percent of the mixture. Lead oxide is hygroscopic and is stored in an oven. The metal powders are mixed in half-kilogram batches in one of two hoods and pressed in a third hood. All three hoods are commercially procured lead hoods that contain both a prefilter and an afterfilter. The filters are periodically changed by Maintenance. Two grinding machines used for grinding the pressed-powder parts are presently located in the 194-Area. These machines are partially enclosed but are not ventilated. As the result of a planned rearrangement of the area, the two machines will be moved into a new room in 192-Area and will be provided with full enclosures and filtered hoods. The activity presently conducted in the 192-Area room involves the use of zinc oxide and a double-filtered hood similar to those used in the lead powder mixing area. This hood will be moved into 194-Area. The rearrangement will also result in the movement of a new oven into the powder mixing room.

Ferroelectric materials are subjected to physical and electrical testing in several test rooms in 194-Area. An ultrasonic degreaser, which uses isopropyl alcohol or acetone, is located in a hood in this area. About half a kilogram of lead powder is used each month in this area. The lead hoods provide control of potential emissions, and actual emissions from this area are small.

Ferroelectric Tube Finishing/Testing: 183-Area

Ferroelectric generator tubes are finished and tested in 183-Area. No destructive testing of the tubes is conducted in this area, so no tritium is released. Loaded tubes are cleaned in a wet-sand vapor blaster, the exhaust of which is not filtered. A paint booth in which parts are painted with epoxy paint is also located in this area. The paint booth is exhausted through a filter, which is periodically changed by

Maintenance. A manually operated flame spray hood similar to that located in 110-Area is used to aluminize the generator tubes. This unit is not equipped with a scrubber. The existence of metal deposited on the back of this hood indicates that aluminum metal fumes are possibly being emitted to the atmosphere during flame spray operation. Parts are prepared for metal spray in two dry-sand blasters, one using coarse sand and the other fine sand. The fine-sand blaster is exhausted through a filter, but the coarse-sand blaster has no exhaust control. Small amounts of epoxy are used to bond parts. The epoxy bonds are cured in three epoxy curing ovens, one having a nitrogen atmosphere and two an air atmosphere. Small amounts of acetone, alcohol, and CFC-113 are used in this area.

Ferroelectric Tube Encapsulation: 185-Area

Operations in 185-Area are similar to those in 139-Area (resin casting). Phenolic resin (EPON 828) used to encapsulate tubes is poured under vacuum into molds and pressure- or heat-cured. Resin used to encapsulate capacitors is hand-poured. Resin materials are mixed in a hood. Curing ovens and hoods have no emission controls. Injection molding and transfer molding of parts is also conducted in this area. Urethane foam parts fabricated from lock foam are made in this area and used to insulate tubes against mechanical shock. The foam material is stored in a ventilated hood, and parts are formed in a foam machine, which is enclosed on three sides and exhausted to a roof vent. Approximately 10-15 pounds of lock foam and 4 gallons of EPON 828 resin are used in this area each week.

The Mb/Mn metal paint used in 117-Area is mixed with amyl acetate solvent in a ventilated workstation in 185-Area. A thermoforming machine in this area is used to hot-press PVC and polycarbonate materials into plastic parts. The fumes given off by thermal decomposition of the PVC are exhausted through a hood.

Process Development: 163- and 164-Areas

Operations in 163- and 164-Areas duplicate many of the manufacturing operations. A retort hydrogen atmosphere furnace and sintering furnace similar to those located in 140-Area are used to fire parts. Experimental plating studies using nickel baths are conducted in a plating room. The baths are covered and are equipped with slot exhausts above the covers. Parts are cleaned in a vapor degreaser using

trichloroethylene and in a wet-sand vapor blaster. The sand is recycled back into the unit. A metallizing screen print workstation similar to those in 117-Area, but without the slot exhaust, is used for the painting of parts with metal paint. A clean room similar to that in 143-Area (chemical processing) contains ultrasonic cleaners and small acid baths. The baths are covered and there are exhausts below the covers. The exhausts have no emission controls. A second clean room similar to that in 126-Area contains two vacuum furnaces and two vacuum metal evaporators. The evaporators are not yet operational. An encapsulation machine similar to those in 139-Area is located in 164-Area, but it too is not yet operational. Six welding booths, each having flexible hoses and individual exhaust fans for local ventilation, are situated in 164-Area. A pressure spray washer, which uses chlorofluorocarbon, is used to clean parts. The chlorofluorocarbon is recycled within the machine and periodically replaced.

3.1.2.12 Volatile Organic Compound Emissions

Vapor Degreasing Operations

Vapor degreasers in several plant areas are used to degrease parts, tools, or components as part of manufacturing and engineering operations. Table 3-7 provides a summary of the degreasing operations in Building 100 and Area 300. Vapor degreasing operations use either trichloroethylene, 1,1,1-trichloroethane, or chlorofluorocarbons. Trichloroethylene is used for metal parts and 1,1,1-trichloroethane for ceramics. While all manufacturing degreasing operations have been converted from trichloroethylene to 1,1,1-trichloroethane, some manufacturing units--particularly those using aluminum parts--have experienced quality control problems with 1,1,1-trichloroethane. The use of trichloroethylene in vapor degreasers is permitted case by case, but it requires review and approval by plant Environmental Health and Safety personnel (Majestic, 1985).

Written procedures for the installation and operation of vapor degreasers at the site have been developed by the Environmental Health and Safety Department (GE, 1987f). These procedures incorporate the control and operating standards of the Florida Air Quality Regulations covering vapor degreasers, as well as industrial hygiene considerations. Included are specific procedures for the use of covers, for

TABLE 3-7

VAPOR DEGREASING OPERATIONS - BUILDING 100 AND AREA 300

Area	Type	Solvent	Coolant	Operation	Local Ventilation	Solvent Recovery Still
104	Conveyorized	Trichloroethylene	Chilled Water	Tool room	Yes	Yes
104	Open Top-Manual	Trichloroethylene	Chilled Water	Tool room	Yes	No
128/129	Open Top-Manual	CFC 113	Refrigerator	Tube Testing	No	No
143	Open Top - Automatic Overhead Transport	Trichloroethylene	Chilled Water	Chemical Process	Yes	Yes
145	Open Top-Manual	1,1,1 Trichloroethane	Refrigerator	Ceramics	Yes	No
145	Open Top-Manual	1,1,1 Trichloroethane	Refrigerator	Ceramics	Yes	No
163	Open Top-Manual	Trichloroethylene	Refrigerator	Process Development	Yes	No
192	Open Top-Manual	1,1,1 Trichloroethane	Refrigerator	Ceramics Lab	Yes	No
325	Open Top-Manual	CFC-113	Refrigerator	LAC Area	Yes	No
349	Open Top-Manual	1,1,1 Trichloroethane	Refrigerator	Thermal Battery	No	No
351	Open Top-Manual Overhead Transport	1,1,1 Trichloroethane	Chilled Water	Maintenance (Tube exhaust)	Yes	No

Source: Data provided by GE, 1987f.

the minimization of solvent carryout and vapor loss, and for thermostat controls and new vapor degreaser installations. There are also procedures for the maintenance of cooling water flow through the degreaser for 15-30 minutes after shutdown of heating elements in order to minimize solvent losses. Local ventilation systems and refrigeration systems on degreasers are operated continuously.

Degreasers in 143- and 145-Areas are directly involved in manufacturing operations. Degreasers in 104-Area are used to clean fabricated metal parts. Other degreasers are used in support of other manufacturing and engineering operations. At the time of the Survey, the conveyORIZED degreaser in 104-Area (tool room) was dismantled and in the process of being rebuilt. This degreaser is the oldest unit in the plant; it is believed to be original plant equipment. According to the operator, it had developed cooling water leaks and was experiencing high solvent losses. Trichloroethylene use in the first quarter of 1987 was approximately eleven 55-gallon drums, about the same amount of solvent as was used in all of 1986. The unit was shut down on April 1, 1987. Since that time, the open-top manual degreaser in 104-Area, normally reserved for precleaning operations, has been used for all 104-Area degreasing. Both degreasers are ventilated to a common duct and fan. The conveyORIZED unit has an internal solvent recovery still:

The 143-Area (chemical processing) vapor degreaser, which uses trichloroethylene, is used in conjunction with a series of ultrasonic cleaners and detergent/acid cleaners to clean metal and ceramic parts. Parts from stock that are heavily soiled may require degreasing before introduction into the detergent/acid cleaning area. Lightly contaminated parts are cleaned in the ultrasonic cleaners in the clean room. Solvent is continuously recovered from the degreaser in an external still and recycled into the degreaser. The recycled solvent is returned to the ultrasonic portion of the two-stage degreaser, then flows through the vapor portion and back into the still. The parts are thus only exposed to clean solvent in the ultrasonic portion. Solvent consumption in the 143-Area degreaser is about one 55-gallon drum per month. Both the degreaser and the recovery still are equipped with local ventilation. The degreaser is equipped with an automatically operated overhead transport.

The 351-Area (maintenance and calibration) vapor degreaser, which uses 1,1,1-trichloroethane, is used for precleaning tube vacuum system equipment before its introduction into the 351-Area acid baths. The degreaser is water-cooled and is about 2 by 4 feet in surface area. Both the degreaser and acid baths are fully enclosed and hooded and are connected by a manually operated overhead rail transport. This unit is scheduled to be replaced by a new ultrasonic vapor degreaser, which has been purchased but had not been installed by the time of the Survey.

Degreasers used in other plant manufacturing and engineering areas are on the order of 1 by 2 feet in surface area. All vapor degreasers, with the exception of the dismantled conveyORIZED unit, were found to be covered, and in some cases locked, during the Survey. Cooling water systems were found to be in operation. Only one unit, that in 143-Area, was observed in operation during the Survey, and the operator appeared to be experienced in its use. Ventilation systems on the open-top degreasers are above the covers, such that the cover separates the vapor area from the ventilation exhaust. This minimizes solvent emissions from the degreasers.

3.1.3 Environmental Monitoring Program

3.1.3.1 Toxic and Criteria Pollutant Ambient Air Quality Monitoring

The Pinellas Plant does not conduct any on-site or off-site monitoring for toxic or criteria air pollutants. Emissions of both toxic and criteria pollutants are small (53 tons per year of VOCs compared to a total county inventory of 11,500 tons per year) and have a small effect on air quality. The plant is not required by the state to conduct air quality monitoring. The State of Florida operates a network of ambient air monitoring stations in Pinellas County. These stations provide data on ambient concentrations of ozone, sulfur dioxide, lead, carbon monoxide, and total particulates. Ambient air quality data are discussed in Section 3.1.1.

The plant presently operates a meteorological tower that provides wind speed and direction, but not air temperature or turbulence/stability class data. The data can therefore not be used for dispersion modeling. The plant intends to upgrade the capability of the on-site meteorological system to include turbulence/stability class and temperature data in FY 1988.

3.1.3.2 Volatile Organic Compound Emission Inventory and Reporting Requirements

Pinellas County is classified as a nonattainment area for ozone. The attainment status of the County and ambient air quality data are discussed in Section 3.1.1. In lieu of monitoring, the Pinellas Plant is required to prepare an inventory of VOC emissions and submit it to the Pinellas County Air Quality Division each year. Volatile organic compounds are defined by Florida state regulations as any chemical compound or mixture containing carbon or carbon and hydrogen that has a vapor pressure greater than 0.1 millimeter of mercury at 20°C.* The county requires reporting of both "reactive" (ozone precursor) and "nonreactive" (non-ozone precursor) organic compounds, as well as all chlorofluorocarbons with the exception of those used in air conditioning service.

The plant submits a VOC emission inventory to the county each year. It calculates VOC emissions by the following procedure:

- From inventory and purchasing records, the amount of each reported organic compound used at the plant in the reporting year is calculated.
- The amount of each reported compound is summed to give the total annual VOC use for the reporting year.
- The amount of flammable solvents and halogenated solvents recovered at the plant for disposal off-site is calculated from waste tank inventory and shipping records.

* The state has informed the plant that acetic acid, which meets this definition, and which the plant uses in manufacturing operations, is not a VOC.

- The difference between the total amount of VOCs used and the total amount of solvents disposed of during the reporting year is assumed to be the atmospheric emission of VOCs.

Pinellas County actually requires the reporting of emissions of each individual organic compound. However, as the plant does not keep waste generation records by compound, but only by waste type (flammable and halogenated), the calculation of individual releases cannot be performed. The Pinellas County Air Quality Division understands this difficulty and accepts the above-described aggregate emission estimate. The plant does not presently have a fully automated chemical inventory system, and the preparation of the emission inventory involves the hand-searching of purchasing and inventory records. At present, the plant reports in the emission inventory VOCs used in manufacturing and degreasing operations, including trichloroethylene, ethyl alcohol, and methylene chloride. Some minor uses of VOCs, including paint spray facilities, some trade name products, and laboratory reagents, are not included in the inventory reported to the state. Potential emissions of VOCs from resin casting operations have not been assessed. The major uses of VOCs at the site are included in the inventory, and plant representatives consider the emissions estimate to be accurate within ± 10 percent.* Installation of a computerized chemical inventory system, expected in late 1987, will enable the plant to more easily track and report minor uses of VOCs (Richardson, 1987).

The plant emissions of VOCs, including both reactive and nonreactive compounds were 53.3 tons in 1986. Table 3-8 shows the 1986 VOC emission inventory for the plant (Richardson, 1987). The total VOC emissions from all permitted sources in Pinellas County in 1986 were on the order of 11,500 tons, according to data for the period 1982-1984 (PCDEM, 1986).

*The calculational method assumes that all VOCs that are not disposed of as liquid waste evaporate to the atmosphere. This assumption does not account for any VOCs that are incorporated into the products made at the plant, and would tend to overestimate emissions from the plant, as VOCs actually in the product are assumed to evaporate. This offsets to some extent the minor solvent uses not included in the inventory.

TABLE 3-8

VOC INVENTORY (1986 USAGE) U.S. DEPARTMENT OF ENERGY PINELLAS PLANT

Material/Compound	Gallons Issued to Using Units	Pounds/Gallons	Pounds Issued
Acetone	1,662	6.59	10,952
Alcohol, Butyl	37	6.76	250
Alcohol, Isobutyl	23	6.70	154
Alcohol, Ester	14	7.92	111
Alcohol, Ethyl (3A)	5,734	6.62	37,959
Alcohol, Isopropyl	136	6.59	896
Alcohol, Methyl	60	6.60	396
Amyl Acetate	808	7.30	5,908
Diacetone Alcohol	18	7.84	141
Fluoroenert FC77	520	14.85	7,722
Lacquer Thinner	28	6.49	182
Methylene Chloride	3,277	11.02	36,080
Mineral Spirits	50	6.59	330
Trichloroethane-1,1,1	916	11.02	10,094
Trichloroethylene (Reagent Grade)	81	12.51	1,013
Trichlorotrifluoroethane	2,226	13.09	29,138
Toluene	155	7.22	1,119
Trichloroethylene	2,972	12.18	36,199
Primer-Gray Acrylic	4	1.59	6
Methyl Ethyl Ketone	1	6.71	7
Mold Release Compound	494	6.08	3,004
Mold Release Compound	5	7.17	36
Mold Release Compound	14	13.76	193
TOTAL POUNDS:			181,880

Source: Richardson, 1987.

Description	Gallons	Pounds/Gallons	Pounds
Flammable Solvents	6,006	6.98	41,922
Halogenated Solvents	2,900	11.48	33,292
TOTAL POUNDS:			75,214

Source: Richardson, 1987.

3.1.4 Findings and Observations

3.1.4.1 Category I

None

3.1.4.2 Category II

None

3.1.4.3 Category III

None

3.1.4.4 Category IV

1. Reporting of minor sources of atmospheric emissions of volatile organics is incomplete. The annual plant VOC emission inventory submitted to the state as required by state regulations for ozone nonattainment areas does not account for some minor sources of VOC emissions from the plant.

The plant presently prepares an emission inventory for VOCs using purchasing records, as discussed in Section 3.1.3.2. The majority of the VOCs used at the plant, including those used in manufacturing and degreasing operations, are included in the inventory. Some minor VOC sources, including potential emissions from resin casting operations, are not included in the inventory reported to the state at the present time. Other emissions not accounted for in the inventory include reagent chemicals used in engineering and analytical laboratory areas, and trade name products containing volatile compounds. Most of these chemicals are used in smaller quantities than those used in manufacturing and degreasing operations (e.g., trichloroethylene, acetone, ethyl alcohol-3A) and represent a small percentage of the estimated total inventory of 53.3 tons per year. Installation of the automated chemical inventory tracking system, expected in late 1987, will enable more complete tracking and reporting of minor VOC emissions from the plant.

2. There are no estimates of potential emissions of toxic air pollutants. Plant operations emit, or have the potential to emit, to the atmosphere toxic resin compounds for which no emissions estimates are available.

The manufacturing and engineering operations at the plant use a number of toxic resin compounds, including epichlorohydrin, urethanes, methylene dianiline, MDA, and toluene isocyanate (TDI). There is a potential for atmospheric emissions of resin compounds and degradation products from vacuum pouring and oven curing of the resin compounds. No emission estimates are presently available for these processes. Following a 1982 plant inspection, the Pinellas County Air Quality Division expressed interest in emissions from the plant, particularly potential emissions from resin casting operations. The plant provided information on the resin casting process to the County in response to their request. Since that time no further action has been taken by the County or the plant. Rather large amounts of resin compounds (on the order of 20,000 pounds per year) are stored and used at the plant and they are mostly incorporated into the products produced.

3.2 Soil

This section will provide an overview of the surface soil types, geology, and land use at and in the vicinity of the Pinellas Plant. The existence of and potential for soil contamination on the plant property by direct and atmospheric releases will be discussed. Off-site soil contamination or the potential for such contamination via atmospheric releases will also be reviewed.

3.2.1 Background Environmental Information

The area around the Pinellas Plant is underlain by a number of layers of limestone. Collectively, the limestone formations are referred to as the Floridan aquifer. The Floridan is overlain by sand, silt, and clay of varying thicknesses. The surface soil layer in Pinellas County consists of sands and shelly sands of the Myakka and Wabasso types, which were probably deposited during the Pleistocene Age (1 million years ago or less). The depth over the plant area varies from 25-40 feet.

The land use of the county when the plant was constructed was significantly agricultural, with the major activity being the citrus industry. This activity has declined rapidly in recent years as more and more of the lands once used for citrus farming have been developed as residential areas for the expanding population. As explained in Section 3.3.2, the changes in land use in the area surrounding the plant have a great influence on the surface water discharge and on the types of controls employed by the Pinellas Plant over the years since the plant was constructed.

While not highly industrialized, Pinellas County contains over 650 manufacturing plants, the manufacture of electronic equipment being the major industry (ERDA, 1975). The Pinellas Plant is located in an industrial land use area. Figure 3-3 shows the land use in the areas around the plant. As can be seen in the figure, within 2 miles, especially to the north and northeast, there are many residential areas of medium density (7.6-15.5 units per acre) and low to medium density (0-7.5 units per acre). Residential dwellings are located immediately north of the plant and around a lake approximately 0.5 mile from the northwest corner of the plant property. A light industrial park containing a fiberglass boat manufacturing facility is

LAND USE CATEGORIES SURROUNDING
THE PINELLAS PLANT

FIGURE 3-3

contiguous to the plant property at the eastern side of the plant's northern boundary. The areas contiguous to the southwestern and southern boundaries of the plant are currently used for warehouses and light technical commercial businesses.

3.2.2 General Description of Pollution Sources and Controls

Radioactive gaseous effluents are released from three exhaust stacks at the Pinellas Plant: the Building 100 main stack, the Building 100 laboratory stack, and the Building 800 stack. Total discharges from these sources for 1985 are presented in Table 3-9.

TABLE 3-9
TOTAL DISCHARGES OF RADIOACTIVE GASES
FROM PINELLAS PLANT IN 1985

Effluent	Bldg. 100 Main Stack ^a	Bldg. 100 Lab. Stack ^b	Bldg. 800 Stack ^c
Tritium gas	68 Curies	34 Curies	9 Curies
Tritium oxide	92 Curies	56 Curies	1 Curie
Krypton-85 gas	5 Curies	--	--
Totals	165 Curies	90 Curies	10 Curies
Annual Average Stack Concentrations	3.89×10^{-10} Ci/l	2.43×10^{-10} Ci/l	4.95×10^{-10} Ci/l

Source: DOE, 1986b.

- ^a Per 4.24×10^{11} liters of air.
- ^b Per 3.71×10^{11} liters of air.
- ^c Per 2.02×10^{10} liters of air.

The maximum ground level concentrations would occur approximately 100-155 meters (328-509 feet) downwind from the Building 100 stacks and could be either on-site or off-site, depending on wind direction. For Building 800 releases, the location would be approximately 29 meters (95 feet) downwind and all would be on-site.

As noted in Section 4.3, plutonium is used at the plant as a source of heat for RTG manufacture. The plutonium arrives in three-layer, encapsulated metal packages, which are incorporated into the RTGs and are capable of maintaining their containment integrity under extremely severe environmental conditions. Thus, the likelihood of release of plutonium at the plant is very low. Unencapsulated plutonium has never been handled or stored at the Pinellas Plant. If particulates of plutonium-238 and -239 were released to the atmosphere, however, they would be deposited on the soil. Therefore, soil sampling is performed in the plant area and the results compared with the results of a study conducted before the introduction of the plutonium sources at the plant.

Various potential and actual facility-wide releases directly to the soil were identified during the Survey effort. These include acid and alkali spills and leaks, numerous industrial drain leaks, a release from the old health physics tanks, and potential releases from abandoned underground pipelines. These releases are discussed in Section 4.5.

3.2.3 Environmental Monitoring Program

The routine environmental monitoring program at the Pinellas Plant includes off-site surface water monitoring for tritium (see Section 3.3) and on-site and off-site soil monitoring for plutonium.

The Pinellas Plant also performs off-site air monitoring (see Sections 3.1 and 4.3). The off-site monitoring locations for air and surface water are related to off-site soil contamination in that they would be indicative of potential soil contamination borne by precipitation or particulate airborne transport. Figure 3-4 shows the locations of the off-site water and air sampling locations.

There is no soil monitoring program for organic chemical constituents, nor is any monitoring done for vegetation, animal fodder, milk, or other animal food products. Some limited on-site soil monitoring has been performed in the past (see Section 4.5); however, except for plutonium monitoring no regular monitoring of soil on-site is conducted.

OFF-SITE SAMPLING LOCATIONS

FIGURE 3-4

3.2.3.1 On-Site Soil

Two on-site soil samples were analyzed for plutonium content during 1986. In addition, four off-site samples collected at locations around the plant at distances from 4 to 6 kilometers (2.5 to 3.7 miles) were analyzed. Each sample consisted of a composite of three plugs 9 centimeters (3.5 inches) in diameter, and 5 centimeters (2 inches) deep. They were dried to constant weight at 110°C (230°F) before analysis.

According to the 1986 Environmental Monitoring Report, the plutonium levels in all six soil samples were below the minimum detection level. These findings are thus comparable to those obtained during the preoperational study. The levels for both plutonium-238 and -239 ranged from 3.8×10^{-10} to 5.1×10^{-9} microcurie per gram of soil.

Wastewater discharge to the three old health physics tanks was terminated on April 20, 1986, and actions directed toward closure of these tanks were initiated. Initial assessment of soil conditions surrounding the tanks consisted of soil analysis for bound tritium and for total concentrations of lead, cadmium, and chromium. Fourteen 6-inch core samples were collected with a hand auger at the surface and 4 feet below the surface at seven locations around the tanks. Surficial and 4-foot-deep soil samples were also collected at the southeast corner of the plant property as a background comparison. Analytical procedures for bound tritium in the soil consisted of dried soil acid leaching followed by liquid scintillation counting of the leachate. Soil samples for total lead, cadmium, and chromium analyses were pretreated by the USGS Method 1 5485-7 and analyzed by atomic absorption graphite furnace methods published in 40 CFR 136. The results are presented as Table 3-10:

3.2.4 Findings and Observations

3.2.4.1 Category I

None

TABLE 3-10

ANALYSIS OF SOILS IN VICINITY OF OLD
HEALTH PHYSICS TANKS AT PINELLAS PLANT

Soil Sample I.D.	Tritium (pCi/g) ^a	Total Lead (ppm)	Total Chromium (ppm)	Total Cadmium (ppm)
1 Surface	<MDA	1.30	1.39	0.10
1 4' depth	<MDA	1.45	1.32	0.09
2 Surface	<MDA	4.00	2.78	0.23
2 4' depth	<MDA	3.82	2.92	0.22
3 Surface	<MDA	1.71	1.47	0.10
3 4' depth	<MDA	1.53	1.36	0.09
4 Surface	<MDA	3.53	3.33	0.15
4 4' depth	<MDA	2.30	2.04	0.20
5 Surface	<MDA	7.36	8.18	0.29
5 4' depth	<MDA	4.23	11.90	0.30
6 Surface	<MDA	6.63	9.50	0.27
6 4' depth	<MDA	1.84	3.20	0.11
7 Surface	<MDA	2.27	6.74	0.11
7 4' depth	<MDA	1.57	3.07	0.09
Background				
Surface	<MDA	3.40	2.61	0.06
4' depth	<MDA	3.08	0.71	0.54

Source: DOE, 1986d.

^a Minimum detectable activity (MDA) is based on counting efficiency and background associated with each sample; range is 1.9 to 82.5 pCi/g

3.2.4.2 Category II

None

3.2.4.3 Category III

None

3.2.4.4 Category IV

None

PRELIMINARY

3.3 Surface Water

This section provides a characterization of the surface water and the factors that influence it at and in the vicinity of the Pinellas Plant. Basic water sources and water usage information is presented, area patterns of surface water drainage are explained, and resultant wetlands areas and areas prone to flooding are indicated.

Also, historical and current sources of wastewater at the Pinellas Plant are described. A description of past and current methods of treatment and disposal of wastewaters from the plant is included.

3.3.1 Background Environmental Information

3.3.1.1 Water Sources and Water Use

The area of the Pinellas Plant is underlain by a number of layers of limestone (see Section 3.4). Collectively, these limestone formations are referred to as the Floridan aquifer. The Floridan is overlain by sand, silt, and clay of varying thicknesses. The more permeable beds and these overlying materials contain water and are called simply the Shallow aquifer. This aquifer is highly variable in distribution and thickness throughout the region, and it is generally considered a poor water source. The supply available is rather small and the quality is objectionable owing to its highly organic color and the concentration of iron and sulfates. The Shallow aquifer is nonartesian. It is separated from the Floridan aquifer by clays, silts, and marls that form a confining layer, making the Floridan an artesian aquifer.

Nearly all municipal, industrial, and agricultural water systems in the region are supplied by wells dug into the Floridan aquifer. Most of this water is supplied from well fields located in northeast Pinellas County or in Pasco and Hillsborough Counties respectively north and east of Pinellas. The City of Tampa, however, derives most of its water supply from the Hillsborough River, although groundwater from the Floridan aquifer supplements the river flow via discharge from the Crystal Springs into the river. It has been reported that all domestic water usage within 1.5 miles of the plant is supplied by municipal water systems (DOE, 1987); however, there are several permitted wells used for irrigation and several nonpermitted, small-diameter wells within this 1.5-mile radius. It is believed that some of these

wells may be used for nondrinking domestic purposes. See Section 3.4 for additional discussion of this issue.

The water in the Floridan aquifer is very hard. It contains some calcium, magnesium, and sulfate but is otherwise of very good quality. Since the entire state is underlain with salt water, potable water can be obtained only to certain depths. The depth to the base of the potable water ranges from near sea level along the coast to approximately 2000 feet below ground level in an area 45 miles inland and northeast of the plant site.

The dramatic increase in population in the Tampa Bay area has severely stressed the area's water supply and distribution systems. This has resulted in the necessity of periodic water usage restrictions. The region itself, however, has an adequate water supply for both current and predicted needs. Another difficulty has been the management of the total water resources in the Tampa Bay area. To alleviate this situation, the Florida Legislature has passed several laws to improve water management and comprehensive planning efforts. One of these acts, the Water Management Districts and Regional Water Supply Authorities Act, which became effective October 1, 1974, provided enabling legislation for the formation of regional water supply authorities. The Counties of Hillsborough, Pasco, and Pinellas, along with the Cities of St. Petersburg and Tampa, form the West Coast Regional Water Supply Authority. This group, together with the Southwest Florida Water Management District, is working toward alleviating these problems by developing well fields, expanding supply and distribution systems, and purchasing recharge areas.

3.3.1.2 Surface Water Drainage

Surface drainage is influenced by the general topography of the area. The most pronounced topographical feature in the county is the so-called "Pinellas Ridge." It is an area 3 to 4 miles in width bordering the Gulf of Mexico and extending north and south along the central portion of the county. It consists of gently rolling hills with summits of 85 to 95 feet above sea level. The ridge is drained by a series of short creeks on the east and west sides.

The northern portion of the county is drained underground by solution channels in the Tampa Limestone Formation, and by the Anclote River. The Hawthorn Formation, which consists of sandstone to calcareous grey clay, is not present in the northern portion of the county. The southern portion of the county, in which the Pinellas Plant is located, is drained by Long Bayou and Cross Bayou and their short natural tributaries, and by an extensive network of county drainage canals. In all, 22 separate drainage basins have been identified in Pinellas County (DOE, 1986). Figure 3-5 shows the location of the plant in Pinellas County in relation to Long Bayou and Cross Bayou.

There is no natural surface water on the Pinellas Plant site. Two man-made ponds (East Pond and West Pond) were formerly used to contain treated sanitary and neutralized industrial wastewaters (see Section 3.3.2), and there are two storm water retention ponds along the southern boundary of the site. The plant lies on the surface water divide of two drainage subbasins, as shown in Figure 3-6. Surface water in the Starkey Road Subbasin flows west and is carried by a county drainage ditch from the northwest corner of the site in a southwesterly direction. Surface water in the Cross Bayou Subbasin flows southeast. Both routes empty into Boca Ciega Bay and ultimately the Gulf of Mexico.

3.3.1.3 Wetlands and Flooding

Groundwater exists in relative abundance in the shallow aquifer throughout the county at only a few feet below the ground surface. Because of the frequency of sinkholes and depression areas, small wetlands are dispersed in many locations around the plant. Figure 3-7 shows the location of wetland areas in the immediate area of the plant.

The plant site is about 17 to 18 feet above sea level. Because the 100-year tidal flood is expected to reach a level of 11 feet above sea level, flooding at the plant site is not regarded as a significant hazard (DOE, 1987). Figure 3-8 shows the location of flood-prone areas around the plant.

LOCATION OF THE PINELLAS PLANT
IN PINELLAS COUNTY

FIGURE 3-5

FIGURE 3-6

SURFACE DRAINAGE DIVIDE

Source: DOE 1987

WETLANDS AREAS

FIGURE 3-7

FLOOD PRONE AREAS

FIGURE 3-8

3.3.2 General Description of Pollution Sources and Controls

3.3.2.1 Sources of Liquid Waste

In the plant's operation, five types of liquid waste are generated. Liquid solvent and hazardous chemical wastes are one type. They are kept in small containers (1-gallon cans up to 55-gallon drums) at the points of generation throughout the plant. These liquid wastes are collected daily, weekly, or monthly by plant waste management personnel and removed to a central liquid waste storage area in Building 1040. See Section 4.1 for a more complete description of liquid waste handling and disposal. The other four types of liquid waste at the Pinellas Plant are all wastewaters. These include sanitary wastewater, potentially radioactive wastewater, industrial wastewater (also called chemical waste), and stormwater. Separate collection, treatment, and control systems have been provided for each type of wastewater. A thorough description of these systems is provided in Section 3.3.2.3.

Sanitary Wastewater

Sanitary wastewater is generated from each of the major buildings on the Pinellas Plant. The major sources are bathrooms, locker rooms containing shower facilities, sinks, drinking water fountains, and the Building 100 cafeteria and scullery. In several areas of Building 100, floor drains are connected to the sanitary sewer system. Some types of nonsanitary wastewater are also discharged into the sanitary wastewater sewer system. These include parts washing sinks in which materials, mostly metals and ceramics, are washed with deionized water and/or tap water with detergent. Some hood sinks used for the same purpose are believed to discharge similarly into the sanitary drain system. Although there are blueprint plans available for all areas of the plant, the many additions to the structure of Building 100 and the resultant almost yearly relocation of manufacturing and engineering functions from room to room have resulted in confusing alterations to the sanitary sewer system. There is no site-wide or building-wide plan of the as-built status of sanitary drains and pipes, and most sanitary floor drains are not labeled as required by plant standard operating procedures. As a consequence, many area supervisors in Building 100 and in other major site buildings are unsure as to whether floor and industrial sink drains are connected to the sanitary or

industrial (chemical) collection system. Hence, discharges of acidic or caustic wastewater may be going directly to the sanitary sewer system rather than the industrial wastewater neutralization facility.

Although sanitary wastewater is generated 24 hours a day, most of the generation occurs during the day shift from 7:00 a.m. to 3:30 p.m. Only guards and a small percentage of the work force are present at the plant for the second and third shifts, and the cafeteria in Building 100 is only open from approximately 6:30 a.m. to after lunch.

Potentially Radioactive Wastewater

Wastewater generated in the areas of Building 100 where tritium is used may contain small amounts of that isotope. This wastewater is transported in a separate sewer system and collected in aboveground storage tanks for tritium analysis and ultimate batch disposal. During the 1970s, those potentially tritium-containing wastewaters that were suspected of being acidic were directed to a neutralization pit near the southwest corner of Building 100. The pit contained a pH sensing unit that metered a sodium hydroxide solution into the pit to neutralize acidic effluents. The equipment was installed to protect the holding tank from corrosion by acids, but was reported by the Pinellas Plant personnel to never have been needed.

Before 1986, three holding tanks for potentially radioactive wastewater, each with a capacity of 10,000 gallons, were located underground adjacent to the southwest corner of Building 100. These tanks were commonly referred to as the health physics tanks. The system of operation involved using one tank until it was 70 percent full, then switching to the second one. The contents of the first tank were then analyzed for compliance with the Pinellas Plant discharge guideline--i.e., 0.9 curie for one tank as of 1975 (ERDA, 1975). Wastewater falling within the guideline was batch-discharged to the combined-effluent disposal system. The third tank was always maintained as a standby. In 1986, the three underground tanks were removed from service because of concerns that leaks had contaminated soil and potentially the groundwater in the area with tritium. Three new aboveground fiberglass tanks were constructed in a diked area adjacent to the industrial wastewater neutralization plant. These tanks are now in use. Additional discussion of the pollution potential of the unused tanks is contained in Sections 3.4 and 4.5.

The method for sampling and analysis of the new aboveground tanks is contained in Sections 4.3 and 4.4. A closure plan for excavation of the old, now abandoned health physics tanks has been submitted to the state for approval.

Industrial Wastewater

All nonsanitary, nonradiological process wastewater is discharged to a separate sewer system sometimes called the "chemical drain" or "chemical sewer." This wastewater has many sources:

- Metal plating and metal finishing rinse bath overflows containing various acids and caustics*
- Laboratory wastes
- Wastewater from the cleaning of parts with deionized water and detergent to remove traces of oils, solvents, and other chemicals
- Cutting and machining contact-cooling waters containing water-soluble lubricants
- Wastewater from the "vapor blasting" of metal and ceramic parts with abrasives in an aqueous slurry
- Cooling tower blowdown

* With a few exceptions (see Section 3.3.4), metal plating/finishing concentrated-acid or caustic baths are not batch discharged to the sewer system. When they are batch-dumped two or three times per year, plating wastes are containerized and handled as hazardous wastes. Rinse baths, which contain carryover of contaminants, are normally continuously discharged.

- X-Ray and photographic development wastewaters, including rinse bath overflows, developer and fixer bath continuous overflows, and batch dumped development chemicals
- Wastewater from the washing out of ball mills and mixing devices used to process ceramics
- Chemical spill sump wastewater from floor washdown

Most of the industrial wastewater sources are in Building 100. All of the other buildings at the Pinellas Plant were inspected for sources of industrial wastewater with the following results:

Building 800

Only two potential sources of industrial wastewater were noted; however, both were connected to the sanitary sewer system. The first source is a lab hood sink drain fitted with a manually operated holding tank. The sink is intended for use in cleaning parts with deionized water. The second is a floor drain located close to a tank of Marcol Oil (a high-purity mineral oil) containing electronic pulse forming network equipment.

Building 400

Three sources of industrial wastewater were noted in this building. The first is floor drains, one of which is under a glovebox line for processing encapsulated plutonium. This drain has the potential to receive lubricating oil leaks and liquid nitrogen spills as well as any other chemical spills on the floor. The second source is spent water-soluble coolant from two wafer slicing machines used in the production of thermopiles. Approximately 5 gallons per week of Cincinnati Miltron "Cimplus 80" and "Cimclean 30" mixed in water is discharged to the industrial sewer after once-through machine cooling. This source only exists during thermopile construction, which is not regular. The third source of industrial wastewater is a decontamination shower. It has a separate outside belowground holding tank and is not connected to the industrial sewer.

Building 700

A concrete pad and associated sedimentation tank/sump are located behind Building 700. This pad, called the tractor wash station, is used to clean lawn mowers, heavy equipment, and parts with water to remove dirt, grass, and debris. The wastewater from the pad sump is pumped to the industrial sewer main lift station.

Building 200

No sources of industrial wastewater were noted.

Building 500 and Cooling Towers

Building 500 contains zeolite water softeners that are regenerated with brine, and ion exchange columns that are backwashed with acid and caustic solutions. Both of these wastewaters are discharged to the industrial sewer system. The total deionization system consists of three parallel banks of water softeners followed by the cation and anion exchange units. Normally, one bank is regenerated and backwashed on Tuesday, one on Wednesday, and one on Thursday.

The entire plant is served by one six-cell cooling tower that is immediately adjacent to Building 500. Blowdown from the cooling tower is a significant source of industrial wastewater. The cooling tower system consists of a closed loop fed by six 2700-gpm pumps with three in-line, mixed-media pressure filters and four in-line microscreens. The collection basin at the base of the cooling tower is intermittently blown down to a pump station sump. The blowdown is controlled by the total conductivity of the cooling water. In the summer the system releases blowdown every few minutes to maintain desired water quality, and in winter blowdown may be as infrequent as once every 1 or 2 days. The pressure filters are backwashed once every 30 days and the microscreens are continuously backwashed. All backwash and blowdown is collected in a circular sump approximately 6 feet in diameter and 10 feet deep. This sump is pumped, when full, to the main industrial wastewater lift station on the west side of Building 100. The pump is activated by a level control switch in the sump.

The caustic biocide, Dearcide 900, which contains potassium hydroxide, is added continuously. To maintain cooling tower water pH at 7.5 (raw water pH is approximately 7.5), about 110-130 gallons of concentrated sulfuric acid is added to the system per year. It is estimated that an average of 550 gallons per year of Dearcide 900 is used. Two shock treatment biocides are also used; each is applied once per week on alternate weeks. Dearcide 702 is added in 27 gallons per dose, and Dearcide 717 is added in 15 gallons per dose. The entire volume of the cooling tower system is 18,000 gallons.

Building 600

Building 600, which is used to store hazardous raw materials, contains spill collection sumps in the floor of each cell. These sumps are piped separately, without being valved, to adjacent outside collection tanks. Five such tanks exist, one each for flammables, acids, oxidizers, alkalines, and toxics. These tanks are pumped one at a time by a common diaphragm pump to the main industrial wastewater lift station. Because of improper drainage on the concrete pad surrounding Building 600, rainwater can enter the doors and flow into the sumps. Additionally, poor surface drainage control allows rainwater to seep directly into the outside collection tanks. As the tanks fill up with rainwater, floor washings, and any spilled chemicals, they are manually pumped out, one at a time, to the industrial treatment facility. This pumping occurs when the tanks are 75 percent full and total conductivity is below a set limit. This limit is believed to be 1000 micromhos, although it is not recorded in the plant procedures.

Stormwater

Stormwater is generated by runoff from the paved areas (mainly parking lots) around the plant and by road drainage waters. This water is carried by a collection system of catch basins and piping to one of three locations: East Pond, the twin south retention ponds, or a drainage ditch at the southwest corner of the plant property. No stormwater is currently discharged to West Pond, which only receives overland runoff from the immediate area. East Pond discharges into a drainage culvert, which flows south under Belcher Road, east in a culvert under Bryan Dairy Road to a county drainage ditch, then south into Cross Bayou Canal (see Figure 3-9).

DISCHARGE FROM EAST POND

FIGURE 3-9

The south stormwater ponds flow under and across Bryan Dairy Road and into a drainage ditch that flows southeasterly along the east side of the railroad. This ditch is the same one that receives discharge from the southwest corner of the site.

3.3.2.2 Wastewater Treatment and Disposal

Sanitary Wastewater Treatment

Sanitary wastewater was treated by an extended-aeration package treatment system from the opening of the plant until about 1965. The package treatment plant was immediately west of the current industrial wastewater neutralization facility (see Figure 3-10). A more permanent treatment plant consisting of in-ground concrete tanks was built at the same location in 1965. The new plant featured an activated-sludge system with primary and secondary sedimentation. The capacity of the in-ground activated-sludge system was doubled in 1972 with a second, parallel group of clarifiers and aeration tanks. When all sanitary and industrial wastewater was diverted to the Pinellas County Publicly Owned Treatment Works (POTW) in December 1982, the activated-sludge treatment plant was abandoned. The sanitary wastewater is now discharged untreated and mixed with neutralized industrial and untreated radiological wastewaters. The South Cross Bayou Pollution Control facility to which the effluents are being piped has a capacity of 28.5 million gallons per day (mgd) and currently has an average daily flow in the range of 20-24 mgd.

Radiological Wastewater Treatment

Potentially tritiated wastewaters are now collected in three aboveground fiberglass tanks and discharged, after analysis for the concentration of tritium, into the main industrial wastewater lift station and through the industrial wastewater neutralization facility (see Figure 3-10). The tanks formerly used for this purpose are located underground at the southwest corner of Building 100 and are now in the process of being excavated.

FIGURE 3-10

PINELLAS PLANT SEWER SYSTEMS

Source: Gray 1987

Industrial Wastewater Treatment

Industrial wastewaters are pumped to the main industrial lift station on the west side of Building 100 from two major satellite industrial pump stations, one west of Building 400 and the other at the southeast corner of Building 100 (see Figure 3-10). From this pump station, which has two 300-gpm pumps operated by float switches, industrial wastewater is pumped to a treatment plant (completed in 1986) for neutralization.

The wastewater (industrial and radiological combined) first enters a 30-foot-diameter poured-in-place concrete buffering tank that has a clarifier-type peripheral serpentine weir and a central mixer suspended from a bridge. The tank has 14 feet of usable depth to the weir and a capacity of 75,300 gallons. Although the design plans refer to this tank as an "equalization tank", a term that is commonly used for flow equalization, it is designed only to operate full and is therefore not accomplishing flow equalization. Plant personnel state that the tank was designed for pH equalization only. Monitors for pH in the drop pipe discharge to this tank were originally supposed to automatically control sulfuric acid and caustic addition to the tank influent. This system was unsuccessful, evidently because of improper location of the pH sensors and oversizing of the chemical metering pumps. A portable pH probe was installed in the "equalization tank" and now manual readings are taken once every 2 hours to adjust chemical metering pumps temporarily set up at the main influent lift station. These pumps dose acid and caustic to the wet well from 4-foot plastic cube containers, which have no containment.

The effluent from the equalization tank flows in series through two cast-in-place open circular tanks, also with peripheral serpentine weirs, called neutralization tanks 1 and 2. These tanks may also be run in parallel. Each tank is 25 feet in diameter, tank 1 being 13 feet 9 inches deep and tank 2 11 feet 9 inches deep. Tank 1 contains 35,800 gallons in parallel operation and 45,000 gallons in series. Tank 2 contains 35,800 gallons in each mode. Both tanks are equipped with pH electrodes. In the manner previously described for the influent pump station, portable acid and caustic are currently being added to tank 1 based on pH readings in tank 2. The discharge from neutralization tank 2 is then directed to one of the two aeration tanks of the now-abandoned sanitary-wastewater-activated sludge plant. It is

batch collected there before discharge by pumping to the industrial wastewater parshall flume after pH measurement and final pH adjustment by manually controlled metering pumps, which deliver acid and caustic from temporarily installed 55-gallon drums.

This neutralized industrial wastewater is combined with the untreated sanitary wastewater and discharged through a combined parshall flume into the POTW system sewer which services the plant. The County Sewer System has recently installed a flow measuring and sampling station in the vicinity of West Pond at the request of the county (see Figure 3-10).

Before the above-described industrial neutralization system, a simpler system was operated between 1968 and 1986 to the north of Building 700. This facility consisted of an aboveground, 20,000-gallon steel buffering tank that discharged into an open, 1,000-gallon concrete basin. Control of pH was accomplished in the small basin prior to discharge.

Wastewater Disposal

Between 1972 and 1983, a combination of treated sanitary wastewater and neutralized industrial wastewater was discharged to West Pond and through a spray irrigation system (Figure 3-11). The irrigation system covered 18 acres with 40 sprinkler heads underlain by 4-inch-diameter PVC collection pipes 3 to 5 feet underground. The discharge from this irrigation system, which was designed to reduce biochemical oxygen demand and total suspended solids, was piped to East Pond. During the period from 1968 until about 1978, East Pond discharged into an open ditch on the west side of Belcher Road and flowed north approximately 0.5 mile to a westerly flowing drainage ditch. This ditch flowed into a lake approximately 0.5 mile north of the northwest corner of the plant property. The lake discharges to the Seminole Bypass Canal and into Long Bayou. According to current plant employees, the East Pond discharge was rerouted south along Belcher Road (see Figure 3-9) because of concern over increased residential development around the lake. It should be noted that there is a closed, private landfill adjacent to the east side of the referenced lake. Additionally, the east-west drainage canal

Not to scale

Source: ERDA, 1975

FORMER SPRAY IRRIGATION TREATMENT SYSTEM

FIGURE 3-11

feeding the lake probably received drainage from several other sources along Belcher Road, and the canal is reported to have been dredged every few years.

Between 1968 and 1972, neutralized industrial wastewater was discharged directly to East Pond. During that time, treated sanitary wastewater was discharged along with radiological ("health physics") wastewaters to a ditch at the southwest corner of the plant. Prior to 1968, industrial wastewater that had passed through lime-rock-filled pump station sumps was also discharged to this ditch. Table 3-11 lists the dates of discharge of various wastewaters from the plant site.

3.3.3 Environmental Monitoring Program

3.3.3.1 Monitoring Since December 1982

On-Site Monitoring

Since December 1982, all wastewater from the Pinellas Plant, with the exception of stormwater, has been discharged to the Pinellas County POTW.

The two stormwater discharge points (see Section 3.3.2) are monitored for tritium only. Although no plant effluents other than stormwater are directed to East Pond, trace quantities of residual tritium are contained in the pond and presumably in precipitation. During 1985, 51 grab samples of the East Pond overflow were analyzed. Tritium concentrations detected ranged from 5.6×10^{-7} microcurie per milliliter to 3.2×10^{-6} microcurie per milliliter (DOE, 1986b). Measurements of the East Pond discharge for tritium in years since 1983 have been in the same range. The 1983 total calculated discharge of 0.73 curie of tritium in 1.09×10^7 liters of water discharged from East Pond is also typical.

Since connection to the POTW, monthly 24-hour flow-proportional composite samples of the sanitary wastewater, industrial wastewater, and the combined total effluent have been analyzed. The combined and industrial samples are analyzed for the POTW sewer use ordinance parameters shown in Table 3-12, which provides a typical month of discharge data. Measurements of the individual and combined discharges for pH are also obtained every 2 hours and averaged and recorded daily.

**TABLE 3-11
CHRONOLOGICAL RECORD OF WASTEWATER DISCHARGES**

Wastewater Source	Discharge to S.W. Ditch		Discharge to East Pond		Discharge to West Pond		Discharge to POTW		Discharge to Spray Irrigation Field	
	Began	Ended	Began	Ended	Began	Ended	Began	--	Began	Ended
Sewage Treatment Plant	1957	10/11/73			10/11/73	8/29/82	8/29/82			
Industrial Wastewater W. side of 100	1957	7/68	7/68	9/6/72	9/6/72	12/1/82	12/1/82			
Health Physics Holding Tanks (tritium)	1957	12/2/70	12/2/70	9/6/72	9/6/72	12/1/82	12/1/82			
West Pond									9/5/72	~4/83
Cooling Tower Blowdown	1957	4/14/69	4/14/69	~11/72	~11/72	12/1/82	12/1/82			
Incinerator Scrubbing H ₂ O	*	12/23/70	12/23/70	*						

	Discharge to East Pond		Discharge north on Belcher, West to Lake Seminole Bypass Canal, South to Long Bayou		Discharge south on Belcher to Bryan Dairy Road, East to ditch, South to Cross Bayou	
	Began	Ended	Began	Ended	Began	Ended
Spray Irrigation Field Underdrain	9/5/72	12/1/82				
East Pond			early 1968	4/78	4/78	currently the direction (5/87)

Source: Gray, 1987

* Unknown dates

TABLE 3-12
WASTEWATER DISCHARGE ANALYSES, JANUARY 1987

Parameter	Industrial Wastewater ^a (mg/l)	Combined Effluent ^a (mg/l)	Effluent Limits (mg/l)
Arsenic	0.001	0.001	0.1
Barium	0.020	0.021	1.0
BOD-5	2.8	39.1	250.0
Boron	<0.04	0.08	1.0
Cadmium	<0.005	<0.005	0.2
Chromium - Total	0.006	<0.001	2.0
Chromium - Tri.	0.006	<0.001	1.0
Chromium - Hex.	<0.01	<0.01	1.0
Copper	0.12	0.11	1.0
Cyanide	<0.05	<0.05	0.8
Iron	0.37	0.42	5.0
Lead	0.03	<0.02	0.1
Manganese	0.01	0.02	1.0
Mercury	0.0002	0.0002	0.1
Nickel	<0.05	<0.05	1.0
Phenolics	<0.001	0.006	0.1
Selenium	<0.002	<0.002	0.05
Silver	0.021	0.017	0.05
Sulfate	86.8	81.2	No limit
Sulfide	<1.0	<1.0	50.0
Suspended Solids	10.15	71.42	250.0
Zinc	0.09	0.09	0.08

Source: Pinellas Plant monthly reports to POTW, 1987.

^a Analytical data represent a proportional 24-hour flow sample taken during a normal day of operation.

Tritium measurements of the combined and industrial discharge are also obtained daily. Table 3-13 provides a typical month of such data. The total annual discharge of tritium to the POTW is approximately 0.5 curie. As can be seen on Table 3-12, all sewer use ordinance limits except that for zinc are met by the Pinellas Plant for the month shown: January 1987. For other months, both zinc and silver have been in excess of County limits. During 1985 the range of measured monthly zinc analyses was 0.06-0.19 milligram per liter compared with a limit of 0.08 milligram per liter. In that year, six of twelve zinc analyses exceeded 0.08 milligrams per liter. During the same year of 1985, the range of monthly silver analyses was 0.003-0.062 milligram per liter in relation to a limit of 0.016 milligram per liter (DOE, 1986b). The source of the silver is film developing processes. It is felt by the plant also that the zinc "resulted from galvanized piping in the older portions of the plant's potable water distribution system" (DOE, 1986b). Before startup of the new industrial wastewater neutralization facility in 1986 (see Section 3.3.2), there were regular pH excursions outside of the County limit of 6.0-8.0. According to the DOE (1982), the pH reached 3.5 on one day and 4.5 on another in 1982. No analyses of the industrial, sanitary, or combined effluent for organic chemicals are conducted, and analyses thereof for priority pollutants have been limited to those parameters in Table 3-12 for which there are county sewer use ordinance limits. It was reported that one sample was analyzed for organic chemicals by the County "several years ago with satisfactory results", however the data could not be located by either the plant or the County Sewer District.

Off-Site Monitoring

The area surrounding the plant was divided into eight equal, pie-shaped segments, the center line of each being one of the major compass points. These segments were further divided by arcs at distances of 3.2, 6.4, and 9.6 kilometers (2, 4, and 6 miles). This procedure resulted in a total of 24 sectors. With the exception of the 6.4- to 9.6-kilometer (4- to 6-mile) northeast sector (mostly in Tampa Bay), samples of surface water from ponds, lakes, and ditches are collected quarterly from each location and analyzed by liquid scintillation counting for tritium content. During 1985, 69 samples were analyzed. The average concentration of tritium detected in 1985 was less than 1.1×10^{-7} microcurie per milliliter, as reported in the 1985

**TABLE 3-13
WASTE WATER DISCHARGE ANALYSES BY DAY, JANUARY 1987**

Date	Combined Discharge (Domestic plus Industrial)			Remarks	Industrial Discharge		
	Estimated Daily Flow (Gallons)	pH (Average of Analyses made every two hours)	H-3 (μ Ci/l) (Composite Sample)		Daily Flow (Gallons x100) Hrs. pump X Avg. Rate	pH (Composite Sample)	H-3 (μ Ci/l) (Composite Sample)
1	20,100	7.1	.01930		No data available	7.7	.01932
2	24,600		.02928		"	7.9	.02973
3	58,100	7.1	.02968		"	7.8	.03060
4	43,400	7.2	.02236		"	7.9	.02314
5	123,900	7.2	.00956		"	7.8	.01204
6	139,400	7.3	.00363		"	7.5	.00503
7	179,400	7.1	.00325		"	7.4	.00425
8	131,200	7.1	.00311		"	7.4	.00409
9	109,000	6.9	.00133		"	7.3	.00171
10	132,900	6.8	.00385		"	7.1	.00375
11	114,600	7.2	.00304		"	7.6	.00411
12	142,700	7.4	.00035		"	7.8	.00071
13	147,000	7.2	.00067		"	7.6	.00049
14	151,300	7.1	.00140		"	7.7	.00140
15	165,300	7.2	.00255		"	7.8	.00348
16	157,800	7.1	.00223		"	7.6	.00259

TABLE 3-13
WASTE WATER DISCHARGE ANALYSES BY DAY, JANUARY 1987 (continued)

Date	Combined Discharge (Domestic plus Industrial)			Remarks	Industrial Discharge		
	Estimated Daily Flow (Gallons)	pH (Average of Analyses made every two hours)	H-3 ($\mu\text{Ci/l}$) (Composite Sample)		Daily Flow (Gallons x 100) Hrs. pump X Avg. Rate	pH (Composite Sample)	H-3 ($\mu\text{Ci/l}$) (Composite Sample)
17	99,600	7.1	.00256		No data available	7.7	.00249
18	95,600	7.2	.00527		"	7.9	.00312
19	163,800	7.4	.00395		"	7.9	.00375
20	158,600	7.3	.00409		"	7.8	.00478
21	135,800	7.1	.00407		"	7.4	.00400
22	146,900	6.9	.00385		"	7.6	.00322
23	100,400	7.2	.00206		"	7.5	.00245
24	117,000	7.0	.00156		"	7.6	.00169
25	125,900	7.0	.00167		"	7.8	.00145
26	159,800	7.0	.00115		"	7.7	.00142
27	184,200	7.0	.00065		"	7.7	.00080
28	128,500	7.0	.00176		"	7.6	.00045
29	138,700	7.1	.00085		"	7.6	.00102
30	141,700	7.2	.00117		"	7.5	.00121
31	108,400	6.9	.00116		"	7.4	.00143
Total Flow	3,845,600				"		

Source: Pinellas Plant monthly reports to POTW, 1987.

Environmental Monitoring Report. The highest reading was 0.32×10^{-6} microcurie per milliliter. Sampling locations are shown in Figure 3-4.

Sludge Monitoring

The industrial wastewater neutralization system started up in 1986 will keep any settleable materials in suspension in the "equalization tank" by mechanical mixing. The mixing was designed to aid in pH equalization of the influent wastewaters. Sludge was expected to collect in neutralization tanks 1 and 2; however, facilities were installed to pump the sludge from these tanks into a two-bay, uncovered sludge drying bed with underdrains for leachate recovery. Analyses of samples of the neutralization tank sludge obtained in December 1986 are shown in Table 3-14. Although these analyses do not show the sludge to be a characteristic hazardous waste by the criteria of the Resource Conservation and Recovery Act (RCRA), the presence of electroplating operations has led the Pinellas Plant to conclude that the sludge should be handled as a hazardous waste. The sludge drying beds designed for the facility were never completed and have never been used. The plant has no standard procedure or equipment for either measuring the quantity of sludge currently in the neutralization tanks, and the rate of its buildup, or removing and disposing of the sludge.

Removal of sludge from the basin at the base of the previously described six-unit cooling tower adjacent to Building 500 is accomplished by use of a commercial vacuum truck. During a recent shutdown of the tower, some sludge which was removed during cleaning of the towers was analyzed. The results are presented as Table 3-15.

3.3.3.2 Monitoring Prior to December 1982

National Pollutant Discharge Elimination System Permit Monitoring

The Pinellas Plant was issued a National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge Permit effective December 13, 1976. The permit required 24-hour composite sampling twice per month for the East Pond discharge

TABLE 3-14
NEUTRALIZATION TANK SLUDGE ANALYSES

Date Samples Received: 12/19/86

Sample Identification	Parameter	Concentration ^a
Neutralization Tank #2 Sludge Sample #169	Total Nickel	43.0 ppm
	Total Iron	1400 ppm
	Total Tin	165 ppm
	Total Copper	616 ppm
	EP Toxicity	
	Arsenic	< 0.05 mg/l
	Barium	< 1 mg/l
	Cadmium	< 0.05 mg/l
	Chromium	< 0.05 mg/l
	Lead	< 0.1 mg/l
	Mercury	< 0.01 mg/l
	Selenium	< 0.1 mg/l
	Silver	< 0.01 mg/l
Neutralization Tank #1 Sludge Sample #170	Total Nickel	86.7 ppm
	Total Iron	2200 ppm
	Total Tin	145 ppm
	Total Copper	424 ppm
	EP Toxicity	
	Arsenic	< 0.05 mg/l
	Barium	< 1 mg/l
	Cadmium	< 0.05 mg/l
	Chromium	< 0.05 mg/l
	Lead	< 0.1 mg/l
	Mercury	< 0.01 mg/l
	Selenium	< 0.1 mg/l
	Silver	< 0.01 mg/l
Neutralization Tank #1 Sediment Sample #168	Total Nickel	59.9 ppm
	Total Iron	1950 ppm
	Total Tin	191 ppm
	Total Copper	806 ppm
	EP Toxicity	
	Arsenic	< 0.05 mg/l
	Barium	< 1 mg/l
	Cadmium	< 0.05 mg/l
	Chromium	< 0.05 mg/l
	Lead	< 0.1 mg/l
	Mercury	< 0.01 mg/l
	Selenium	< 0.1 mg/l
	Silver	< 0.01 mg/l

^a Key: mg/l, milligrams per liter; Btu/lb, British thermal units per pound; g/cm³, grams per cubic centimeter; s.u., standard unit; %, percent by weight.

Source: Gulf Coast Environmental Analytical Report of 1/31/86

TABLE 3-15
COOLING TOWER SLUDGE ANALYSES

Date Samples Received: 1/24/86

Sample Identification	Parameter	Concentration ^a
Cooling Tower Sludge 500 Building Sample Number 105	Aluminum	52.1 mg/l
	Ammonia Nitrogen	2,140 mg/l
	Arsenic	< 10 mg/l
	Barium	60 mg/l
	Cadmium	4.27 mg/l
	Chloride	556 mg/l
	Chromium	53.4 mg/l
	Copper	651 mg/l
	Cyanide, total	< 1.0 mg/l
	Density	1.00 g/cm ³
	Flash Point	> 200°F
	Fluoride	< 10 mg/l
	Heat Content	< 1,000 Btu/lb
	Iron	1,050 mg/l
	Lead	85.1 mg/l
	Mercury	< 0.02 mg/l
	Nickel	5.67 mg/l
	pH	7.32 s.u.
	Pesticides/Herbicides	< 1.0 mg/l
	Phenol	11.6 mg/l
	Phosphate	3,120 mg/l
	Potassium	984 mg/l
	Selenium	< 0.1 mg/l
	Silver	0.14 mg/l
	Sodium	30 mg/l
	Solids, total	28.8 %
	Sulfate	167 mg/l
	Sulfide	254 mg/l
	Thallium	< 1.0 mg/l
	Total Organic Carbon	41.2 %
	Total Organic Halogens	1.1 %
	Water	54.8 %
	Zinc	530 mg/l

^a Key: mg/l, milligrams per liter; Btu/lb, British thermal units per pound; g/cm³, grams per cubic centimeter; s.u., standard unit; %, percent by weight.

Source: Gulf Coast Environmental Analytical Report of 1/31/86

TABLE 3-15 COOLING TOWER SLUDGE ANALYSES (continued)

Date Samples Received: 1/24/86

Sample Identification	Parameter	Concentration ^a
Cooling Tower Sludge 500 Building Sample Number 105	Extraction procedure toxicity	
	Cadmium	<0.05 mg/l
	Chromium	2.6 mg/l
	Lead	11.4 mg/l
	Physical state	Liquid
	Reactivity	Low
	Layering	Two layers
	Color	Colorless liquid over black solids
	Odor	Strong septic
	Waste classification	Hazardous
	DOT shipping description	Hazardous waste
	DOT hazard class	liquid, n.o.s.
	Placarding	ORM-E
	EPA hazard class	None
	Toxicity	D008
	Oral	Low
	Dermal	Low
	Inhalation	Low

^a Key: mg/l, milligrams per liter; Btu/lb, British thermal units per pound; g/cm³, grams per cubic centimeter; s.u., standard unit; %, percent by weight.

Source: Gulf Coast Environmental Analytical Report of 1/31/86

point. Parameters for which analysis was required included biochemical oxygen demand, suspended solids, fecal coliforms, total nitrogen, and total phosphorus. Additional parameters for which monthly or quarterly sampling and analysis were required included arsenic, chlorides, total chromium, copper, cyanides, detergents, fluorides, iron, lead, mercury, phenols, oil and grease, zinc, and turbidity.

During the years between 1977 and 1981, when permit monitoring was conducted, the Pinellas Plant Annual Environmental Monitoring Reports showed permit limit excursions for pH, suspended solids, fecal coliforms, iron, mercury, and phenols.

Spray Irrigation System Monitoring

In conjunction with installation of the spray irrigation system in 1972, analyses of samples from West Pond, the irrigation field sump, and East Pond were performed to assess the degree of treatment provided by the irrigation system and to ensure compliance of the East Pond discharge with Florida state standards for sanitary wastewater discharge. The parameters analyzed for included biochemical oxygen demand, chemical oxygen demand, copper, dissolved oxygen, dissolved solids, fluorides, iron, lead, nitrogen, oil and grease, phosphorus, sulfates, suspended solids, and zinc.

Cyanide Investigation in West Pond

Analysis of the water sample obtained in October 1978 from West Pond indicated 6 ppb cyanide. Subsequent analyses of two additional samples later in the same month indicated 12 ppb and 9 ppb cyanide. Since the NPDES permit limit for cyanide was <2.0 ppb, an investigation was instituted to determine the sources of the cyanide discharge.

Following formation of a committee, an extensive sampling program of materials and drain systems was instituted. In excess of 300 analyses were performed with the following conclusions:

1. Cyanides were present in West Pond. They had been entering the pond for some time and were continuing to be introduced.

2. A series of events were responsible for the cyanides detected on October 18, 1978. The vacuum pumps on the deionized-water system were deteriorating, and this reduced their carbon dioxide removal efficiency. This resulted in the need for more frequent resin regeneration to maintain deionized-water quality.

More frequent regeneration results in the use of more acid, which is discharged to the industrial waste system. Acids are normally neutralized by the addition of caustic at the neutralization facility. However, on or about October 18, 1978, while repairs were being made to a broken valve at the neutralization facility, the effluent flow was diverted to by-pass the facility, and acids were thus discharged to West Pond. This reduced the pH level from a normal of 6-8 to less than 3. Also during these repairs, the neutralization facility holding tank was drained. This allowed the sludge in the bottom of the tank to flow into West Pond. Because the sludge had high-oxygen-demand characteristics, the three floating agitators in West Pond were activated to increase the oxygen level. This action caused movement and mixing of the sludge at the bottom of the pond. The cyanides present in the agitated pond sludge were liberated by the low pH and also by sunlight.

3. There were several sources of cyanide discharges from the plant. These included the following:
 - a. There was an inadequate cyanide waste collection container in a hood in 154-Area. The container was changed.
 - b. The contents (approximately 40,000 gallons) of the circulating hot chilled-water systems contained on the order of 40 ppb cyanide. A leaking county water makeup valve (ultimately repaired) resulted in daily discharges from the system. The source was found to be the water treatment compound, Dearborn 727, used in the system.
 - c. The multilith machine in 115-Area of Building 100 turned out to be a major intermittent high-level source. During periodic cleaning of the machine, a small quantity of the multilith electrostatic solution

was discharged. Analysis of this material showed 3,900 ppm cyanide.

- d. Five synthetic cutting oils used for machining operations at various locations in the plant showed the following cyanide concentrations (in ppb): Cimcool 52 - 1030; trim regulator 3,300; Cimclean 30 14,000; Coolstream 83,000; and Cimpluss 49, 190,000.

- 4. Efforts to destroy the cyanides in the sludge in West Pond were necessary. Levels in 1978 showed approximately 300 ppb at the north end, 40 ppb in the center, and 70 ppb at the south end. Methods under consideration included addition of chlorine in liquid form, possibly in combination with permanganate. Adjustment of pH was also evaluated. The possibility of dredging was also to be investigated, but none of the above methods are believed to have ever been accomplished.

3.3.3.3 Pretreatment Program Baseline Monitoring Report

In accordance with the National Pretreatment Standards for Metal Finishing that became effective February 15, 1986, pursuant to the Clean Water Act of 1977, the Pinellas Plant prepared a Baseline Monitoring Report to be submitted to the Pinellas County Sewer System. The original report, dated February 23, 1984, was supplemented by a Compliance Status Report dated May 13, 1986. Both of these reports certified compliance with the pretreatment standards based on data compiled on seven 24-hour composite samples of the plant's total industrial wastewater for the period October 1985-April 1986. Table 3-16 lists the discharge data. As can be seen from the table, the analysis of total industrial wastewater discharge did not allow for separate analysis of metal finishing wastewater before its mixture with other types of industrial wastewater, as is required by the pretreatment regulations. Table 3-16 also shows that there were no analyses of the discharge for solvent chemicals, even though they are believed to be present as a result of the carryover of additives in metal finishing rinsewaters.

TABLE 3-16

COMPLIANCE STATUS REPORT -- METAL FINISHING CATEGORY

	Indus. Wastewater Pln. Plant Discharge		National Pretreatment Stds. (40 CFR, 433)		Combined Wastewater Pln. Plant Discharge		Pin. County Sewer Use Ordinance (mg/l)
	7-Samp. Avg (mg/l)	Range (mg/l)	Max. Day (mg/l)	30-Day Avg. (mg/l)	7-Samp. Avg. (mg/l)	Range (mg/l)	
Cadmium	<0.005	<0.005-0.006	0.69	0.26	<0.005	<0.005-0.005	0.2
Chromium	<0.021	<0.001-0.043	2.77	1.71	0.018	0.005-0.059	2.0
Copper	0.12	0.06-0.29	3.38	2.07	0.14	0.09-0.23	1.0
Lead	<0.02	All <0.02	0.69	0.43	<0.02	All <0.02	0.1
Nickel	0.14	0.08-0.25	3.98	2.38	0.11	0.05-0.18	0.1
Silver	0.03	0.006-0.090	0.43	0.24	0.020	0.003-0.062	0.05
Zinc	0.10	0.04-0.26	2.61	1.48	0.13	0.06-0.24	0.08
Cyanide	<0.06	<0.05-0.1	1.20	0.65	<0.10	<0.05-0.39	0.8
TTO(1)			2.13				

(1) Total Toxic Organics

Source: Base GENDD Compliance Monitoring Report, May, 1986

Material	Uses
Benzene	Lab reagent
Bromoform	Lab reagent
Butyl Benzyl phthalate	Lab reagent
Carbon Tetrachloride	Lab reagent
Chloroform	Lab reagent
1,2-Dichloroethane	Lab reagent
2,4-Dinitrophenol	Lab reagent
Di-m-Octyl Phthalate	Lab reagent
1,1,2-Trichloroethane	Lab reagent
Methylene Chloride	Parts cleaning
Tetrachloroethylene	Parts cleaning
1,1,1-Trichloroethane	Vapor degreasing
Trichloroethylene	Vapor degreasing

Note: Analyses were not performed for toxic organics which are listed in the Effluent Guidelines and Standards for Metal Finishing (40 CFR, 433). These materials were segregated and collected for off-site reclamation or disposal in accordance with the Plant's Waste Management Plan.

The Pinellas Plant was informed in a letter from EPA Region IV dated April 7, 1987, that although the DOE is in compliance with the county acceptance criteria, the pretreatment standards stipulated in the Clean Water Act, Section 437, are applicable and that the DOE must demonstrate compliance in a baseline monitoring report. Although the County Sewer System has not yet implemented its industrial permit system, the Pinellas Plant Baseline Monitoring Report will be used to establish permit limits that will ensure compliance with National Pretreatment Standards. The County Sewer System has indicated that it intends to issue such a permit for the Pinellas Plant sometime in 1987.

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

1. Toxic substances are being discharged to the Pinellas County Sewer System. Toxic substances such as spent acids, photographic developer solutions, and wastewaters with toxic constituents are being discharged to the plant's industrial sewer system. The toxic constituents of these wastes could disrupt the biological treatment system of the county's POTW, cause the POTW sludge to become toxic, or pass through the POTW untreated and be discharged to the environment.

Specific sources of toxic substances include the following:

- Metal plating and metal finishing wastewaters that contain acids, heavy metals, and organic chemical solvents and that are discharged at various locations in Building 100. At some of those locations, such as Room 143 in Building 100, concentrated baths of these substances are being batch-dumped (see finding 5 in Section 3.3.4.4). Room 143 contains at least three concentrated-acid baths, each with a capacity of approximately 30 gallons. These baths, which are batch-dumped once or twice per year, contain nitric, hydrofluoric, and sulfuric acids and are likely to be heavily contaminated with metals and other toxics. The spent acids have never

been analyzed for the EF-Toxicity characteristic to determine if they are regulated hazardous wastes due to contamination with metals.

- Photographic developer and fixing solutions discharged at four areas in Building-100 where X-ray and photographic solutions are continuously overflowed and batch-dumped. These solutions contain silver, other metals, and organic chemicals. The locations include the photographic laboratory in the Graphic services shop, the X-ray development laboratories in the dispensary (Room 336), and the X-ray testing laboratory (Room 131).
- Cooling tower blowdown discharged from the central cooling tower adjacent to Building 500. The discharge contains the following biocides:

Dearcide 702: 700 gallons per year containing 1.15 percent 5-chloro-2-methyl-4-isothiazolin-3-one and 0.35 percent 2-methyl-4-isothiazolin-3-one

Dearcide 717: 380 gallons per year containing perhaps 100 percent dimethyl benzyl ammonium chloride and bis(tributyltin) oxide

Dearborn 900: 550 gallons per year containing 12 percent potassium hydroxide

- Cutting oils Cimplus 80 and Cimclean 30 from the thermopile cutting machine area of Building 800. Cimclean 30 was tested by the plant and found to contain 14,000 ppb cyanide (GENDD, 1978). Two such cutting machines are in use periodically, and they can discharge up to about 250 gallons per year of the cutting oils after dilution with cooling water.
- Vapor blasting wastewaters from the aqueous grit solution cleaning of metal and ceramic parts in Rooms 112, 138, 183H, and 185 of Building 100. These wastewaters are generated during the day shift, 5 days per week, and are of an unmeasured volume. They potentially contain metals, organic solvent chemicals, phenolics, and possibly tritium.

Sampling and analysis of the vapor blasting wastewaters and the cooling tower blowdown is planned to better assess the toxicity of the discharges.

3.3.4.3 Category III

1. Soils and sediment in the Southwest discharge ditch may be contaminated. Past discharges of wastewaters containing organics, heavy metals, and tritium may have contaminated soil and sediment in a ditch at the southwest corner of the plant site.

These contaminated soils and sediments may have migrated off-site along a drainage ditch next to the railroad. The contamination may also extend farther along the drainage course, which eventually ends in Boca Ciega Bay. Any contamination of sediment and soil may be currently migrating farther off-site and acting as a source of surface water contamination.

From 1957, when the plant opened until 1968, all treated sanitary, untreated industrial wastewater and health physics tank (low-level tritiated) wastewater were discharged to this ditch. If wastewater then flowed in a drainage ditch along the railroad tracks to the southeast and into Cross Bayou Canal, which ultimately flows into Boca Ciega Bay.

Sampling and analysis is planned for the area of the ditch immediately off the plant property but north of Bryan Dairy Road to identify specific contaminants above background levels attributable to previous discharges.

2. Pond sediments are contaminated. Past discharges of wastewaters containing organics, heavy metals, and tritium may have contaminated sediments in West Pond and East Pond, groundwater beneath the spray irrigation system, and drainage ditches north along Belcher Road (between about 1968 and 1978) and south along Belcher Road (after about 1978). These contaminated sediments may be acting as continuing sources of groundwater contamination.

From 1968 to 1972, neutralized but otherwise untreated industrial wastewaters from the plant were discharged to East Pond. From 1973 to 1982, these industrial wastewaters plus treated sanitary wastewaters were discharged to West Pond, and then pumped through the spray irrigation system, collected, and discharged to East Pond. These discharges contained organic chemical solvents, acids, heavy metals, cutting oils, tritium, and possibly other contaminants. Sediment sampling in both ponds revealed at least one hazardous constituent as well as coal tar derivatives (DOE, 1987) (see Section 4.5 for additional data). The potential groundwater contamination in the area of the spray irrigation system is exacerbated or potentially overshadowed by the past direct disposal of solid wastes in both ponds and the suspected disposal of such wastes on or in the ground next to East Pond (see Sections 4.5 and 3.4). Additional groundwater monitoring studies currently under way by the Pinellas Plant will address this problem.

3.3.4.4 Category IV

1. The industrial wastewater neutralization system has design and operational problems. Problems in the design and operation of the industrial wastewater neutralization system may produce a combined wastewater discharge to the Pinellas County Sewer System with a pH of less than 6.0 or greater than 8.0, in violation of the County Sewer System Ordinance.

According to plant records and statements of operators, the system of manual pH titration of treated wastewater collected in the former sanitary aeration basin prior to batch pumping to the POTW is subject to human error. Moreover, the biweekly calibration of pH meters is not marked on pH record charts, so all past records of discharge pH are unusable. The practice of averaging instantaneous pH readings taken every 2 hours to determine a daily pH discharge is not in compliance with the regulation, which requires instantaneous continuous minimum and maximum pH readings for a 24-hour period. The present system of recordkeeping is therefore inadequate to determine pH compliance.

2. The pretreatment baseline monitoring report was incorrectly prepared. The pretreatment baseline monitoring report submitted to the Pinellas County

Sewer System pursuant to the Clean Water Act regulations reflected incorrect metal finishing treatment parameters. Sampling was not accomplished before the admixture of metal finishing wastewaters with other wastewaters from the Pinellas Plant site; only the total industrial wastewater discharge was measured. The combined-waste-stream formula of compensating for the dilution volume was not applied either. One of the two methods is required by EPA regulations (EPA, 1985).

3. Sludge buildup in neutralization tanks could result in toxic discharges. Excessive sludge buildup in the neutralization tanks or the 10:1 fluctuations in tank loading could result in sludge carryover with the POTW discharge. The daily flow has varied in the past from as low as 207,000 gallons per day (July 18, 1986) to 2,595,000 gallons per day (July 16, 1986). Because of its potential toxicity due to metals, this sludge is treated as a hazardous waste. There is no sludge-level measurement equipment in place, nor is there equipment or standard procedures for the removal of accumulated sludge.
4. Spill prevention, control, and countermeasures procedures are inadequate. Inadequate spill prevention, control, and countermeasure procedures have been applied to the storage of hazardous materials in close proximity to sanitary sewer floor drains and stormwater drains.

At some locations, hazardous materials without proper containment if leaked or spilled could flow into the sanitary drain system or stormwater drain system resulting in indirect discharge to the POTW, or to East Pond and thence to off-site drainage ditches. These locations include

- A roughly 1500-gallon tank of Markol oil (mineral oil) in Building 800 immediately next to a sanitary sewer floor drain.
- Temporary acid and caustic plastic storage tanks (4- by 4-foot cubes) without containment at the cooling towers or at the main industrial pump station influent to the pretreatment plant. These tanks could flow into storm drains as a result of leaks or spills.

Additionally, several drains throughout the site are not marked as to whether they are connected to the industrial (chemical) sewers or sanitary sewers. This could lead to the inadvertent discharge of acid or caustic to the sanitary sewer, and, since these substances would bypass the on-site pretreatment plant and not be neutralized, to the exceedance of POTW limits for discharge.

Lastly, there is lack of flow equalization, emergency fire water, and hazardous material spill storage in the industrial neutralization pretreatment plant. Because of the lack of storage, it would be impossible to contain the discharge of chemically contaminated sprinkler or hose water to the plant sewers, as the result of a serious fire or spill. Both neutralization/clarifier tanks are operated full when the design allows for them to be used alternately.

5. Chemical spill sump rainwater infiltration could dilute chemical spills and thereby conceal hazardous substances. The Building 600 chemical spill sumps receive rainwater infiltration, which could dilute small spills of toxic substances and cause them to be batch-discharged undetected into the plant wastewater system.

Rainwater on the Building 600 apron can flow into the building and into the floor drains in each building cell. These drains are not valved off from the outside pump station collection sumps for each cell. The wet wells also receive surface stormwater inflow. When the tanks are 50 percent full, the total conductivity is measured and, if it is below a predetermined limit, the water is discharged to the pretreatment system and the POTW. The use of total conductivity to regulate discharge to the pretreatment plant may allow chemicals in spills diluted with rainwater to be discharged undetected to the POTW.

6. "Vapor blaster" wastewater discharge is not being adequately monitored for tritium contamination. Liquid effluents from Rooms 112, 138, 183, and 185, which could be contaminated with tritium, are released to the sanitary sewer without adequate monitoring and control. In fact, no monitoring is conducted until the combined wastewaters are released from the plant.

Neutron tubes and devices containing a neutron tube are routinely processed in abrasive blasting equipment termed "vapor blasters" in these rooms. The water used in the abrading process drains into the sanitary sewer. Occasionally, neutron tubes are broken and the water may become contaminated with tritium.

While small quantities of tritium are probably being discharged into the sanitary system, it is unlikely that the amounts come close to exceeding the allowable discharge levels.

PRELIMINARY

3.4 Hydrogeology

The following sections present hydrogeologic data pertinent to the Pinellas Plant. Section 3.4.1 contains background information on geologic and hydrogeologic conditions and provides a summary of groundwater users near the plant. Section 3.4.2 concerns the known and potential sources of groundwater pollution and includes a brief presentation of ongoing remedial efforts (controls). Section 3.4.3 is divided into two parts. The first deals with the details of the historic and current monitoring programs at the plant and includes information on well locations and construction. The second presents a brief discussion of the analytical results associated with each program and the implications thereof. Section 3.4.4 includes the categorized findings.

3.4.1 Background Environmental Information

3.4.1.1 Geology

The Pinellas Plant is located in the Coastal Plain Physiographic Province. The sediments that immediately underlie the plant are generally divided into three units. These units are, in descending order:

1. undifferentiated surficial deposits of Pleistocene age
2. the Hawthorn Formation of Miocene age
3. the Tampa Limestone of early Miocene age (Fernandez, 1985)

Beneath the Tampa Limestone is a series of limestones called the Ocala Group. The Ocala Group sediments occur at depths below 300 feet in the vicinity of the plant. These sediments range in age from Cretaceous to Oligocene. Crystalline bedrock occurs at depths of approximately 10,000 feet (DOE, 1987). Figure 3-12 is a generalized geologic cross-section. The thickness and composition of each of the significant geologic units discussed above are indicated in the following paragraphs.

The surficial deposits typically consist of fine sands and shells that range in thickness from 25 to 40 feet. The Hawthorn Formation is variable in nature and consists of both sandstone and sandy clay. It may also contain chert and calcareous zones. The Hawthorn ranges in thickness from 50 to 100 feet.

Source: DOE 1987

GENERALIZED GEOLOGIC CROSS-SECTION BENEATH PINELLAS PLANT

FIGURE 3-12

Underlying the Hawthorn is the Tampa Limestone. The Tampa Limestone typically is composed of sandy limestones that range in thickness from 100 to 150 feet. Beneath the Tampa Limestone are the Ocala Group Limestones. These limestones are thousands of feet thick and overlie the crystalline bedrock.

3.4.1.2 Hydrogeology

The sediments underlying the Pinellas Plant have been divided into three hydrologic units (Fernandez, 1985):

1. The surficial aquifer
2. The upper confining bed of the Upper Floridan aquifer
3. The Upper Floridan aquifer

The surficial or shallow aquifer in the vicinity of the Pinellas Plant is unconfined and generally contained within the surficial deposits noted above. It also is 25 to 40 feet thick. The confining bed of the Upper Floridan is estimated to be 50 to 100 feet thick and consists of marl and clay. According to site reports (DOE, 1987) the confining bed occurs in both the Hawthorn Formation and the Tampa Limestone.

The Upper Floridan aquifer is many thousands of feet thick and occurs within the limestones. It occurs at a depth of approximately 100 feet beneath the plant (Fernandez, 1985). A discussion of both of the aquifers is included below.

Surficial aquifer

The surficial aquifer is reported to occur at depths of 3 to 5 feet beneath the plant. However, during the wet season the groundwater has been found to rise to the ground surface. Horizontal hydraulic conductivities have been reported to range from 22.7 feet per day to 42.5 feet per day (Fernandez, 1985). In-situ horizontal hydraulic conductivities in monitoring wells have been reported to range from 1.5 to 20 feet per day (Haztech, 1987). Vertical hydraulic conductivities were also assessed by Fernandez (1985). These values ranged from 0.2 to 73.7 feet per day. Horizontal hydraulic conductivities were also reported to range between 13 and 33 feet per day in Pinellas County (Hickey, 1982).

Direction of groundwater flow in the surficial aquifer is not well understood at the Pinellas Plant. In the northwestern portion of the property, flow has been noted to change with the season of the year. Depending on the season, groundwater flow is toward the northwest or the southwest. On the eastern side of the site, flow appears to be toward the east and southeast (CH₂M Hill, 1987a). Fernandez (1985) reports that shallow flow appears to be predominantly toward the southeast and southwest from the plant. A regional groundwater contour map for the surficial aquifer is provided as Figure 3-13.

Flow velocities (Haztech, 1987) have been reported to range between 5 and 69 feet per year in the shallow aquifer at the 4.5-acre site northwest of the plant. Average groundwater flow velocity at that site was estimated to be approximately 18 feet per year.

According to USGS data (Fernandez, 1985), there is a net downward movement of groundwater from the surficial aquifer to the Upper Floridan aquifer. This fact, coupled with the occurrence of numerous sinkholes in the vicinity of the plant, indicates that the surficial aquifer can recharge the Upper Floridan aquifer. Sinkholes can provide a possible conduit between the aquifers.

Upper Floridan Aquifer

The Upper Floridan aquifer is the principal source of groundwater in the area surrounding the Pinellas Plant. It is used for municipal, industrial, and agricultural water supplies. Specifics regarding the properties of the Upper Floridan were not available in the documents reviewed. However, this aquifer is known to be prolific throughout this region of the state. No data are available for that portion of the aquifer on-site.

Groundwater flow in the aquifer in the vicinity of the plant is to the northeast toward Old Tampa Bay. The regional potentiometric contour maps indicate that the potentiometric head in the vicinity of the plant is on the order of 5 feet above sea level. Figures 3-14 and 3-15 are potentiometric contour maps of the Upper Floridan for May and September 1984, respectively.

Source: Fernandez 1985

REGIONAL CONFIGURATION OF THE WATER TABLE IN THE SURFICIAL
AQUIFER AND DIRECTION OF GROUNDWATER MOVEMENT IN
MID PINELLAS COUNTY, MAY 1982 (modified from Coussement, 1985)

FIGURE 3-13

Source: Fernandez 1985

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN MID-PINELLAS COUNTY, MAY 1984 (modified from Barr and Schiner, 1984) **FIGURE 3-14**

Source: Fernandez 1985

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN
 MID-PINELLAS COUNTY, SEPTEMBER 1984
 (modified from Barr and Schiner, 1894)

FIGURE 3-15

3.4.1.3 Groundwater Use

It was reported in 1985 that there were 132 wells located within 8000 feet of the Pinellas Plant (Fernandez, 1985). A more recent review (CH₂M Hill, 1987a) indicates that there are approximately 240 wells in the nine sections located within a 1- to 2-mile radius of the plant (see Figure 3-16). These wells were identified as those not requiring a withdrawal permit by the Southwest Florida Water Management District (SWFWMD).

An additional 22 wells were reported in 1984 to be used for water supply. They are south of the plant and were permitted to withdraw 1.5 million gallons per day (mgd). Figure 3-17 shows the locations of these wells.

Two hundred forty wells were identified in a February 1987 (CH₂M Hill 1987a) site inventory. They ranged in diameter from 2 to 10 inches. The majority of these wells are reported to be used for agriculture or for the irrigation of lawns and shrubs. However, over 20 domestic and public trailer park wells were identified in this inventory. Four of these were within the same section as the plant. The locations of these wells have not been determined.

Total depths of the wells, identified in the 1987 inventory, range from 65 to 285 feet. The depth to the top of the open interval or bottom of the casing ranges from about 30 to 180 feet. It appears, therefore, that the wells tap either the Hawthorn Formation or the Upper Floridan aquifer.

The more recent information also indicates that a golf course immediately south of the plant is permitted to extract groundwater at rates over 1 mgd. The water is reportedly used for the irrigation of a 300-acre area. Of particular importance is the observation by CH₂M Hill (1987a) that the wells south of the plant may cause the flow in the Upper Floridan aquifer to be toward the south beneath the plant.

WELL INVENTORY IN THE VICINITY
OF THE PINELLAS PLANT

FIGURE 3-16

WITHDRAWAL FROM PERMITTED WELLS LOCATED NEAR VICINITY OF PINELLAS PLANT FIGURE 3-17

3.4.2 General Description of Pollution Sources and Controls

3.4.2.1 Sources

Known sources of groundwater contamination at the Pinellas Plant are typically associated with areas that have been used for the disposal of waste products. The majority of these sites are discussed in Section 4.5. In general, the following areas at the plant represent the significant sources of groundwater contamination:

1. The 4.5-acre site
2. The northeast site (near East Pond)
3. West Pond
4. The spray irrigation area
5. East Pond
6. The health physics tanks

Environmental data associated with these areas are discussed in Section 3.4.3.

Potential sources of groundwater contamination also exist at the plant. These areas are generally those which have the potential to contaminate groundwater but for which there are no means (i.e., monitoring wells, sampling) to assess impact. The following areas represent the potential sources of groundwater contamination:

1. Existing and former fuel storage tank areas
2. Old septic tank locations
3. Old incinerator areas
4. Existing and former fire training areas
5. The methylene chloride disposal ditch
6. Other portions of the site where materials may have been disposed of

These potential sources are discussed in greater detail in Section 4.5.

3.4.2.2 Controls

A major effort is currently underway at the Pinellas Plant to complete a feasibility study for the remediation of the 4.5-acre site. Partial remediation of this site was

achieved in 1985 when 83 drums and 303 tons of contaminated soil were removed. Groundwater contamination is still present at the site.

A remedial investigation is proceeding on the northeast site in order to provide information for potential remedial schemes.

3.4.3 Environmental Monitoring Program and Data

3.4.3.1 Monitoring Programs

Currently there is no routine monitoring of groundwater at the Pinellas Plant. Groundwater monitoring is performed in connection with specific studies or contaminant investigations. Historically, routine monitoring of the groundwater was performed in different areas of the plant.

Various programs, investigations, and studies conducted at the Pinellas Plant have resulted in the placement of approximately 192 wells. Since 1984, 106 wells have been installed. A list of the various wells, associated programs, and intended uses of the wells is presented as Table 3-17.

A detailed description of each of these well series is presented below.

Deep Wells

The deep wells were installed to provide a water supply for lawn irrigation. Very little specific information on these wells is available. The first well is believed to have been installed in 1957 or 1958, when the plant was being constructed (Gray, 1987). This well was abandoned in 1964 and the second well installed to take the place of the first. The second well was known to have been grouted shut, but the first may only have been capped. Both wells are believed to have been installed in the Upper Floridan aquifer. Plant personnel know that some sampling of these wells did occur, but only one record could be found and it could not be confirmed. The locations of the two wells are indicated on Figure 3-18. Each well is now located under Building 100.

**TABLE 3-17
WELLS INSTALLED AT PINELLAS PLANT**

<u>Well Series</u>	<u>Number of Wells</u>	<u>Use/Purpose</u>
Deep wells	2	Lawn irrigation
HP tanks	5	Routine groundwater monitoring near waste tanks
Perimeter wells	27	Routine groundwater monitoring at perimeter of plant
Pipeline wells	14	Routine groundwater monitoring adjacent to radioactive waste line
Sprayfield wells	17	Routine groundwater monitoring at spray irrigation fields
Site iron study	21	Groundwater sampling for iron analyses
USGS Reconnaissance	4	Preliminary groundwater assessment (sitewide)
4.5-Acre site	49	Groundwater contaminant assessment at 4.5-acre site
USGS shallow aquifer test wells	10	Wells for pump test in shallow aquifer
USGS expanded site study	15	Initial phase of sitewide groundwater quality assessment
Northeast site (East Pond)	10	Phase 1 contaminant assessment
Northeast site (East Pond)	18	Phase 2 contaminant assessment

Source: Unnamed site drawing

WELL LOCATIONS, IRON STUDY, AND DEEP WELLS

FIGURE 3-18

Health Physics Tanks

The five wells installed adjacent to the inground health physics tanks were used to perform monthly routine monitoring of groundwater from 1969 to 1986. They were installed in 1969 and the monitoring was stopped when the tanks were taken out of service. The wells are constructed of 2-inch-diameter galvanized-steel pipe. All the wells are installed to a depth of 17 feet and are used for routine monitoring of the shallow aquifer for tritium. The well locations are shown on Figure 3-19.

Site Iron Study

Twenty-one wells were installed as part of a study of groundwater iron content in 1970. The study was initiated due to the occurrence of elevated iron levels in surface water discharges. The wells were used to provide two samples of groundwater for iron analyses to determine if the levels of iron were related to plant discharges. They were installed in the shallow aquifer at various areas around the plant (see Figure 3-18). The wells are believed to have been constructed with 1.5-inch PVC pipe and installed to depths of between 3 and 4 feet. Groundwater samples were collected twice from each well in 1970 and analyzed for iron. No additional sampling or use of these wells is known to have occurred since that time.

Perimeter Wells

Twenty-seven wells were installed around the plant perimeter in 1973 to provide routine monitoring of tritium in groundwater. Figure 3-20 shows their locations. All the wells were installed in the shallow aquifer. Fourteen of these wells were 30 feet deep and thirteen were 15 feet deep. They were all constructed of 1.5-inch-diameter PVC pipe. Routine sampling and analysis for tritium took place from 1973 to approximately 1980. Some of these wells can still be located on the plant.

Sprayfield Wells

Seventeen wells were installed for monitoring groundwater beneath the spray irrigation field. The field received effluent from West Pond from 1972 to 1982. The

Source: H.P. Tank Closure Plan 1987

LOCATIONS OF MONITORING WELLS AT H.P. TANKS

FIGURE 3-19

WELL LOCATIONS—PERIMETER, PIPELINE, SPRAYFIELD, AND
USGS RECONNAISSANCE WELLS

FIGURE 3-20

wells were installed in four clusters of four wells each and one isolated well (see Figure 3-20). It is believed that they were constructed of 1.5-inch PVC pipe. Each of the four wells in a cluster was placed at a different depth below the surface in the surficial aquifer. The screened intervals were as follows:

<u>Well Designation</u>	<u>Depth of Screened Interval (ft)</u>
A	3 - 5
B	6 - 8
C	9 - 11
D	12 - 14

That well not included in a cluster was reported to be screened from 12 to 14 feet in depth. The wells were reported to be monitored from 1972 to sometime prior to 1980. The exact monitoring schedule and the number of monitored parameters is not known. Records found at the site for these wells indicated that the monitoring parameters included tritium, zinc, sulfate, total dissolved solids, lead, chromium, and copper.

These wells are no longer used and could not be located on-site.

Pipeline Wells

A series of 14 wells were installed adjacent to the underground radioactive waste pipeline in 1973. Figure 3-20 shows the locations of these wells. According to plant drawings, these wells are constructed of 1.25-inch PVC pipe and installed in the shallow aquifer. The exact depths of these wells are not known, but it is thought by site personnel that these wells were typically 3 to 4 feet deep. These wells were reportedly monitored between 1973 and 1974 and analyses were performed for tritium. They are no longer used and their disposition is not known.

U.S Geological Survey Reconnaissance

Four wells were installed by the U.S. Geological Survey (USGS) as part of a water quality reconnaissance study in 1984. The primary purpose of this effort was a preliminary assessment of water quality to identify any potential problem areas at the Pinellas Plant. The wells are constructed of 2-inch PVC pipe and range in depth from 23 to 39.5 feet. All wells were installed within the shallow aquifer. Figure 3-20 shows the locations of these wells. Groundwater samples were collected from the wells and analyzed in 1984. The analyses included priority and nonpriority pollutants, total organic carbon, volatile organic compounds, herbicides, insecticides, trace elements, nutrients, and major constituents. A complete list of the analyses is provided as Appendix E. The wells are still accessible and have provided groundwater samples for other studies on-site.

4.5-Acre Site

The 4.5-acre site is the focus of a major groundwater contamination study being performed by Haztech, Inc., at the direction of the plant. A total of 37 permanent and 12 temporary wells were installed between 1985 and 1986. The permanent monitoring wells were installed in four phases in May, August, and October of 1985 and in February of 1986. The primary purpose of these wells is to provide sufficient hydrogeologic and geochemical data to characterize the 4.5-acre site. All the permanent wells have a 2-inch-diameter stainless-steel casing and screen that extend to depths of between 6.5 and 30.7 feet. Appendix Figure E-1 shows the construction detail of a typical monitoring well.

The wells monitor the top of the water table and both an upper and lower sand zone within the shallow aquifer. Locations of the wells are shown on Figure 3-21. Five samplings have taken place since May of 1985, the most recent in May of 1987. Routine monitoring is not conducted at this site; all sampling has been associated with the ongoing investigation. The parameters selected for analysis for each sampling event have not been consistent. However, the most extensive analysis included volatile organics, priority pollutants, base/neutral and acid-extractable compounds, and metals. Appendix Table E-2 presents the parameters that have been analyzed.

USGS Shallow Aquifer Test Wells

Ten wells were installed in 1986 by the USGS for the purpose of an on-site pump test. The test, to be conducted in June 1987, is intended to provide data on parameters for the surficial aquifer. Nine 1.5-inch-diameter PVC wells have been installed to a depth of 25 feet. The tenth is a 4-inch-diameter well constructed of PVC that also extends to a depth of 25 feet. This well is to be used as the pumping well, and the smaller diameter wells will serve as groundwater-level measurement points. Although not planned for use in monitoring, the pumping well has been used to provide groundwater samples for analysis as part of the northeast site investigation.

USGS Expanded Site Study

In 1986 the USGS began a study for the plant of groundwater quality across the entire plant site. The first phase of this investigation included the installation of twelve 2-inch-diameter PVC wells to depths of 4 feet within the shallow aquifer (see Figure 3-22). Three additional wells were installed at the edges of the stormwater retention ponds south of Building 100.

An additional 50 wells are to be installed as part of the second phase of this effort in June 1987. Samples obtained from the Phase I wells were analyzed for chloride, nitrate, phosphorus, sulfate, lead, fluoride, pH, specific conductance, temperature, and chromium. In addition, a GC/FID scan was performed on these samples. A more complete set of analyses were performed for the samples obtained from the three wells near the stormwater pond (see Appendix Table E-3). All information associated with this study is provisional; it has not yet been subjected to USGS review.

Northeast Site (East Pond)

A detailed groundwater contamination assessment was begun in 1986 following discovery by the USGS that groundwater contamination was present near East Pond. The study is being performed by CH₂M Hill. Work to date has included the installation of 28 monitoring wells 10 in the first phase and 18 in the second. The

Source: USGS 1987

WELL LOCATIONS—USGS EXPANDED SITE STUDY

FIGURE 3-22

wells are constructed of 2-inch-diameter PVC and are installed within the surficial aquifer. Construction details of these wells are included as Appendix Figures E-2 and E-3. According to discussions with CH₂M Hill personnel, the wells extend to maximum depths of approximately 40 feet (Alonso and Koechlein, 1987). Only preliminary data are available from this investigation, since work is ongoing. Groundwater samples are being and have been analyzed for volatile compounds, metals, total organic carbon, tritium, pH and specific conductance (see Appendix Table E-4).

3.4.3.2 Environmental Data

As noted previously, the groundwater data for the Pinellas Plant were developed in separate programs. Formal documents were not developed, however, and thus much of the data has apparently been lost or misplaced. The most recent data are more complete, but more are still in the process of being developed and/or interpreted. In order to clearly present the available information, this section is organized in the same fashion as Section 3.4.3.1. The results for each series of wells and/or monitoring program are discussed in separate sections.

Deep Wells

Specific analytical data for these wells could not be located. A set of sample data for March 1964 was found, but the locations did not correspond to any identifiable wells.

Health Physics Tanks

Although routine monitoring of groundwater took place for approximately 17 years from 1969 to 1986, very little data could be located. Tritium was the only routine parameter monitored. The limited historical data indicate that groundwater in the vicinity of the tanks did exceed current drinking water standards for tritium. Well 1 in May of 1972 exhibited a concentration of 20,400 picocuries per liter and Well 5 in July of 1982 showed 24,900. The 1972 data indicate that tritium levels were typically in the thousands to less than 20,000 picocuries per liter. As part of the closure plan for the tanks developed in 1986, additional groundwater analyses were run. The tritium levels in groundwater in the five wells

ranged from 1020 to 2150 picocuries per liter. Analyses were also performed for lead, chromium, and cadmium. All results were below the detection limit.

Site Iron Study

The only groundwater analysis data available are handwritten values appearing at the site of each well on a March 1970 site plan. These data indicate that iron concentrations ranged from 2.06 to 26.75 ppm.

Perimeter Wells

Records of tritium levels for all wells could be located for only the years 1977 and 1978. The yearly summaries for 1977 and 1978 indicate that the maximum tritium concentration occurred in well 11-S in 1977. That concentration was 2820 picocuries per liter (the drinking water standard is 20,000 picocuries per liter). Concentrations above 1000 picocuries per liter occurred in wells 11-S, 12-D, and 12-S in 1977. All these wells are adjacent to the East Pond. Limited data for seven of the perimeter wells for the years 1975 and 1976 indicate tritium concentrations lower than the maximum value reported in well 5-D (1600 picocuries per liter) in July of 1975. A 1980 study suggests that the surficial aquifer had been contaminated by fluoride and sulfates from West Pond. The basis for this conclusion was exceedances of applicable standards for these parameters in two of the perimeter wells near West Pond.

Sprayfield Wells

Data on these wells were found only for the year 1972, although it is known that analyses were performed for several years. Unfortunately, 1972 was the first year of irrigation system operation; hence the environmental impacts may not be reflected. The maximum chemical concentrations observed in the groundwater in a single sampling event in 1972 are presented in Table 3-18. Judging from these data, lead exceeded the primary drinking water standard in well S-D and three other wells. It is of interest to note that lead has appeared in the effluent during operation of the plant. These limited data also suggest that the sprayfield operations had some impact on the groundwater regime.

TABLE 3-18
MAXIMUM CONCENTRATIONS OF VARIOUS CONTAMINANTS IN PINELLAS
GROUNDWATER FOR SINGLE 1972 SAMPLING EVENT

<u>Parameter</u>	<u>Maximum Concentration^a</u>	<u>Well Number</u>
Tritium	4775 pCi/L	C-C
Zinc	0.51	S-D
Sulfate	141	C-B
Dissolved solids	901	E-D
Lead	4.2	S-D
Chromium (total)	0.014	E-D
Copper	0.17	N-B

a - in milligrams per liter, except where otherwise indicated.

Pipeline Wells

No data were located regarding tritium concentrations in these wells.

USGS Reconnaissance

The analyses of the groundwater from the four wells installed during this study indicate that the concentrations were "... (1) less than the detection limits, (2) within U. S. Environmental Protection Agency quality criteria for water, or (3) within the range of results for a designated background water-quality site." (Fernandez, 1985).

4.5-Acre Site

The 4.5-acre site (no longer owned by the DOE) is the site of groundwater contamination in the surficial aquifer. That contamination is a result of the disposal of drums on the site by the Pinellas Plant. When the drums were removed during initial site remediation, the drums were found to contain chlorinated solvents, plasticizers, resinous materials and some metals (Haztech, 1987).

Three zones of contamination have been defined at the site. A phreatic and a shallow plume cover an area of approximately 1.5 acres, and a deeper plume covers an area of approximately 0.5 acre. Figure 3-23 shows the extent of the three plumes. The major constituents in the plumes are indicated in Table 3-19.

A variety of chemical constituents other than those reflected in the table were also identified.

Sampling techniques were observed during the May 1987 sampling event for the 4.5-acre site. In general, the procedures used were found to be adequate.

USGS Shallow Aquifer Test Wells

No groundwater sampling or analysis has been performed in association with this effort. However, the pumping well has been used in the northeast contaminant investigation.

4.5-ACRE SITE CONTAMINANT PLUMES

FIGURE 3-23

TABLE 3-19
**MAJOR CONTAMINANTS OBSERVED IN GROUNDWATER PLUMES OF 4.5-
 ACRE SITE AT PINELLAS PLANT**

<u>Parameter</u>	<u>Maximum (ug/L) Concentration</u>	<u>Well Number</u>
Vinyl chloride	19,000	MW-14
Toluene	22,000	MW-2
Trans-1, 2- dichloroethylene	16,268	MW-4
Trichloroethylene	721	MW-4
Acetone	620	TW-5
Methylene chloride	570	TW-1

USGS Expanded Site Study

The data associated with this study are still provisional, and no specific conclusions have been drawn. A review of the preliminary data indicates that most compounds are within the range of background values and/or appropriate standards. However, no analyses for volatile organics or other compounds found in the other site groundwater plumes were performed on the samples from wells C-1 through C-12. Analyses of samples from the three stormwater wells showed trace levels of toluene, benzene, and trans-1,2-dichloroethylene. Well C-2 had a higher sulfate level (340 milligrams per liter) than the other wells in this series.

Northeast Site (East Pond)

Preliminary results of groundwater quality analyses indicate significant levels of contamination in the shallow groundwater (surficial aquifer) at the northeast site. The source of the contamination is thought to be an old staging and disposal area west of East Pond. The most significant levels of contamination occur in well 2S. The maximum concentrations of contaminants found in groundwater samples obtained from this site are indicated in Table 3-20.

Figures 3-24 and 3-25 show preliminary contaminant data associated with the samples obtained from the wells. Tritium analyses were also performed on groundwater samples obtained from the wells. The maximum concentration (6020 picocuries per liter) was found in the groundwater sample from well MW-7D. This value is significantly higher than the concentrations observed in other wells. Since groundwater flow is estimated to be toward the east, this elevated level may reflect the impact of groundwater from East Pond. East Pond is known to have had tritium levels in excess of 6000 picocuries per liter; in fact, the level once reached 18,900 picocuries per liter.

3.4.4 Findings and Observations

3.4.4.1 Category I

None

TABLE 3-20

**MAXIMUM CONCENTRATIONS OF CONTAMINANTS FOUND IN
GROUNDWATER OF NORTHEAST SITE (EAST POND) AT PINELLAS PLANT**

<u>Parameter</u>	<u>Maximum (ug/L) Concentration</u>	<u>Well Number</u>
Methylene chloride	4,100,000	MW-2S
Vinyl chloride	50,000	MW-4
Trans-1,2 - dichloroethylene	37,000	MW-2S
Trichloroethylene	19,000	MW-2S
Acetone	5,900	MW-1S
Toluene	2,500	MW-21
Benzene	88	MW-21

FIGURE 3-24

NORTHEAST SITE WATER QUALITY RESULTS JANUARY 1987

CONCENTRATIONS OF SELECTED VOLATILE COMPOUNDS NORTHEAST SITE MAY 1987 FIGURE 3-25

3.4.4.2 Category II

1. Shallow groundwater contamination. The shallow groundwater has been contaminated by solvent chemicals, tritium, and anions.

The contamination is a result of past plant activities and practices at a number of areas. The contamination has moved off-site and has the potential to impact off-site wells (see Figure 3-16 and Finding No. 2c). The areas involved are listed below.

- a) The 4.5-acre site was used for the burial of waste drums. Groundwater has been contaminated with up to 19,000 µg/l of vinyl chloride, 22,000 µg/l of toluene, 16,268 µg/l of trans-1,2-dichloroethylene, and 721 µg/l of trichloroethylene. This site is no longer owned by the DOE, and contaminants have migrated beyond it to adjacent properties (see Figure 3-23, and Section 4.5).
- b) The area in the vicinity of East Pond has been used for the disposal of solvent chemicals. The groundwater has been contaminated with up to 4,100,000 µg/l of methylene chloride, 50,000 µg/l of vinyl chloride, 37,000 µg/l of trans-1,2-dichloroethylene, 5,900 µg/l of acetone, and 19,000 µg/l of trichloroethylene.

Above-background levels (6020 pCi/l) of tritium have also been discovered southeast of East Pond, as have lower levels of some of the above-noted solvent chemicals. Historical tritium levels in East Pond have been above 6000 pCi/l (18,900 pCi/l). Groundwater flow is to the east. It is possible that tritium from the East Pond has moved from the Pond and off-site toward the east or southeast.

- c) Samples analyzed from wells that monitor the old HP tanks have historically indicated that groundwater has been contaminated with tritium at levels near or in excess of the Drinking Water Standards of 20,000 pCi/l (20,626 pCi/l in 1971). Since the shallow flow regime is not well understood in this and other areas of the site, there is a potential for

movement of the contaminated groundwater toward the nearby plant boundary.

- d) Shallow groundwater has also been contaminated in the vicinity of the West Pond presumably as a result of effluent discharges to the pond. A 1980 study for the site states that fluoride and sulfate levels in groundwater in 2 nearby perimeter wells exceeded applicable standards.

2. Lack of characterization. Groundwater flow in the surficial aquifer has not been adequately characterized. In addition, local flow directions (and heads) and contaminant conditions in the deeper Upper Floridan aquifer beneath the site have not been defined. Although local groundwater users (wells) have been identified, the exact locations of nearby wells have not been ascertained. Specifics regarding these issues and associated consequences are listed below.

- a) Groundwater flow directions have only been defined at the 4.5-acre site and the East Pond Site. Although other site wells exist they have not been integrated into an overall assessment of the flow regime. Additional wells will likely be necessary to accomplish this assessment. The consequences of this inadequacy relate to the potential for movement of contaminants off-site, in areas where the flow is not understood (e.g., HP Tanks).
- b) Downward vertical gradients have been recorded in site wells which indicate that existing shallow groundwater (surficial aquifer) contamination has the potential to migrate to the Upper Floridan aquifer. (The Upper Floridan is frequently used for water supply in the vicinity.) Although the regional flow regime has been defined for the Upper Floridan, the local conditions and potential site impacts (or lack of site impacts), have not been defined. Additionally, a former deep (Upper Floridan Aquifer) site well could serve as a conduit for shallow groundwater to reach this aquifer since it was believed to have been capped and not sealed shut (well installed in 1957, possibly capped in 1964).

- c) Off-site wells have been identified and data obtained on the construction details. However, the locations of these wells in relation to the site boundary is not known. Since contamination has been discovered off-site, it is important to know if any potential sources of groundwater are nearby.

3.4.4.3 Category III

1. Potential groundwater contamination. Groundwater (in the surficial aquifer) may have been contaminated as a result of other plant activities.

These areas include those identified by CEARP and others that have not as yet been assessed by the plant. This lack of assessment could potentially result in contaminated groundwater going undetected and moving off-site. Examples of these areas include the:

- Old petroleum product underground storage tank area where a historic spill occurred
- The area where solvent chemical wastes were disposed of on the ground surface
- Perimeter wells which were drilled with contaminated water from the West Pond
- Historic effluent discharge areas
- A terrain conductivity (geophysical) anomaly discovered by the USGS.

3.4.4.4 Category IV

1. Potential contamination of well. Well PW (USGS) has the potential to have been contaminated. The well is open to the atmosphere (no cap) and insecticides have been used in the vicinity of the well to control fire ants. This practice could potentially contaminate the groundwater in the well.

2. Well security. Only the wells installed at the 4.5-acre site are secured (locked). Sample custody cannot be ensured if wells remain unsecured.
3. Well abandonment. Wells used in previous site monitoring have been left in place (abandoned) without proper closure. Although Florida regulations do not require that wells less than 2 inches in diameter be closed, this is not a good practice. However, the wells do not appear to pose any problems for the surficial aquifer (with regard to acting as conduits for groundwater contamination).

PRELIMINARY

4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

4.1 Waste Management

4.1.1 General Description of Pollution Sources and Controls

In this section are described the types and sources of waste materials generated at the Pinellas Plant as well as the facilities and procedures for management of those wastes. Hazardous, radioactive, and nonhazardous/nonradioactive solid wastes are discussed separately.

Hazardous wastes at the Pinellas Plant are generated from the manufacturing and engineering of neutron generators and specialty electrical components. These wastes originate in Building 100, Building 200, Area 300, and Buildings 400 and 800, with the largest amount originating in Building 100, Area 300, and Building 400. Building 100 and Area 300 are the main manufacturing and engineering areas of the plant; they contain most of the major processes and laboratories. Radioisotopically-powered thermal generators (RTGs) are manufactured in Building 400. Buildings 200 (Environmental Test Facility) and 800 (Accelerator Facility) are primarily sources of radioactive waste, but produce small quantities of hazardous waste. Plant services (Utilities), which also generate small quantities of hazardous waste, are located in Building 500.

Radioactive wastes at the Pinellas Plant are generated from the use of tritium in manufacturing and engineering of the neutron generators in Building 100. Wastes containing tritium are also generated by the destructive testing of neutron generators, conducted in Building 200, and by nondestructive testing conducted in Building 800. Drums of mixed radioactive/hazardous waste containing lead and tritium were generated during the decommissioning of wastewater holding tanks (health physics tanks) in 1986. This waste is being stored at the plant.

A summary of major plant areas that store or use chemical or radioactive materials, including manufacturing and engineering areas, is provided in Table 4-1. Descriptions of major products manufactured at the plant are included in Section 2.0. A more detailed description of plant manufacturing and engineering operations and plant services (utilities) is included in Section 3.1.2. Detailed information on waste disposal facilities and procedures is included in the Pinellas

TABLE 4-1

MAJOR AREAS ASSOCIATED WITH THE STORAGE OR USE OF CHEMICAL OR RADIOACTIVE MATERIALS

Area No.	Area Name	Major Processes
103	Test Equipment Construction	Chemical Conversion Coating Paint spray booth Plating
104	Machine Shop	Degreasing Machining, grinding Soldering, brazing
105	Ceramics	Formulating ceramic powders
106	Tool Room	Degreasing Machining, grinding Soldering, brazing
108	Tube Exhaust	Loading tritium onto parts Product engineering Equipment maintenance
109	Final Inspection	Krypton-85 leak test
110	Magnetics	Production involving polymers, resins and other chemicals
110	Flame Spray	Flame spraying tube assemblies
111	Timer Room	Assembly of Drivers/Detonators
112	Generator Assembly	Degreasing and cleaning of parts
114	Paint, Ink & Misc.	Paint spray booth
115	Graphic Services	Photographic developing equipment
117	Metallize and Plating	Application of metal slurry Plating
124	Maintenance Shop	Welding Wood working equipment
132m	Tritium Recovery System	Stack Effluent Control System (SECS)
138	Final Preparation	Machining Welding Degreasing
139	Resin Casting	Application of polymers in various product lines
140	Furnace Room	Hydrogen furnaces, ceramics firing
143	Chemical Processing	Chemical treating of metals Degreasing and cleaning of parts

TABLE 4-1

**MAJOR AREAS ASSOCIATED WITH THE STORAGE OR USE OF CHEMICAL OR
RADIOACTIVE MATERIALS (continued)**

Area No.	Area Name	Major Processes
145	Ceramics Machining	Machining and cleaning of ceramics parts
146	Ceramics Fabrication	Preparation of raw ceramics
155	Chemistry Laboratory	Chemical analyses
156	Chemical Analysis Lab	Chemical analyses
157	Gas Analysis Laboratory	Chemical analyses
158	Gas Analysis Laboratory	Chemical analyses
160	Chemistry Laboratory	Chemical Analyses
162	Metallurgy Laboratory	Metallurgy
163	Process Technology Shop	Degreasing Plating Welding Glass blowing
176	Environmental Chemistry	Chemical and radiological analyses
176	LAC, Glass, RTG Laboratory	Engineering activities
180	Capacitor Laboratory	Flame spraying
181	Tube Developing Engineering	Parts degreasing and cleaning
182	Tube Developing Engineering	Tritium loading
183	Generator Development	Flame spraying
185	Materials Engineering	Engineering of Polymers, Resins
192	Ceramics Laboratory	Formulating and machining of ceramics
194	Ferroelectric Laboratory	Formulating and machining of ferroelectric materials
200	Environmental Test Facility	Product quality testing
307	Engineering Dry Room	Thermal battery development
313	Chemical Cleaning	Parts cleaning and degreasing
315	Ceramic Processing	Small plating operation
316	Power Sources Dev.	Use of polymers

TABLE 4-1

**MAJOR AREAS ASSOCIATED WITH THE STORAGE OR USE OF CHEMICAL OR
RADIOACTIVE MATERIALS (continued)**

Area No.	Area Name	Major Processes
325	Maintenance Shop	Parts degreasing
349	Manufacturing Dry Room	Thermal battery manufacturing
350	Lithium Ambient Battery	Parts cleaning Casting of polymers
351	Cal/Maint Tube/Resonator	Chemical treatment of metal Degreasing
351	Resonator, Osc, Clock	Cleaning of parts with ozone
353	Iron Disulfide Processing	Cleaning and milling of iron disulfide
400	Thermoelectric Facility	Assemble RTGs Chemical treating of parts
500	Plant Services	Emergency Power, Plant Heating/Cooling
600	Chemical Storage Facility	Bulk storage of chemicals
700	Vehicle Storage Facility	Spray paint booth
800	Accelerator Facility	Engineering laboratory Work involved with tritides
1000	Waste and Drum Storage	Radioactive Waste Warehouse
1040	Hazardous Waste Building	Waste Chemical packaging
1200	Security Building	Firing range.

Source: GE, 1987a.

Plant Waste Management Site Plan (GE, 1987a) and in the Pinellas Plant Hazardous Waste Facility permit application (DOE, 1986b).

General classes of hazardous wastes generated at the plant include halogenated hydrocarbons and flammable liquids, waste sludges and solutions from plating operations, reactive metals and chromium wastes from battery fabrication, epoxies and diisocyanates from the resin casting operation, and sludges from the wastewater neutralization system. Radioactive wastes include waste neutron generator tubes and solid generator tube materials containing tritium, tritium-contaminated gloves, wipes, and other paraphernalia from neutron generator tube manufacturing, engineering and testing; and spent absorbent materials from various tritium handling systems and the tritium recovery system. Nonhazardous wastes include petroleum-based waste oils, aqueous cutting oils, construction materials, salvageable metal scrap; and paper and cafeteria-type wastes generated throughout the plant. Machining operations in several plant areas produce the waste machine tool coolant/cutting oil TRIM, which is approximately 90 percent water. Sand sludges from wet-sand abrasive blasting operations in four areas of Building 100 are also disposed of as nonhazardous waste.

4.1.1.1 Hazardous Wastes

Types of Hazardous Wastes Generated

The Pinellas Plant generates several classes of hazardous wastes routinely. A smaller number of waste types, some of which are mixed wastes, are generated sporadically or on a one-time-only basis. Table 4-2 summarizes the major types of hazardous wastes generated in 1986, as well as the specific sources and areas from which the wastes derive. These are discussed briefly in the following sections.

Halogenated Hydrocarbons and Flammable Liquids

Halogenated wastes are generated primarily from vapor degreasing and cold cleaning operations throughout Building 100, Area 300, and Building 400. The locations and characteristics of plant vapor degreasers are listed in Table 3-7 in Section 3.1 of this report. These units generate waste still bottoms containing trichloroethylene, trichloroethane, or chlorofluorocarbons (CFCs). Used solvent is

**TABLE 4-2
HAZARDOUS WASTES GENERATED AT THE PINELLAS PLANT IN 1986**

TYPES OF WASTES	EPA HAZARDOUS CODES	SPECIFIC SOURCES	MAJOR PLANT AREAS WHERE WASTE IS GENERATED
Halogenated Hydrocarbons (mixture of methylene chloride, 1,1,1-trichloroethane, trichloroethylene, and CFCs)	F001, F002	Vapor degreasing and cold cleaning in manufacturing and engineering areas, laboratory operations and waste CFCs from heat pumps chillers	Heat pumps, chillers are located in Building 500. Vapor degreasing/cold cleaning and laboratory operations occur throughout Building 100, Area 300, and Building 400.
Flammable Liquids (mixture of alcohol, toluene, acetone, amyl acetate, and other ignitable liquids)	F003, F005, D001	Cold cleaning processes in manufacturing and engineering areas	Throughout Building 100, Area 300, and Building 400
Methylene Chloride/Epoxy Resin (mixture of methylene chloride and epoxy resins)	U080, F002	Resin casting mold cleaning process	139 Resin Casting 185 Materials Engineering
Ethanol/Epoxy Resin (variable mixture of ethanol solvent and epoxy resins)	D001	Resin casting mold cleaning processes	139 Resin Casting 185 Materials Engineering
Plating Bath Solution Containing Arsenic (waste solutions that contain cyanide)	D004, D006	Waste solutions from gold plating and stripping operations	117 Metallize and Plating
Plating Bath Solution Containing Cyanide (waste solutions that contain cyanide)	D002, D003, F007	Waste solutions from gold plating and stripping operations	117 Metallize and Plating

TABLE 4-2
HAZARDOUS WASTES GENERATED AT THE PINELLAS PLANT IN 1986 (continued)

TYPES OF WASTES	EPA HAZARDOUS CODES	SPECIFIC SOURCES	MAJOR PLANT AREAS WHERE WASTE IS GENERATED
Calcium Metal/Calcium Chromate Batteries	D003	Waste calcium chromate batteries, some of which have been dismantled for inspection and waste battery material	307 Thermal Battery Engineering 349 Thermal Battery Manufacturing
Calcium Chromate Residues/Calcium Chromate Contaminated Solids (solid calcium chromate residues)	U032, D007	Calcium chromate residue from thermal treatment of heat paper. Calcium chromate contaminated gloves, wipes, and coveralls from thermal battery manufacturing and inspection operations	307 Thermal Battery Engineering 349 Thermal Battery Manufacturing
Lithium Contaminated Solids	D003	Lithium contaminated materials such as gloves, wipes, etc.	307 Thermal Battery Engineering 349 Thermal Battery Manufacturing
Heat Paper and Heat Powder (Heat paper contains barium chromate and zirconium. Heat powder contains potassium perchlorate and iron fillings)	D003	Usable waste explosive from thermal battery manufacturing and inspection operations	307 Thermal Battery Engineering 349 Thermal Battery Manufacturing
Detonators, Reactive	D003	Unusable electronic detonators containing explosives	111 Assembly Driver Room 200 Environmental Test Facility

TABLE 4-2
HAZARDOUS WASTES GENERATED AT THE PINELLAS PLANT IN 1986 (continued)

TYPES OF WASTES	EPA HAZARDOUS CODES	SPECIFIC SOURCES	MAJOR PLANT AREAS WHERE WASTE IS GENERATED
Miscellaneous Laboratory Chemicals	—	Laboratory wastes and chemicals which have exceeded their shelf lives	Throughout Building 100, Area 300, and Building 400
Lithium Metal/Lithium Batteries Lithium/Silicon Metal	D003	Waste lithium batteries and waste battery material	307 Thermal Battery Engineering 349 Thermal Battery Manufacturing 350 Lithium Ambient Battery (LAMB) Assembly
Electroplating Sludges	D005	Sludge operated from treatment of electro-plating wastes	117 Metallize and Plating 163/164 Process Development 103 Test Equipment Calibration
EP Toxic Plating Waste Containing Arsenic	D004	Wastes from gold plating and stripping operations	117 Metallize and Plating
EP Toxic Lead Sludge Waste	D008	Sludges from waste - water storage and treatment tanks which contain lead	HP Tanks, Wastewater Neutralization Facility

TABLE 4-2
HAZARDOUS WASTES GENERATED AT THE PINELLAS PLANT IN 1986 (continued)

TYPES OF WASTES	EPA HAZARDOUS CODES	SPECIFIC SOURCES	MAJOR PLANT AREAS WHERE WASTE IS GENERATED
EP Toxic Mercury Waste	D009		
Toluene Diisocyanate Waste and Epoxy Resin Waste	U223, D003	Waste from resin casting process	139 Resin Casting 185 Materials Engineering 110 Magnetics
Lead-Contaminated Solid Waste	D008	Waste dust filters, glassware, ceramic material and other solids from ferroelectric materials lab	194 Ferroelectric Materials Laboratory
Miscellaneous Corrosive Wastes (e.g. Nitric, Hydrochloric, Sulfuric, Acetic Acids, Nickel Chloride Solution)	D002	Acid cleaning and plating operations throughout Building 100, Area 300, and Building 400	143 Chemical Process 351 Calibration and Maintenance 117 Metallize and Plating

distilled within the units or recovered in separate distillation units. Trade-name solvent mixtures, methylene chloride, alcohols and CFCs are used in ultrasonic degreasers and dip tanks in numerous areas of the plant.

Various flammable solvents, including alcohols, acetone, and amyl acetate are also used for cold cleaning. The use of amyl acetate is primarily associated with the manganese/molybdenum (Mn/Mb) metal paint used in 117- and 140-Areas. Ethyl alcohol and acetone are used in numerous areas of the plant. Major areas where cold cleaners are located are identified in Section 3.1.2.

Plating Waste Solutions

Plating wastes are generated primarily by a plating operation in 117-Area, but also by smaller operations in 163/164-Area and 103-Area. Generator tube parts and other parts are plated with copper, nickel, or gold. The gold plating bath and the stripping solution used to recover gold from plated parts contain cyanide and arsenic. Nickel sulfate, copper pyrophosphate, potassium permanganate, and phosphoric and boric acids are used, and these may become corrosive wastes. Plating solutions may be used for months before recovery or disposal is required, and for this reason the baths are not continuously replenished. Solutions containing gold are collected for gold recovery, and only solutions that do not contain recoverable quantities of gold are disposed of as hazardous waste. Corrosive wastes may be collected in drums for disposal as hazardous waste, or they may be drained to the wastewater neutralization system.

Plating Waste Sludges

Solid materials are suspended in the plant wastewater streams and settle out in the wastewater neutralization system. Sludges are periodically collected from the lift stations of that system. These sludge wastes may contain lead and are sometimes extraction procedure (EP) toxic. They have also been classified as "sludge from the treatment of electroplating wastes" (Waste Code F006), since plating wastes are discharged to the neutralization system.

Toluene Diisocyanate and Epoxy Resin Wastes

Liquid toluene diisocyanate and epoxy resin wastes are generated in 139-, 185-, and 110-Areas. Parts are encapsulated with resin mixtures in these areas, and urethane foam parts are also fabricated. Resin mixture and foam materials are poured into molds and oven- or pressure-cured using a curing agent. Waste materials may be generated by the creation of off-specification mixtures or the insufficient curing of a specific mixture. Waste resins and foams are solidified, which renders them nonhazardous.

Solvent/Resin Mixtures

Methylene chloride/epoxy resin and ethanol/epoxy resin mixtures are generated in 139-Area. The methylene chloride/epoxy resin mixture is generated by a distillation unit associated with several large tanks in which resin is removed from molds used in the resin casting process. Ethyl alcohol-3A is also used in the mold cleaning process. Solvent/resin mixtures are also generated in other plant areas where resins are used, including 185- and 103-Areas.

Thermal Battery Wastes

Lithium/silicon alloy, calcium chromate, and calcium metal are used in 307- and 349-Areas to form thermal battery anodes and cathodes. Waste thermal batteries containing calcium chromate and/or lithium/silicon metal are generated by battery production and inspection operations. Waste lithium and calcium metal, lithium/silicon, and calcium metal (calcium-coated iron) that cannot be used for battery production are generated in both areas. Lithium and calcium chromate-contaminated materials such as gloves, wipes, and other paraphernalia are also generated by battery inspection and laboratory operations. Most of the waste batteries generated are fully assembled units, although some batteries that have been disassembled for inspection are also disposed of.

Battery anodes and cathodes are separated in the batteries by heat paper and/or heat powder. Heat paper contains barium chromate and zirconium. Heat powder is a reactive mixture of iron and potassium perchlorate. When the heat powder or paper is activated by an electric spark, the heat generated from chemical reaction

melts the solid anode and cathode material and causes current to flow through the battery. Waste heat powder or paper that cannot be used for battery production is generated in both 307- and 349-Areas.

Detonators

Explosive detonators are used to activate the neutron generator tubes. Waste detonators are generated from generator tube manufacturing and inspection operations.

4.1.1.2 Hazardous Waste Management Facilities

Hazardous waste management facilities at the Pinellas Plant are regulated under the provisions of Permit HT52-64622 for the Temporary Operation of a Hazardous Waste Storage and Treatment Facility. This temporary operating permit (TOP) was issued by the Florida Department of Environmental Regulation (FDER) on April 30, 1986, and it expired on October 30, 1986. An application for a hazardous waste facility operating permit was submitted to the FDER prior to the expiration date of the TOP (DOE, 1986b). The FDER had not taken any action on the submittal at the time of the Survey. The facilities covered by the TOP include

- Three aboveground, 5000-gallon storage tanks
- One 17,000-gallon sludge storage tank
- Drum Storage Facility (Building 1040)
- Thermal Treatment Facility
- Reactive Metal Treatment Facility

The locations of these facilities are shown in Figure 4-1.

The three 5000-gallon storage tanks are behind (west of) Building 1040. Two of them are reserved for the storage of halogenated solvent wastes and flammable liquid wastes. The third is usually empty and kept available for the storage of any liquid hazardous wastes shipped to an off-site disposal facility, rejected by the waste disposal contractor, and sent back to the plant. All of the tanks are of epoxy-lined, carbon steel construction and are mounted on saddle supports within

NONRADIOACTIVE HAZARDOUS WASTE MANAGEMENT FACILITIES

FIGURE 4-1

concrete secondary containment structures. The tanks are ultrasonically tested annually and visually inspected daily, and the records are maintained by the Waste Management Unit. The tanks and containment structure appeared to be in good repair during the Survey. The tanks are filled via a system of dedicated air-operated diaphragm pumps located inside Building 1040. The dedicated pumps and associated piping are color-coded, and male and female pipe couplings are used to prevent the mixing of different wastes. An estimated 6,000 to 12,000 gallons of the flammable liquid and halogenated solvent wastes are generated annually by the plant, according to the facility permit application. In 1986, however, a total of 2900 gallons (33,292 pounds) of halogenated solvents and 6006 gallons (41,922 pounds) of flammable solvents were generated (DOE, 1987). Disposal arrangements are made when the tank volumes reach 3000 gallons. Therefore, the tanks are emptied approximately 2-4 times a year. Disposal is contracted through Ramsey Chemical Company of Valdosta, Georgia, which distills the waste chemical liquids at a facility permitted under the Resource Conservation and Recovery Act (RCRA) and subsequently sells the reclaimed solvent. Prior to pickup by the disposal contractor, the waste liquids are analyzed for indicator parameters (e.g., halogenated organics, flash point) to determine their suitability for reclamation.

The sludge holding tank is a concrete tank formerly used as a settling tank for the facility's sanitary wastewater treatment plant. Located west of Building 800, adjacent to the industrial wastewater neutralization plant, the tank is now used to store sludges collected from the industrial wastewater lift stations. Some sludge samples have been found ER toxic for lead (6.7 milligrams per liter) and the sludges are also classified by the U.S. Environmental Protection Agency (EPA) as "sludge from the treatment of electroplating waste" (Waste Code F006). The tank, which was empty at the time of the Survey, has a capacity of 16,970 gallons. Allowing for a 2-foot freeboard, however, the greatest amount that would be allowed to accumulate would be 13,825 gallons. Sludges are presently pumped out of the tank, transported by Byrson Environmental annually, and disposed of by Solid Tek Systems, Inc. of Morrow, Georgia. Both firms are permitted hazardous waste contractors. Different transportation and disposal contractors were used in the past.

The Drum Storage Facility is located in Building 1040. The building is divided into three bays separated by floor-to-ceiling concrete walls. Waste storage activities are segregated among the bays as follows:

- Bay 1: Contains air-operated diaphragm pumps along the west wall for transferring liquid wastes into the storage tanks. The south end of the bay has a storage capacity of forty-two 55-gallon drums and twenty-four 20-gallon drums of liquid wastes, including methylene chloride waste and plating bath solutions.
- Bay 2: Contains no free-standing liquid wastes. Wastes stored include waste batteries, reactive metals and alloys, and other hazardous solid wastes. It has a capacity of thirty-six 55-gallon drums and eighteen 20-gallon drums.
- Bay 3: Used for storage of miscellaneous laboratory chemical wastes or off-specification products, and for storage and neutralization of arsenic and cyanide-containing wastes. The lab-packs of Bay 3 contents are prepared by a contractor in Bay 3, after which the packed drums are stored in Bays 1 or 2. A list of miscellaneous wastes packed in this facility is provided as Table 4-3.

The design of Building 1040 provides secondary containment of potential spills by means of sloped flooring, curbing, floor drains, and collection sumps. Spill control equipment (e.g., sorbent materials, nonsparking tools) is located in the bays, as are fire extinguishers. The building is equipped with an automatic, wet-pipe sprinkler system.

The Thermal Treatment Facility consists of a shallow steel pan (2 x 6 x 0.5 feet) located north of Building 700 (Tractor Shed). Materials treated at this facility are off-specification or waste solid explosives, including heat pellets (powder), heat papers, and "electronic" detonators. Heat pellets and wet heat papers are thermally treated by individually laying them on the steel pan, covering them with

TABLE 4-3
MISCELLANEOUS CHEMICAL LAB-PACK CONTENT

Diethanolamine	Wall Paint (non-flammable)
Uralite Resin (polyurethane containing resin)	Wall Paint (non-flammable)
Uralite Resin	Wall Mask
Concap Conathane Part A Polyurethane Resin	Butanediol
Concap Conathane Part A Polyurethane Resin	Detergent with Ethylene Oxide
Mixed Polyurethane Resin	Pyroloxin Solution
Mixed Polyurethane Resin	Weber Marking Ink
Lorvell Paint Primer	Boron Nitride Solution
Weber Marker Ink	LAS Containing Detergent and Cleaner

Note: The list of chemicals presented above is reported to be typical of the materials that have been disposed of from 1984 to 1986. Due to the research and development operations at the facility, actual waste quantities and types that will be handled in the future are not determinable.

Source: CH₂M Hill, 1986.

gasoline, and igniting them, thus reducing the materials to ash. Heat powder, composed of potassium perchlorate and iron filings, is reduced to a nonhazardous ash. The heat papers, however, contain barium chromate and zirconium, which produce a residue that is EP toxic for chromium. Approximately 150 pounds of heat powder and 50 pounds of heat paper are treated in this manner annually. Plant personnel estimate that 3 percent of the material remains as residue, which indicates that approximately 1.5 pounds of EP toxic wastes are generated by the process annually. The heat paper residues are drummed for off-site disposal as hazardous waste. The waste detonators are placed in a steel vessel on the pan, doused with kerosene, and ignited. The detonations are counted, and when all the detonators have exploded, the fire is extinguished and allowed to cool. After a final visual check, the "treated" detonator casings are collected. The casings are not hazardous and are disposed of as nonhazardous wastes. Any remaining kerosene is handled as an ignitable waste. Approximately 10-12 detonators are treated annually.

The Reactive Metal Treatment Facility is also north of Building 700. The facility consists of a concrete pool containing five reaction vessels (55-gallon drums). Four of the vessels are dedicated to the treatment of calcium metal and calcium bimetal wastes, and the fifth is for treatment of lithium-contaminated wastes. The calcium metal and bimetal wastes are transported to the reaction facility under oil in secured metal containers. The lithium-contaminated wastes are transported in plastic bags.

The wastes are placed in the reaction vessels and the pool is filled from the bottom to a depth of 16-20 inches. (Calcium and lithium wastes are treated by separate reactions.) The calcium wastes are reacted for 48 hours and the lithium for 16 hours. Cessation of hydrogen gas evolution is checked before the reaction is judged to be complete. Upon completion, the pool is drained and the reaction water discharged to the neutralization facility as an alkaline wastewater and mixed with other wastewater streams before discharge to the local publicly owned treatment works (POTW). The reacted metals are disposed of as nonhazardous solid waste.

Hazardous Waste Management Procedures

Although the Pinellas Plant Waste Management Unit has direct responsibility for the proper storage, treatment, and disposal of hazardous wastes, implementation of waste management procedures at the plant is a coordinated effort among the individual production and laboratory areas of the plant, as well as several plant departments, including Environmental Health and Safety, Maintenance, and Security, among others. The Environmental Health and Safety Department assigns the storage and disposal codes that are marked on the diamond safety labels affixed to all hazardous raw materials used in the plant. Maintenance personnel may generate wastes such as machine oils, vapor blaster sludges, dust from air filter units, etc., in the process of their activities and also are responsible for checking that waste materials discarded in individual plant areas have been properly segregated before the materials leave the building. Security measures for waste storage, such as access restrictions and alarms, are integrated into the overall plant security system.

Staff and supervisory personnel in each plant area are responsible for disposing of waste materials in appropriate containers provided for that purpose. There is a conscious effort within the plant to facilitate waste segregation by providing different waste receptacles appropriate for the different types of wastes generated within a particular area.

Collection receptacles for liquid wastes are fairly standard throughout the plant. Depending on the volume of waste chemical liquids generated, color-coded cans or carts are provided for waste liquid collection for subsequent disposition by Waste Management personnel. The color codes are as follows:

- Blue: TRIM machine coolant (nonhazardous)
- Black: Halogenated hydrocarbons
- Gray: Petroleum-based oils
- Red: Flammable liquids

Waste plating bath solutions are drummed at the point of generation. Liquid epoxy resins are solidified in the resin curing ovens. The solidified resin material is nonhazardous. Liquid wastes are picked up daily at 12:45 p.m. at Door 57 of

Building 100. Waste Management personnel then shuttle the liquids to Building 1040 for transfer into the appropriate storage tank or containers. Liquid wastes from other buildings or wastes that may not fit the four broad categories are picked up as necessary, and replacement waste containers that are not color-coded, but are appropriately marked and labeled, are provided by Waste Management.

Segregation of hazardous or contaminated solid waste is not so uniformly applied throughout the plant, however. While most plant areas demonstrate some attempt at solid waste segregation, the types of receptacles and markings used vary from one area to another. The degree to which waste segregation is practiced may also vary from area to area. For example, the machine shop appears to exhibit a high degree of waste segregation, apparently related to the salvage value of the various metal scraps that are generated. In other areas, however, there may not be the same perception of the practical value of waste segregation. In one of the chemistry laboratories, a waste can labeled "glass only" was observed to contain aluminum foil and plastic bottles, and a "metal only" container had some black, plastic-appearing items and what appeared to be a fibrous, heat shielding material.

The Pinellas Plant has an ongoing training program by which new personnel first receive a general plant and facility orientation. Those directly involved with waste management also receive further specialized waste management training provided by the Environmental Health and Safety Department. This training is conducted annually for all Waste Management staff. In order to enhance awareness among individual plant areas, the staff has initiated a training program that attempts to address the specific needs of individual laboratory and manufacturing operations. Among the topics covered are the Pinellas Plant Diamond Label Code Legend and Health and Safety Standard 8.1, Chemical Waste Disposal. In addition, an inventory of chemicals used in the area is made, and a list of succinct disposal instructions for each of these chemicals is generated. This training is provided on a request and availability basis, and records of attendance and information covered are maintained.

4.1.1.3 Radioactive Solid Waste

The Pinellas Plant generates no high-level radioactive waste and no transuranic waste. Low-level solid radioactive waste contaminated with or containing tritium is

generated by systems and supporting equipment used in the tritium loading of neutron generator components. Analytical laboratory and contamination control operations also generate tritium-contaminated solid waste. Scrapped contaminated equipment is generated sporadically from generator tube loading areas. Waste molecular sieve material containing tritium is generated from the stack effluent control system (SECS). During FY 1986, radioactive solid wastes generated at the Pinellas Plant consisted of 663 curies of tritium in a packaged volume of 713 cubic feet weighing 22,565 pounds.

Disassembly of vacuum equipment in 108- and 182-Areas generates decontamination-type wastes containing tritium including acid waste, which is (was) solidified and disposed of as radioactive waste, and solvent waste, which is allowed to evaporate into the ventilation system and eventually to the main stack. Neutron generators are tested at the rate of several hundred per month in Building 200. "Rubble" from neutron generator testing contains tritium and is disposed of as low-level radioactive waste.

No radioactive solid wastes are disposed of at the Pinellas Plant. Solid wastes are shipped to a burial site in Aiken, South Carolina, in compliance with Savannah River Operations Test Authorization 2-932A. A summary of radioactive waste management is included in Table 4-4.

Compactible solid wastes contaminated with low levels of tritium are segregated in the generation areas and compacted directly into 55-gallon steel drums. Prior to July 25, 1986, a manually operated drum compactor was used. This has been replaced with a hydraulic drum compactor capable of a 10:1 compaction ratio, a significant improvement over the 7:1 ratio attainable with the manual compactor.

No permanent waste storage facilities are maintained on-site. Because of the classified nature of the solid wastes, they are placed in sealed containers and stored in an enclosed, controlled-access facility while awaiting shipment to the burial site. Shipment to the Savannah River burial site is by U.S. Department of Energy (DOE) Transportation Safeguard Systems vehicles. The normal holding period of these wastes at the Pinellas Plant is less than 1 year.

TABLE 4-4

**RADIOACTIVE WASTE MANAGEMENT
INVENTORY - PAST, CURRENT, PROJECTED**

Fiscal Year	Category	Main Constituents	Curies	Volume (M ³)	Mass (Kg)
1985	LLW	Tritium	10,855	22.5	11,083
1986	LLW	Tritium	663	20.2	10,235
Projected					
1987	LLW	Tritium	15,000	20	11,000
1988	LLW	Tritium	10,000	22	11,000
1989	LLW	Tritium	10,000	21	10,000
1990	LLW	Tritium	10,000	21	10,000
1991	LLW	Tritium	11,000	22	11,000

Source: (DOE, 1987)

4.1.1.4 Nonhazardous Liquid Waste

The Pinellas Plant generates two major nonhazardous liquid wastes, TRIM machine tool coolant and waste oil. TRIM is a 90-percent-aqueous solution generated from machining operations in Building 100, Area 300, and Building 400, particularly from machine shops in 104- and 106-Areas of Building 100 and from the germanium/silicon (Ge/Si) wafer fabrication process in the western half of Building 400. TRIM is recycled within the plant to a large extent. Waste coolant that cannot be recycled is stored in a 5000-gallon, epoxy-lined carbon steel tank near Building 1040.

Waste oil is generated primarily from vehicle maintenance activities in Building 700, plant services (utilities) in Building 500, and mechanical equipment throughout the plant. The waste oil is stored in a 500-gallon, epoxy-lined carbon steel tank near Building 1040.

4.1.1.5 Nonhazardous Solid Wastes

Nonhazardous solid wastes are generated throughout the plant in such forms as paper, food scraps, construction debris, salvageable scrap, and residues from maintenance activities. Waste Management personnel estimate that approximately 3 tons of nonhazardous solid wastes are generated each week.

These wastes are collected predominantly by the third shift janitorial crew. Large canvas carts labeled "nonhazardous waste only" are used throughout the plant for these wastes, although special dedicated receptacles may be used as in the areas where salvageable scrap is generated. Although the janitorial personnel do not routinely screen the contents of the carts, they are under instructions to notify the area supervisor and the Waste Management Unit if any out-of-place item such as an empty chemical container is found in the trash.

Prior to off-site disposal, the nonhazardous wastes may be shredded, compacted, accumulated, or simply held for pickup. All "office" wastepaper is shredded to a fine powder for security purposes. Large, compactible wastes such as cardboard boxes are compacted to reduce volume. Salvageable scrap is accumulated until a

sufficient quantity is accrued and bids for its sale may be accepted. The remaining solid waste is simply dumped into the 30-cubic-yard dumpster for pickup. This material may include construction debris and solid wastes from maintenance activities.

Waste Management of Pinellas is the current nonhazardous solid waste disposal contractor. Wastes are picked up twice weekly for either landfill disposal at the Pinellas County Landfill or, if they are combustible, incineration at the Pinellas County Resource-to-Energy Plant.

As with the hazardous wastes, the plant desires to separate the types of nonhazardous wastes to avoid problems in shredding, compaction, or incineration. Also, for security purposes, it is desired to route all "office" wastepaper to the shredder prior to disposal. Although canvas carts labeled for nonhazardous wastes are available, other receptacles from wastebaskets to empty drums may also be used. During the Survey, a canvas cart positioned to receive filtered sludges from a vapor blaster unit was found to contain wastepaper along with the sludge. On inquiry, it was learned that the sludge was routinely disposed of in the dumpster for landfilling, as a nonhazardous waste. However, there was no testing of the sludge prior to disposal, despite the possibility that the abrasive material could acquire heavy metal, chemical, or tritium contamination as a result of the vapor blasting of various parts, and despite the fact that the 140-grit abrasive was labeled with disposal code 8, that is, for disposal as a toxic solid.

Prior to completion of the on-site portion of the Survey, Waste Management personnel obtained a sample of the vapor sludge for metals analysis. The results of that analysis showed only total chromium (9.6 milligrams per gram) at levels high enough to cause failure in EP toxicity testing. Subsequent analysis by the plant showed that the sample did not leach chromium at levels above the EP toxicity standard. Inquiry revealed that the disposal code designation was attributable to Pinellas Plant Environmental Health and Safety guidelines. According to these guidelines, since the quartz abrasive had an elevated health hazard ranking (presumably owing to threshold limit values for respirable quartz dust levels in the workplace rather than inherent toxicity), the appropriate storage and disposal codes should be T and 8, respectively.

4.1.2 Findings and Observations

4.1.2.1 Category I

None

4.1.2.2 Category II

1. Vapor blaster sludges that may be contaminated with RCRA hazardous constituents and/or tritium are disposed of as nonhazardous solid wastes in a sanitary landfill. Potentially hazardous vapor blaster sludge wastes may be disposed of improperly at the risk of regulatory noncompliance and environmental health problems.

The vapor blasters in several areas of the facility (e.g., 138-, 112-, 183-, and 185-Areas) are enclosed, glove-box types of equipment in which small parts are "blasted" by a mixture of water and solid, abrasive material. The abrasive materials used may include quartz sand, glass beads, and aluminum oxides. The waste stream from the vapor blasters consists of a wet sludge from which the solids are separated by either filtration (as in 138-Area) or by settling (in the other facility areas). The liquid portion is discharged through the chemical drain system; the solids are collected by plant maintenance personnel for disposal as solid waste. The use of vapor blasters in different areas may vary depending on production flows. The settling basins are reported to be cleaned out weekly, and the filtered sludges are collected in a hopper for daily collection. However, the actual quantity or volume of vapor blaster sludge that is disposed of is not known. The abrasives are inert materials and the resulting sludges are presumed by the facility to be nonhazardous.

The vapor blaster sludges have the potential to acquire heavy metals, resins, lubricants, and tritium from the abrasion of various parts in the facility manufacturing and engineering areas. During the on-site portion of the Survey, plant personnel collected a sample and analyzed it for total metals and EP toxic metals. Chromium was present at 9.7 milligrams per gram total weight, but its EP toxicity was below the standard for chromium. However, the plant does not currently have an ongoing testing program to ascertain

whether such contamination may affect one or several of the vapor blasters. Therefore, samples of vapor blaster sludges will be collected as part of the Survey effort.

4.1.2.3 Category III

None

4.1.2.4 Category IV

1. Waste abrasive materials from dry and vapor blasting are not handled according to procedures required by the toxic solid storage and disposal codes with which they are labeled. Abrasives used for vapor or dry blasting are labeled by the plant as disposal code 8 (toxic solids) but are not handled or disposed of as toxic materials.

There is no disposal code for "nontoxic" solids. If the abrasives are indeed hazardous, then their disposal as nonhazardous materials is a possible nonconformance with plant-imposed disposal designations and creates the potential for uncontrolled disposal of these materials in the environment. There is also the possibility that the abrasives are labeled inaccurately.

2. Solid waste segregation practices are not implemented consistently from one plant area to another. Waste collection containers of various sizes, colors, and markings were observed throughout the plant. These included the likes of standard waste cans (marked and unmarked), open drums, and flame-top containers. In some areas, the containers were well-marked and wastes were well-segregated (e.g., 104-Area). In others, containers were unmarked and the wastes were not separated (e.g., the 138-Area hopper containing vapor blast sludge and paper waste). In still others, the containers were well-marked but the wastes were not segregated (e.g., 160-Area, where a "glass only" can was filled with metallic and plastic waste). These inconsistencies increase the potential for improper solid waste disposal and thus for the inadvertent introduction of hazardous wastes into the nonhazardous solid waste stream. They also increase the hazards recognition burden of maintenance personnel

and waste facility operators and the likelihood of damage to solid waste handling equipment (i.e., shredder compactor).

PRELIMINARY

4.2 Toxic and Chemical Materials

4.2.1 General Description of Pollution Sources and Controls

This section discusses toxic substances and chemicals used for production, maintenance, and construction. The main categories of materials under consideration are process chemicals, polychlorinated biphenyls (PCBs), pesticides, and asbestos. However, most of the discussion concerns process chemicals and PCBs.

4.2.1.1 Toxics Management

The procurement, labeling, storage and use of chemicals, as well as the collection and disposal of these chemicals at the Pinellas Plant, were assessed. The assessment involved reviewing procedures; inspecting storage, transfer, use, and disposal areas; and interviewing personnel from the various work units in these areas.

The Pinellas Plant has an Environmental Health and Safety (EH&S) Manual (GENDD, 1987). Copies of the manual, which was recently updated (February 1, 1987), were issued to each work unit of the General Electric Company-Neutron Devices Department (GENDD) by the Environmental Health and Safety Programs (EH&SP) Unit. Included in the manual is a discussion of the TSCA and GENDD compliance procedures. These procedures cover the requisition of chemicals and radioactive materials; review of the materials request by Industrial Hygiene personnel; and the receipt, labeling, storage, distribution, and use of such materials. They also cover the collection and disposal of waste chemicals by the waste unit, and, finally, off-site disposal of waste chemicals. Waste disposal methods are covered in waste disposal procedures maintained by the Waste Management Unit.

Numerous chemicals are used in the production of products, in the development laboratories, and in laboratory analyses. Certain chemicals (e.g., ones that have a disposal code of 10, such as Vanisol) specified by the EH&SP unit can be disposed of in chemical drains while others (ones that have a disposal code of 7, such as cyanide compounds) must be collected and disposed off-site at a toxic disposal facility.

Procedures (in the E&HS Manual) were established in approximately 1985 so that no chemical could enter the Pinellas Plant without being properly labeled as to safety

hazards, and storage and disposal requirements. This label is based on information contained in the Material Safety Data Sheets (MSDSs) provided by the suppliers of the chemical. A sample diamond label and the codes used at Pinellas Plant are shown in Figure 4-2. These codes are posted throughout the plant.

When a General Purchase Requisition (GPR), Form FC-1246, is initiated, it is sent to EH&SP for review. If the material requested is a chemical, an industrial hygienist checks to see if an MSDS is on file by querying a locally developed computer program called the Chemical Labeling System (CLS). If the chemical is not found, the GPR is stamped "MSDS required." If the request is for radioactive material, the GPR is also given to a health physicist for his review. The GPR is then sent to Purchasing, which orders the material. This requisition process is shown in Figure 4-3.

Incoming materials are received by the Incoming Test and Inspection Unit located in 105-Area. Bulk chemicals such as sulfuric acid or sodium hydroxide are added directly to appropriately labeled storage tanks from the transporting tank trucks. Other materials, including chemicals, are received in 105-Area at the rear of Building 100.

If the materials are to be used in production and the material specifications must be verified, a Hold for Testing label is placed on the container and a sample of the material is analyzed by an on-site laboratory. Until all specifications are met, or deviations are accepted by the responsible person, the material is held. If the material is rejected for use, it is returned to the manufacturer for credit or disposed of as waste.

After the material is received, Incoming Test and Inspection Unit personnel look up the chemical in the CLS via a local computer terminal, print out a diamond label that indicates the material hazards (see Figure 4-2), and affix the label to the container. If the material is not listed in the CLS, it is held until information is received to properly label it, or it is returned to the manufacturer.

FIGURE 4-2
DIAMOND LABEL CODE LEGEND

SAMPLE

In each of the color-coded diamonds, a number code from 0 (no hazard) to 4 (extreme hazard) will appear to reflect the relative health, fire, and reactivity hazards of the material. The bottom white diamond will carry two pieces of coded data that are specific to NDD. On the left-hand side, a letter code will appear to identify one of seven NDD chemical storage categories for the material. The right-hand triangle will bear a number code to identify the material's proper disposal category from a choice of ten.

HEALTH (Blue)

- 4 Extremely hazardous
- 3 Highly hazardous
- 2 Moderately hazardous
- 1 Slightly hazardous or practically non-hazardous
- 0 Relatively harmless

STORAGE (White)

- A Acids
- B Alkalines (Bases)
- F Flammables (includes combustibles and oils)
- H Heat paper/powder room
- O Oxidizers
- R Reactive Metal
- T Toxics

FIRE (Red)

4	Extremely flammable	Flash point	below	73°F
3	Highly flammable	Flash point		73°F - 100°F
2	Moderately flammable	Flash point		101°F - 200°F
1	Slightly flammable	Flash point	above	200°F
0	Non-combustible	Flash point	above	1500°F

REACTIVITY (Yellow)

4	Extremely reactive	Detonation at ordinary temperatures and pressures
3	Highly reactive	Detonation - strong conditions
2	Moderately reactive	Unstable - violent chemical reaction
1	Slightly reactive	Water reaction - energy reaction
0	Non-reactive	Stable

DISPOSAL (White)

1. Flammable Liquids	7. Toxic Liquids	9. Reactive Compounds
a. Aerosol Cans	a. Cyanides	a. Metals
2. Flammable Solids	b. Arsenics	b. Peroxides
3. Petroleum-Based Oils	8. Toxic Solids	10. Chemical Drain
4. Halogenated Hydrocarbons	a. Cyanides	
a. Freons	b. Arsenics	
b. Methylene Chloride	c. Mercury and Compounds	
5. Oxidizers	d. Chromium Compounds	
6. Corrosives		

Source: Majestic, 1986.

FIGURE 4-3

CHEMICAL REQUISITION PROCESS AT PINELLAS PLANT

Material awaiting a diamond label is temporarily stored in 105-Area, if it is also awaiting the results of acceptance tests; in the Bonded Drum Storage Area (near Building 600), if it is a drum; or among the Bonded Stock Nonproduction Chemicals Building (near the entrance to 400-Area), if it is a nonproduction chemical. Until all specifications and labeling requirements are met, the material is not released from the above areas for use.

When all requirements are met, the material is generally placed in the Chemical Storage Building (Building 600). Small containers and containers requiring special storage conditions (e.g., refrigeration) are placed in the Production Stockroom (157-Area). Small containers of nonproduction, recurring-use items are placed in the General Stockroom (152-Area). One-time orders, special orders, or radioactive materials go directly to the work units or the requisitioner.

Chemicals are dispensed from the 600 Building on a daily basis or are withdrawn from stockrooms on an as needed basis. The chemical receipt and management process discussed above is depicted in Figure 4-4. The major chemicals used, together with their dispensing and disposal, is discussed below.

The Pinellas Plant uses many different chemicals in varying quantities. It has many laboratories that use small quantities of a wide variety of reagents for testing, as well as production facilities that use larger quantities of a limited number of chemicals. As a result, there are over 5000 MSDSs on file. Most of the chemicals are liquids; they fall into the categories of acids, bases, solvents, and oils. The major chemicals and their annual usage are shown in Table 4-5. Storage locations of these chemicals are shown in Table 4-6.

To minimize safety problems, the Pinellas Plant specifies that the work unit should only maintain sufficient hazardous or flammable chemicals to support 2 days of production. Flammable chemicals that are purchased in bulk are stored in the work units in 5-gallon or smaller metal safety containers. Each of these containers, in addition to the diamond label, is required to have a permanently affixed tag describing the chemical and identifying the work unit. If more than 25 gallons of flammable chemicals are stored in one area, they are required to be stored in a fireproof storage cabinet (GENDD, 1987).

CHEMICAL RECEIPT

Test	Temp
PR	PR

TABLE 4-5
MAJOR HAZARDOUS SUBSTANCES USED AT
PINELLAS PLANT

Material	Annual Volume (gals)
Sulfuric Acid	15,000
Nitric Acid	2,500
Hydrochloric Acid	2,500
Acetic Acid	2,500
Sodium Hydroxide	13,000
Hydrofluoric Acid	600
Anhydrous Ethyl Alcohol	17,000
Methyl Alcohol	1,200
Isopropyl Alcohol	500
Butyl Alcohol	300
Acetone	4,500
Toluene	800
Lacquer Thinner	300
Methylene Chloride	800
Amyl Acetate	200
Trichlorotrifluoroethane (freon PCA)	4,000
Trichloroethylene	1,400
Propylene Carbonate	55
Various brand name strippers and solvents	2,000
Oils	600
Diesel fuel	2,500
Lithium Silicon	< 10 lb
Calcium Metal	< 10 lb
Cyanide	6 lb
Arsenic	< 1 lb
Mercury	2 lb
Chromium	2 lb

Source: Data from GENDD, 1984.

TABLE 4-6
TOXIC CHEMICAL STORAGE AT PINELLAS PLANT

Location	Types of Chemicals	Containers	Notes
Receiving Area (Bldg. 100, 105 Area)	All types	All types, 55 gallon max. size	Receiving and temp. storage until testing and CLS labeling complete
Bonded Drum Storage (Near Bldg. 600)	All Types	Drums	Temp. storage awaiting CLS label
Bonded stock Non Production Chemicals (Entrance to 400 Area)	All Types	Jars, bottles, cans normally 10 gallon or less	Temp. storage awaiting CLS label
Bulk storage (North Side Bldg. 500)	H ₂ SO ₄ , NaOH	Bulk storage tanks	For regeneration of deionizers in Bldg. 500
Bulk Storage Wastewater Neutralization Facility)	H ₂ SO ₄ , NaOH	Bulk storage tanks	For neutralization of wastewater
Chemical Storage Bldg. (Bldg. 600)	All types	All types; drums, cans, boxes, bags	Normal chemical storage area
Production Stockroom (Bldg. 100, 157 Area)	Epoxy, grit, paints, misc.	100 lb bags, some 55 gallon drums, mostly smaller containers	Epoxy stored in refrigerator units
General stockroom (Bldg. 100, 152 Area)	Mostly oils, spray paint, misc. items	Generally qt. size or less	Few chemicals

Used or waste chemicals are collected in red, 5-gallon containers. Chemicals are poured into the containers or, in some cases, the containers are connected via flexible tubing to drains from sinks inside fume hoods. These containers are also required to have a permanently affixed, color-coded tag indicating the name and class of waste and the work unit.

To obtain bulk liquid chemicals, the chemical handler for the particular work unit brings the empty containers to a doorway at the rear of Building 100 before noon. Stores personnel from the Chemical Storage Building collect, refill, and return the containers to the rear of Building 100. In the afternoon, the chemical handlers pick up their refilled safety containers and return them to the work unit.

To dispose of liquid chemical waste, the chemical handler brings the red, 5-gallon waste containers to the same door at the rear of Building 100 in the afternoon. Waste Management personnel bring around a specially constructed wagon containing a number of tanks, each of which has a permanently mounted, covered funnel attached to the fill opening. Each tank is color-coded and labeled with the name and code for the waste. The colors, names, and codes correspond with those on the tags affixed to the 5-gallon waste containers to minimize the possibility of an accidental mixing of incompatible wastes. After collection of the waste, the collection cart is brought inside the Hazardous Waste Building (Building 1040), where the transfer tanks are pumped into larger storage tanks. There is a separate hose and air-operated diaphragm pump for each type of waste. Quick-disconnect fittings are used on the hoses and on the drain lines of the transfer tanks on the collection cart. The large waste storage tanks are located aboveground behind Building 1040 in separate diked areas. The Pinellas Plant uses waste handling companies to dispose of the chemicals by approved methods.

During the Survey, bulk acid (H_2SO_4) and caustic (NaOH) tanks in both the Wastewater Neutralization Facility and behind Building 500 were found to be properly diked for spill control. The bulk waste tanks behind Building 1040 are also properly diked, but a 4-foot plastic cube tank of sulfuric acid near the cooling towers does not have a dike around it for spill control. (See Section 3.3.4.4.)

The Chemical Storage Building, which is completely enclosed, is divided into bays with concrete block walls and outside doors. These bays are individually labeled for

toxics, alkalies, heat paper and powder, and flammables. While the cement floors do not have berms at the doors, they do have floor drains in the middle of the floor area with the drain from each area going to a separate, covered sump outside the building so that any spill can be collected. Although the building itself appears to be in generally good condition, the sumps have suffered from the intrusion of surface water and therefore had to be sampled and pumped out to the Wastewater Neutralization Facility after heavy rains.

The Bonded Drum Storage Area consists of a concrete pad with a roof to protect the drums and a fence to prevent access to them. There is no evidence that any spills have occurred here during the temporary storage of drums.

The Bonded Stock Nonproduction Chemicals Building consists of a metal shed on a concrete slab with no drain or berms. The floor is dry and unstained, indicating that no spills have occurred. The shed has been used for chemical storage for the past 2 months while Building 100 is being renovated.

The Survey also revealed the risks of leakage inherent in the different ways chemicals are stored after they are delivered to the work unit. For example, four 55-gallon drums of properly labeled Deacide 717, a biocide used as a cooling tower additive, are stored on a pallet in the open by the cooling tower. Adjacent to these drums is an upside-down drum with an uncovered 1-inch hole punched in the bottom. At the time of the Survey, the drum was full, it had no diamond label, and the manufacturer's label was very faint, but the contents appeared to be a cooling tower additive, Polymate 900 (potassium hydroxide). It was stored next to an undiked 4-foot plastic storage tank containing sulfuric acid. Approximately 30 feet away by the Northeast Fire Pump House were two badly damaged, bulged drums of Polymate 900 on a pallet. The tops were heavily rusted, indicating that the drums had been stored outside for some time. All these chemicals were stored in an undiked area without proper spill control.

In another area northeast of Building 100, a large group of drums (approximately 20) were seen to be stored on the asphalt in the open. These are mostly Polymate 900. Like the storage area above, there are no spill control measures. At the time of the Survey, these drums had been stored here many months, and the tops on some drums are so badly rusted that it is doubtful whether the bung could be unscrewed.

After a joint inspection tour by a manager and EH&SP personnel, these drums were moved to Building 600. About three of them (Dearcide 706) were placed inside the Chemical Storage Building to be saved, and the remainder were lined up on the west side of Building 600 for unknown disposition.

At the rear (north side) of the Chemical Storage Building are a group of usable chemicals in drums (approximately 20) and cardboard boxes of Vanisol cleaner (on pallets) on a concrete walkway under the roof overhang. The storekeeper indicated that most of the drums should be stored inside in the flammable bay, but there is not enough room. Most of the drums contain types of oils. Among the group are five badly rusted drums, three containing methyl ethyl ketone and two containing Immunol 517. There is no spill control, and a grassy area running off to the rear of the property is only 3 feet away.

Away from Building 600 on the west side facing the Hazardous Waste Building is a row of drums (20 or more) containing chemicals that are to be disposed of as waste. Included are 16 drums of Polymate 900 and 3 of Dearcide 717 (another cooling tower biocide), apparently moved there from the rear of Building 100. With this group is a badly rusted 55-gallon drum of powdered material (brightener) with a puncture at the rim. The paperwork requesting disposal, which is attached to the side of the drum, appears to be dated May 12, 1981. Again, none of these chemicals are stored in a manner so as to prevent the runoff of leaks or spills.

When work units cannot readily use process chemicals, the chemicals are not returned to the Chemical Storage Building or sent to the Hazardous Waste Building. Instead, they are often held for long-term storage in areas not designed for this and/or shunted off to a corner and forgotten. Examples of this are the drums of cooling tower additives and brightener discussed above, and cases containing toluene diisocyanate found inside Building 100. The diisocyanate, whose shelf life had expired in February 1986, was found with miscellaneous other material in 150-Area, where it had been shunted from an area being renovated.

During the Survey, the labeling, use, storage, and disposal of chemicals in the various work units in the production areas and laboratories of various buildings were reviewed. In most areas the labeling was found to be good. In a few areas, such as the 155- and 156-Area Chemistry Laboratory, where there is a large reagent

storage area, many of the bottles of chemicals do not have the diamond label, since they were received prior to 1985 when the diamond labeling system was initiated. As time permits, EH&SP is working on the backlog of areas such as this, requesting lists of chemicals from the using unit. The EH&SP prints out a label for the chemical if an MSDS is on hand, or requests an MSDS from the supplier or manufacturer if one is not available in the files for the particular chemical.

A review of the CLS revealed two listings for one particular chemical, Dearcide 706, and two different data sheets indicating different disposal requirements. This occurs because the manufacturer changes some of the data on the MSDS and the new listing is added into the system without purging the old listing. This could lead to improper disposal of a chemical in a drain leading to the Publicly Owned Treatment Works (POTW) or in nonhazardous trash destined for the county landfill. The EH&SP is aware of this possibility and once a year goes through the system to purge duplicate entries and old entries.

Another issue is that there is no category for solid, nontoxic chemicals such as glass beads and grit, so in some cases the labeling is more restrictive than it has to be. Personnel are aware of this and, therefore, some of these materials are disposed of in normal drains and in the trash as nonhazardous waste. This practice of ignoring or countermanding disposal requirements may result in the disposal of properly labeled material improperly in a drain. For further information on this subject, see Section 4.1.2.4.

A few instances of storage of quantities of chemicals in excess of plant use requirements, or inappropriate storage of waste materials were observed. The Polymer Laboratory (185-Area) had a large chemical storage area with a number of flameproof cabinets, some of which were ducted to the ventilation system. A 55-gallon drum of methylene chloride with a hand pump and a 55-gallon liquid waste drum were stored in the same area. Drum-size containers appeared to be in excess of requirements for this area. In the Sputtering Room (163-Area) three cardboard shipping boxes each containing four 4-liter bottles of kerosene were stored underneath a laboratory bench. This also appeared to be in excess of plant use requirements.

4.2.1.2 Polychlorinated Biphenyls

The labeling, use, storage, and disposal of PCB oils and PCB-containing equipment were assessed at the Pinellas Plant by the review of procedures, and inventory and shipping records; the inspection of the currently operating equipment for leaks; and the interviewing of Facilities Engineering and Waste Management personnel. Section 8 of the EH&SP manual provides adequate guidance on compliance with the regulations for the use, storage, and disposal of PCBs.

Originally there were 30 capacitors and 12 large electric transformers containing PCBs on site. At the time of the Survey, no records of capacitor sampling were available. However, since the transformers contained 100 percent PCB oil, they presumably had not been sampled. The capacitors each contained 1 to 2 gallons of oil and were packed two per 55-gallon drum for disposal. The drums were stored temporarily in 137-Area (the Switchgear Room), which is bermed at the doors. The last set of drums was shipped out in 1985 to an approved PCB waste disposal contractor, ENSCO, which disposed of the material at a facility in El Dorado, Arkansas.

Two of the PCB transformers outside Building 500 were removed during the eastern addition to Building 100. They were disposed of by ENSCO at a facility in White Bluff, Tennessee, in 1984.

Inspection and inventory reports were prepared and maintained by Facilities Engineering but were not submitted to the State of Florida or the EPA because the quantities did not warrant reporting.

A review of the shipping records disclosed complete shipping papers and signed certificates of destruction for all PCBs shipped.

At present, the only PCB-containing equipment on-site are the 10 active electric transformers on the second floor of Building 100 (137-Area). They contain a total of approximately 3350 gallons of 100 percent PCB oil. Each of the transformers is labeled, and they appear to be in good condition; no leaks are apparent. Sealant on pipe plugs in the transformer drain valves and a small discolored area on the mat under the drain valves indicate that there may have been a few drips in the past.

The room has berms at the doors to retain a major spill. However, if an electrical overload and/or a fire should occur and rapidly involve all the transformers, the PCB oil released from the transformers and the fire suppression water may overflow the berms, potentially contaminating the building and the ground outside. Pyrolysis products released through the three roof fans can also contaminate the environment on-site and possibly off-site. Details of the potential concerns related to such an accident involving the PCB transformers were reported to the plant in 1984 (Bolton et al., 1984). As a result, the plant is currently in the process of installing new transformers at the west end of Building 100. The 10 active PCB transformers are expected to be taken out of service and shipped off-site for disposal in 1988.

4.2.1.3 Pesticides

The use of pesticides at the Pinellas Plant is limited to insect control. Herbicides for weed control are not used.

No insecticides are currently being applied by plant personnel. The plant does not have licensed applicators/operators and therefore does not apply or store insecticides. An outside contractor, Durkin Extermination Company, performs these services with licensed applicators. It uses commonly available chemicals monthly for the control of roaches, ants, rats, and mice. The chemicals in question, Dursban and Pyron, are typically used in residences and are not on the Federal Restricted Use List. Once per year, during the annual plant shutdown, the company uses a restricted chemical, Killmaster II, in the cafeteria.

During construction of new buildings, the soil is treated to prevent infestation by termites or the growth of grass or plants. This is done through the building architect-engineer (A-E), who subcontracts to a local exterminator. General Electric project engineers specify to the A-E what chemical to request in the bids. The chemical currently in use, Pramitol, is in fact the one specified by the previous industrial hygienist. It is not on the Federal Restricted Use List.

4.2.1.4 Asbestos

During the renovation of the Building 200, the prime contractor discovered asbestos-containing material (ACM) inside the roof. An analysis was performed and, with GENDD approval, a certified company (Lange Engineering) was selected to remove and dispose of the material. The EPA was notified, trained workers removed the material, EH&SP personnel oversaw the double-wrapping in plastic, and the ACM was disposed of in an approved area of the Hillsborough County Landfill. Copies of the training certificates, physicals, and landfill receipts are on file with the EH&SP.

Pinellas Plant chemical waste personnel removed some asbestos-backed tile from 163-Area in November 1986 because of time constraints during renovation. After a written procedure was prepared, the personnel were instructed on their duties, they were issued protective clothing and respiratory protection, and they set to work under EH&SP supervision. The material was bagged, drummed, and shipped to the GSX, Inc., hazardous waste landfill in Pinewood, South Carolina. Copies of the procedure and shipping papers were reviewed and found to be complete.

During February 1987, an assessment for ACM was performed by an outside contractor. (The Pinellas Plant has little ACM and is working to remove most of this material.) All of the above records were reviewed, including a notification letter for a new tile removal project. No findings in this area were recorded.

4.2.2 Findings and Observations

4.2.2.1 Category I

None

4.2.2.2 Category II

None

4.2.2.3 Category III

None

4.2.2.4 Category IV

1. Active PCB transformers. There are 10 active transformers containing a total of approximately 3350 gallons of 100 percent PCB oil on the second floor (137-Area mezzanine) of Building 100 that can leak. In the event of a rupture and/or fire, PCB oil released from the transformers may severely contaminate the building and the local environment. The combination of that oil and fire suppression water may be sufficient to overflow the berms at the entrances to the room, thereby contaminating the building and the grounds outside. Pyrolysis products may also be released through the three roof fans that exhaust the room, thus contaminating the environment on-site and off-site. Details of these possibilities have been reported previously (Borton, 1984).

The plant is currently in the process of replacing these transformers. They are expected to be taken out of service and shipped off-site for disposal in 1988.

2. Chemicals are improperly stored outside plant buildings. Chemicals have been improperly stored outside plant buildings for extended periods of time. Because of the storage conditions, there is a potential for leakage due to corrosion of or damage to the containers. Since the containers (mostly drums) are in undiked areas, such leakage is likely to contaminate the soil and surface water.

Examples of improper storage include

- About 20 drums of the cooling tower additive Polymate 900 with rusty tops behind Building 100 near 353-Area
- About 20 drums of volatiles and chemicals on the north side of Building 600
- An undiked 4-foot plastic storage cube of sulfuric acid by the cooling tower

- Miscellaneous damaged drums in the vicinity of the cooling tower and Northeast Fire Pump House.

3. Chemicals currently in storage do not meet plant requirements. Toxic or flammable chemicals stored in some areas exceed plant requirements. For example, there is a 55-gallon drum of methylene chloride with a hand pump in the chemical storage area of the Polymer Laboratory (184-Area). There are also three cardboard shipping boxes, each containing four 4-liter bottles of kerosene, under a laboratory bench in the Sputtering Room (163-Area).

Unnecessarily large amounts of improperly stored chemicals in work areas could be a safety hazard and, if accidentally released to a drain, might affect the Wastewater Neutralization Facility, the POTW, and surface water resources.

Plant procedures limit the storage of hazardous chemicals in usage areas to amounts sufficient to support 2 days of production. Moreover, flammable chemicals must be stored in metal safety containers with a capacity of no more than 5 gallons.

4. Chemicals are improperly handled and stored: When process chemicals cannot readily be used, they are not returned by work units to the Chemical Storage Building or sent to the Hazardous Waste Building for disposal. Instead, they are often held in long-term storage in areas not designed for this or shunted off to a corner and forgotten. For example, a drum of brightener to the west of Building 600 was found during the Survey to carry a disposal request that appeared to be dated May 12, 1981. Also, in Building 100 (150-Area), three cases containing jars of toluene diisocyanate were discovered. On top was an unsecured plastic bag of what appeared to be used asbestos gloves and laboratory squares. This material had been temporarily moved with other material to the area while another area was being renovated. Tags indicate that its shelf life had expired on February 1, 1986. Moreover, it had been tagged with a Discrepant Material Tag on February 5, 1986, but had not been disposed of. Plant personnel indicated that the diisocyanate would be moved to the Hazardous Waste Building for disposal the last day of the on-site Survey (May 22, 1987).

Improper handling of hazardous chemicals could result in their being accidentally released to drains or directly to the environment, thus contaminating surface water.

5. Incomplete application of the chemical labeling system. Many chemicals in some areas are not labeled with the chemical label indicating storage and disposal requirements. As a result, the material could be improperly disposed of in a drain and thence through the POTW, or be inadvertently sent to a local landfill and thus contaminate the soil in that area.

The diamond label system used at Pinellas is basically effective. It involves labeling every chemical immediately when it enters the plant. Since it was not instituted until 1985, however, most chemicals purchased prior to that year are not labeled--the chemicals in the 155/156-Area Chemistry Laboratories, for example. In addition, some chemicals have more than one MSDS on file in the CLS. Dearcide 706 has two separate MSDSs with differing requirements.

Personnel of the EH&SP, who are aware of both situations, are working on the backlog of labeling as well as reviewing the CLS once per year to purge the system of old MSDSs.

4.3 Radiation

This section (1) identifies the sources of off-site radiation exposure resulting from the operation of the Pinellas Plant, (2) reviews the methods used to measure and monitor the impacts of those exposures, (3) compares the estimated and measured impacts against established standards and limits and, (4) presents findings regarding problems and deficiencies. These topics are addressed in the context of relevant EPA and DOE requirements. The requirements themselves are described in detail in Appendix K.

Several radioactive elements are used at the Pinellas Plant; tritium, krypton-85 and plutonium-238/239. Tritium and plutonium are harmful only if taken into the body. Krypton-85 is a radioactive gas that is not retained by the body; radiation exposure occurs only during the time of exposure to the gas.

4.3.1 **Background Environmental Information**

The total dose rate from natural background radiation in the St. Petersburg area is 51.8 millirem per year (EPA, 1981). This dose rate includes 29.0 millirem per year caused by charged particles from extra-terrestrial sources which, when entering the earth's atmosphere, have sufficiently high energies to generate secondary particles that penetrate to ground level (EPA, 1981). Throughout the United States the average dose rate due to cosmic radiation is 28 millirem per year (NCRP, 1975). Naturally occurring terrestrial radionuclides contribute a dose rate of 22.8 millirem per year in the St. Petersburg area (EPA, 1981), as compared with a national, population-weighted average of 26 millirem per year (NCRP, 1975).

The ambient concentration of tritium in the drinking water in Tampa, Florida, is 0.2 nanocurie per liter. Consumption of 2 liters per day would result in an effective dose equivalent of approximately 8×10^{-3} millirem per year. The drinking water concentration of tritium throughout the United States varies from 0.1 to 5.6 nanocurie per liter (EPA, 1983).

4.3.2 General Description of Pollution Sources and Controls

Tritium is the principal radionuclide used at the Pinellas Plant. It is a radioisotope of hydrogen that emits low-energy beta particles. Because tritium is an isotope of hydrogen, it behaves chemically as normal hydrogen and can mix with hydrogenous materials. Tritium oxide, for example, behaves as does normal water. Tritium gas moves freely with the atmospheric gases and tritium oxide moves freely throughout the hydrosphere. Consequently, tritium does not selectively accumulate in the environment. For example, the concentration of tritium does not increase as it moves through environmental pathways as do some other radionuclides, notably radioiodine. Because of the very low energy of the beta particles emitted when a tritium nucleus decays, these particles cannot penetrate the skin and cause an exposure external to the body. They must be inhaled, ingested, or injected into the body to produce a radiation dose to the body.

Tritium gas is received at the plant in small flasks and transferred onto depleted uranium beds contained within cylinders that are used as the tritium gas supply for processing equipment. Normally a bed is charged with 0.2 to 0.3 gram tritium gas (approximately 2000 Ci). One bed in Room 182 contained 1.15 grams (approximately 11,000 Ci). Most of the plant inventory of tritium is contained on the depleted uranium beds. A much smaller quantity is incorporated into the inventory of neutron tubes, and an even smaller amount is associated with waste products. A few grams of tritium gas will meet the production needs for many months. Consequently the total plant inventory need be only tens of grams and resupply occurs at intervals longer than a year.

Krypton-85 is used in two units of leak detection equipment in the Pinellas Plant. It is an inert radioactive gas with a radioactive half-life of 10.3 years and emits both beta particles and gamma photons. Because krypton-85 is inert, radiation exposure occurs only during the time during which a person is exposed to a cloud of the gas; it does not accumulate or concentrate as it moves through environmental pathways. Bodily exposure occurs both internally and externally.

Small, sealed plutonium sources are used in the manufacture of radioisotopic thermoelectric generators. The sources contain approximately 80 percent plutonium-238 oxide and 20 percent plutonium-239 oxide. Both plutonium

isotopes emit alpha particles and gamma photons. These radioisotopes are extremely hazardous, particularly if inhaled. All of the plutonium received at the Pinellas Plant is contained in triple-sealed metal capsules designed to withstand extreme environmental stresses.

Radioactive gaseous effluents are released from three exhaust stacks at the Pinellas Plant: the Building 100 main stack, the Building 100 laboratory stack, and the Building 800 stack. Total discharges from these sources for 1985 were as indicated in Table 4-7.

**TABLE 4-7
RADIOACTIVE GASEOUS DISCHARGES FROM EXHAUST STACKS AT THE
PINELLAS PLANT FOR 1985**

Effluent	Bldg. 100 Main Stack ^a	Bldg. 100 Lab. Stack ^b	Bldg. 800 Stack ^c
Tritium gas	68 Curies	34 Curies	9 Curies
Tritium oxide	92 Curies	56 Curies	1 Curie
Krypton-85 gas	5 Curies	--	--
Totals	165 Curies	90 Curies	10 Curies
Annual Average Concentrations in Stack:	3.89×10^{-10} Ci/l	2.43×10^{-10} Ci/l	4.95×10^{-10} Ci/l

Source: DOE, 1986b.

^aPer 4.24×10^{11} liters of air.

^bPer 3.71×10^{11} liters of air.

^cPer 2.02×10^{10} liters of air.

The maximum ground-level concentration occurs approximately 100-155 meters (328-509 feet) downwind from the Building 100 stacks and could be either on-site or off-site, depending on wind direction. For Building 800 releases, the maximum ground-level concentration occurs approximately 29 meters (95 feet) downwind. All of these locations are within the plant boundary.

Tritium and Tritium Oxide Air Emission Sources and Controls

Tritium and tritium oxide emissions to the atmosphere are the predominant radioactive releases from the site. According to dose calculations, atmospheric

emissions of tritium oxide* account for the major portion of the maximum off-site dose from Pinellas Plant atmospheric sources (DOE, 1986b).

Sources of atmospheric tritium emissions include neutron generator manufacture (Room 108), development (Room 182), and analysis (Building 800). The destruction testing of neutron tubes in Building 200 is also the source of unmonitored atmospheric releases. Total atmospheric emissions of tritium oxides from Building 100 and 800 stacks in 1986 is reported to be approximately 160 curies (DOE, 1986b).

Approximately two-thirds of the tritium oxides released to the atmosphere are emitted from the Building 100 main stack; the remaining one-third comes from the Building 100 laboratory stack. Less than 1 percent of the total releases are emitted from the Building 800 stack.

All processing equipment that uses tritium exhausts into the Tritium Recovery System (TRS). Discharges from the equipment enter a manifold system that is maintained at a negative pressure. When a preset pressure (500 torr) is reached, the contents of the manifold system are pumped through a heated column containing copper oxide. Hydrogen and its isotopes are converted to water vapor. The water vapor is removed from the gas stream as it passes through a series of columns containing moisture collecting (molecular sieve) material. When pressure in the system is reduced to 400 torr, the system turns off automatically and a 20-minute air purge is initiated to reoxidize the copper. The effluent is directed into the east (main) stack. When "breakthrough" of the molecular sieve material occurs, tritium oxide is no longer being collected and is discharged into the stack. Such a "breakthrough" is identified by an abnormal rate of change in the ionization current of the Karman Chambers located in the stack. The moisture collection columns are then changed and the used columns shipped to the Savannah River Plant. The TRS collects approximately 8000 curies per year of tritium.

*Elemental tritium is not readily absorbed into the environment and therefore does not contribute a significant portion of the total dose.

Two of the quality control tests carried out in Building 200 involve the destructive testing of neutron generators. The tests destroy the containment integrity of the generators, and the small amount of tritium present in each either remains attached to solid material or is released into the room air. The solid "rubble" is collected and disposed of as radioactive waste. The airborne waste, including particulates, is exhausted to the atmosphere via two vents that discharge at roof level with no treatment of the discharged gases. Filtration equipment is being designed that will remove the particulates.

Hoods and enclosures provide directed air flow into an exhaust ventilation system from all operations in which personnel could be exposed to tritium. Additionally, breathing-zone air is monitored by passing continuous samples through Kanne Chambers. The Kanne Chambers are read daily except on weekends. An alarm rings in the Security Officers' office if a preset concentration of krypton is reached or exceeded.

The linear accelerator target area and vacuum pumps in Building 800 are provided with enclosures and hoods that direct air flow into an exhaust ventilation system. The stack of that system is monitored by Kanne Chambers and sampled by the same type of sampling train that is used on the Building 100 stacks.

Plutonium-238 and 239 Air Emission Sources and Controls

Encapsulated plutonium-238 and 239 are received and incorporated into RTGs in Building 400. The plutonium sources arrive at the plant hermetically sealed within a three-layer capsule that is designed to withstand extremely harsh environmental conditions during its use. Thus, plutonium is a highly unlikely source of air emissions at the plant; it is difficult to conceive of conditions that could cause the release of plutonium. Nevertheless, because of the extreme biological risk associated with exposure to plutonium, precautionary measures are taken. For example, the sources are handled in hoods or glove boxes and the exhaust air passes through two banks of high-efficiency particulate air (HEPA) filters prior to discharge. Monitoring of the storage vault of Building 400 and the inlet to the HEPA filter bank is performed with continuous air monitors and discrete sampling filters. Sampling for airborne plutonium is also performed in the exhaust stack of Building 400.

Krypton-85 Air Emission Sources and Controls

Product leak detection equipment containing krypton-85 gas is located in Room 109. Commercially available models of two leak detection units are housed in separate rooms. Shrouds connecting the two units are connected to an exhaust system that discharges into the east (main) stack. Krypton-85 discharges from the Building 100 main stack are monitored by a continuous air sample drawn through a Kanne Chamber connected to a picometer and recorder. The Kanne Chambers are read daily. An alarm sounds if a preset value is reached or exceeded.

4.3.3 Environmental Monitoring Program

This section includes a description and assessment of the methods and practices in use at the Pinellas Plant for determining the environmental impact of its operation. Radiation doses received by nearby inhabitants are evaluated against established standards and limits.

4.3.3.1 Exposure Pathways

The determination of the radiation dose received by persons in the vicinity of the Pinellas Plant requires consideration of the environmental pathways through which exposures can occur, that is

1. Direct radiation from an on-site facility or radioactive material stored there
2. Radiation from airborne effluents (radioactive materials released to the atmosphere from the facility)
3. Radiation from liquid effluents, particularly drinking water.

The contribution of each of these pathways of exposure within the framework of existing environmental conditions in the Pinellas Plant vicinity is examined in this section.

Direct Radiation

There are no ionizing radiation beams, such as x-rays and gamma photons, emanating from the plant. Thus, the only off-site exposures are the result of radioactive effluents from the plant which are inhaled, ingested, or which immerse nearby inhabitants in a gas cloud.

Air

The atmospheric transport of airborne effluents is the exposure of principal significance at the Pinellas Plant. Tritium, krypton, and plutonium particulates could be transported by the atmosphere to locations where they would be inhaled. Airborne tritium oxide could also combine with surface water and be ingested by nearby inhabitants and by animals in the human food chain.

Water

Tritium oxide released into surface or groundwater would act exactly as the receiving water and be used for the same purposes. Thus, radiation exposures could occur if the water were used as drinking water or for the irrigation of food crops. Deep aquifers unlikely to be affected by tritium releases from the plant are the major sources of drinking water in the Tampa Bay area. However, as noted in Section 3.4.1.3, there are approximately 240 wells within a 1- to 2-mile radius of the plant, and most of them are used for agricultural purposes or for the irrigation of lawns and shrubs. Twenty domestic and public trailer park wells have been identified.

4.3.3.2 Air Monitoring

Five off-site air sampling stations operate at the locations shown in Figure 4-5. A continuous air sample is passed through a column of silica gel in which any tritium oxide is collected. Another air sample is passed through a heated column containing copper oxide, which converts the tritium gas to tritium oxide, and then through a silica gel column. The moisture is removed from the columns by distillation and analyzed by liquid scintillation counting. The columns are analyzed

OFF-SITE SAMPLING LOCATIONS

FIGURE 4-5

at 4-week intervals. The sampling results for 1986 are shown in Table 4-8. The average concentrations measured were less than 2×10^{-11} microcurie per milliliter for both tritium gas and tritium oxide (DOE, 1986b).

Airborne particulates are continuously collected at each sampling location. Filters are collected at 4-week intervals and composited for quarterly analysis of plutonium-238 and 239. All samples in 1986 were reported to be below the minimum detection level, which ranges from 1.7×10^{-19} to 3.0×10^{-18} microcurie per milliliter (DOE, 1986b).

4.3.3.3 Water Monitoring

Samples of surface water from ponds, lakes, and ditches are collected quarterly from the 26 locations shown in Figure 4-5. During 1986, 101 samples were analyzed. One sample was above the minimum level of detection for tritium; it had a value of 1.2×10^{-6} microcurie per milliliter.

4.3.3.4 Determination of Radiation Doses

Doses received by persons off-site as a consequence of airborne releases from the plant were calculated by two methods. The first involved the use of standard atmospheric diffusion equations and historical meteorological data to calculate the concentrations of tritium and krypton at various locations that would result from the quantities of those radionuclides detected by the stack monitors. The effective dose equivalents for persons living at these locations for the entire year were then calculated using the Derived Concentration Guide. The results are shown in Table 4-9.

**TABLE 4-8
OFF-SITE TRITIUM AIR SAMPLES**

Location ^a	Tritium Form	Concentration in Air x 10 ⁻¹² μ Ci/ml	
		Range	Average (+ 2 SD) ^b
North	Gas Oxide	<6-<51 <2-<9	<24(+ 37) <6(+ 4)
Northeast	Gas Oxide	<2-<6 <2-<9	<4(+ 3) <5(+ 4)
Southeast	Gas Oxide	<2-<58 <2-<78	<22(+ 45) <30(+ 54)
South	Gas Oxide	<2-<7 <3-<30	<4(+ 4) <8(+ 15)
West	Gas Oxide	<1-<55 <3-<8	<11(+ 34) <6(+ 4)
	Arith Mean:	Gas Oxide	<13 <11

^aSee Figure 4-5.

^bValues in parentheses indicate + 2 standard deviations

Minimum detection levels: Gas 0.8-8.7 x 10⁻¹² μ Ci/ml
Oxide 0.9-9.2 x 10⁻¹² μ Ci/ml

Results showing less than the minimum detection level were assigned this value when computing averages.

Standard: Tritium gas and tritium oxide 1 x 10⁷ μ Ci/ml
(after DOE, 1986b).

**TABLE 4-9
ANNUAL EFFECTIVE DOSE EQUIVALENTS
FROM AIRBORNE RELEASES (mrem)**

	Tritium	Krypton
Individual at the plant perimeter	8.5×10^{-3}	1.2×10^{-5}
Inhabitants of nearest residential area	3.4×10^{-3}	3.8×10^{-6}
Avg. to persons within 80 kilometers	1.1×10^{-4}	-

Source: DOE, 1986b.

The second method involved use of the AIRDOS-EPA model to calculate the dose equivalent for the soft tissues of the maximally exposed individual. That value was less than 1.2×10^{-1} millirem (DOE, 1986b).

No liquid waste containing tritium is released to the environment. Therefore, the only possible source of off-site exposure via the water pathway is the tritium oxide released from the stacks, which enters surface water bodies by precipitation or diffusion. The best evidence of the significance of that pathway is the measured concentrations of tritium in surface water samples. As described in Section 4.3.3.3, the values obtained by such measurement indicate that doses delivered via this pathway are an exceedingly small percentage of the guidelines specified by DOE Order 5480.xx (see Appendix G) and NESHAPS. This exposure pathway is also taken into account in the calculation of off-site doses using the AIRDOS-EPA model.

4.3.4 Findings and Observations

4.3.4.1 Category I

None

4.3.4.2 Category II

None

4.3.4.3 Category III

None

4.3.4.4 Category IV

1. There is a lack of monitoring and control of tritium releases from Building 200. Air contaminated with tritium resulting from the destructive testing of neutron generator tubes is presently discharged through roof vents without monitoring or control.

Several hundred neutron generator tubes undergo destructive testing each month in Building 200. Each test results in the formation of particulates containing tritium. The test chamber is exhausted through a hood to roof vents, and a small amount of tritium is released to the atmosphere as entrained particulate. The test chamber exhaust system is not equipped with either a particulate control or tritium monitoring system. While the quantity of tritium released is small, and is not a significant human health concern, the release may represent a significant fraction of the total tritium released from the site. Plant health protection personnel (EH&SP) have recognized the potential for measurable releases of tritium containing particulates from this source, and from a newly installed test chamber, and have initiated installation of HEPA filters on the exhausts. These filters are presently being designed.

2. Calibration of stack exhaust tritium monitors is inadequate. The performance of the stack exhaust tritium monitors on the Building 100 main and laboratory stacks and on the Building 800 accelerator exhaust are not recalibrated against known quantities and flow rates of tritium. Therefore, the reliability of reported doses received by persons outside the plant, which are calculated using the results of the stack monitoring as source terms, is questionable.

The performance of stack sampling equipment is affected by a number of factors such as location of sample probe, and length and composition of sampling lines. The effect of these factors is normally determined and taken

into account in the design and startup of the equipment. It is important that the performance of the equipment be checked periodically to see if the initial conditions still hold.

The Kanne Chambers, which continuously monitor the tritium concentration in the stack exhaust, are presently calibrated using a sealed cesium-137 source. This calibration method adequately calibrates the electronic components of the monitoring system, but does not determine how well the Kanne Chamber physically detects tritium.

3. Stack monitoring and sampling equipment is deficient. Numerous minor deficiencies exist in equipment and procedures related to the radiological stack monitoring and sampling program. As a result, the accuracy of current and historic atmospheric release data is uncertain.

Reviews of data, reports, discussion with site personnel responsible for various aspects of the stack monitoring program, and inspections of stack sampling and monitoring systems identified numerous deficiencies in the systems. Most of these are considered relatively minor by the Survey team and are already known to the site staff. A report dated September 30, 1986, by the IT/Radiological Sciences Laboratory under contract with the General Electric Company - Neutron Devices Department described numerous stack monitoring problems in detail including:

1. Ionization chambers in use for stack monitoring have neither particulate filters nor ion traps for the inlet air stream. Also, the calibration procedure employs an external "point" source of radiation, and calibration by flowing a quantity of tritium through the chambers is not performed.
2. Long sampling lines (30 to 40 feet) on the tritium samplers allow tritium to be retained along the inner surfaces of the sampling line. Releases of tritium oxide which last for a few seconds or minutes could appear as a gradual increase and not be detected as a discrete increase.

3. The absence of filtration of the inlet air for the silica gel columns (of the tritium samplers) allows particulates to affect the adsorption efficiency of the columns.
4. Tritium releases from the tritium recovery system. Tritium is released to the environment unnecessarily at each breakthrough of the Tritium Recovery System (TRS) molecular sieve columns.

As described in Section 4.3.2, under the current mode of operation of the TRS, depletion of the capacity of the molecular sieve columns to remove moisture (and TOH) is identified by an increase in the Kanne Chambers reading which are located in the stack. At such time the columns are replaced. From the time that "breakthrough" occurs until the columns are placed, tritium that would normally be retained by the TRS is discharged into the stack. Monitoring of the TRS discharge line for "breakthrough" before the tritium is diluted with the large volume of stack gas could decrease the period of time during which tritium is being released. Such a monitor with provision for automatic changeover of the molecular sieve columns was reported as a planned modification to the new system. Until that modification is completed there will continue to be periodic releases of small amounts of tritium from the TRC to the environment with increases, although probably not measurable, in the environmental levels of tritium due to plant operation.

4.4 Quality Assurance

This section of the report discusses the quality assurance aspects of the Pinellas Plant regarding environmental sampling and analysis (S&A), and procedures relating to environmental data management. The major emphasis was on the ability to identify the quality of the data produced as a result of the environmental field sampling/monitoring and laboratory analytical programs.

During the Survey, the scope of the review included the following types of items related to S&A:

- Quality Assurance/Quality Control (QA/QC) plan
- Appropriate S&A methods
- Written approved procedures to implement the QA/QC plan and analytical methods
- Calibration and maintenance of equipment/records
- NBS traceability for calibration/records
- Training of personnel/records
- Analytical techniques
- Analytical records preparation
- QC of analytical data
- Participation in QC programs
- Chain-of-custody procedures

Survey personnel reviewed the QA plan, the S&A procedures, and the standards, calibration, and maintenance records for the analytical equipment. Sample collection transfer and analyses were observed. Data handling and the results of the QC program participation were also reviewed.

Environmental surveillance is performed by a number of organizations both from Pinellas Plant and outside contractors. Table 4-10 shows the responsible organizations for both sampling and analytical work for all the Pinellas Plant environmental monitoring efforts.

TABLE 4-10
RESPONSIBILITIES FOR ENVIRONMENTAL SURVEILLANCE PROGRAM
AT THE PINELLAS PLANT

Type Sample	Sampling			Analysis	
	Collector	Type	Frequency	Laboratory	Frequency
Liquid Effluent - Health Physics Tanks - Wastewater Neutralization Facility	Operations Operations	Grab Proportional	As needed Daily Monthly	EL EL HTL	As needed Daily Monthly
Stack Effluent	EH&SP	Continuous	Monthly	EL	Quarterly
Perimeter & Offsite Air Samples - Particulates - Tritium	EH&SP EH&SP	Continuous Continuous	2 weeks 4 weeks	EL EL	Quarterly 4 weeks
Surface Water	EH&SP	Grab	Quarterly	EL	Quarterly
Soil	EH&SP	Grab	Annually	EL	Annually
Groundwater - Onsite - Offsite	Haztech CH ₂ M Hill	Grab Grab	As needed As needed	WAL CH ₂ M Hill	As needed As needed

EL = Environmental Lab
HTL = Haines Testing Laboratory
WAL = Wadsworth/ALERT Laboratories

4.4.1 General Description of Data Handling Procedures

4.4.1.1 Environmental Monitoring

Background and QA Policy

Typically, environmental monitoring programs are established to monitor for radioactive materials and other parameters to meet regulatory permit requirements.

As a result of few driving requirements, the plant environmental program is rather limited compared to other larger facilities. Pinellas County is the only county in Florida that does not require the laboratory analyses of water to the POTW to be performed by a laboratory certified under the EPA Contract Laboratory Program (CLP) or Florida certification program. However, Pinellas Plant EH&SP personnel expect that when the county finishes writing its revised regulations and issues a permit to the plant, certification of the laboratory performing the analyses will be required.

Operations

The responsibility for collection of environmental monitoring samples is divided among Operations, EH&SP, and two contractors, CH₂M Hill and Haztech. Operations personnel responsible for the Wastewater Neutralization Facility perform sampling of the Health Physics (HP) tanks and liquid effluent from the Wastewater Neutralization Facility. Samples from the HP tanks, which are the radioactive waste holding tanks, are collected manually by an operator after recirculating/mixing the tank. The HP tank samples are collected on an as-needed basis, typically once a day. Samples from the sanitary system, chemical waste system, and combined effluent from the Wastewater Neutralization Facility are collected daily from refrigerated flow-proportional sample-collection units by these operators. These samples are brought by the operator to the on-site Environmental Laboratory (EL) for analysis.

A once-per-month, 24-hour proportional sample of the Wastewater Neutralization Facility effluent is collected by Operations for chromium, mercury, and phenolics

analyses. The day before the sample is to be taken, the operator scrubs out the tank on the refrigerated collection unit using Alconox detergent and then performs a nitric acid rinse. After a 24-hour proportional sample has been collected, the operator places an aliquot into a prelabeled sample bottle to which preservatives have been added by Haines Testing Laboratory (HTL) of Clearwater, Florida. The operator gives the sample to the company driver who transports the sample to HTL.

Operations does not have a QA program for sampling. There is a written procedure for the recirculation and collection of HP tank samples. This procedure (2-101) was numbered, dated, and had approval signatures. It had been revised recently (February 4, 1987), but steps requiring samples which are no longer required are still part of the procedure and had not been deleted. Collection of a sample from one of the HP tanks was observed. The operator followed the procedure during sample collection. A 170-milliliter (6-ounce) bioassay bottle with a cardboard insert cap was used to collect a sample for tritium analysis. The operator had no logbook to record any data; the data (tank number, level, and date) were recorded on the sample bottle cap and the sample brought to the EL.

When the operator brought the sample to the EL, there were laboratory personnel present to whom he handed the sample. However, it was noted there was an area marked on the lab bench where personnel were to leave samples. The sample was tracked by the combination of tank number, tank level, and date of sample.

Environmental Health and Safety Programs

An EH&SP technician collects all environmentally related samples, except liquid effluent samples and well water samples, according to the frequencies shown in Table 4-10. The EH&SP unit does not have a QA program relating to sampling. The unit does have procedures. However, in a procedure book obtained from EH&SP, there were multiple copies from different periods; some had handwritten notes on them and it was difficult to tell if the newest ones were in effect, since there was a blank by the revision number (rather than having revision 0) and the procedures had no approval signatures (except for those relating to Operations).

The collection of perimeter and off-site particulate filters and silica gel canisters was observed. After collection of the on-site air samples (particulate filters and silica gel

canisters), the samples were brought to the EL together with the data sheets. The air samplers had neither a flow regulator nor an integrating gas meter but did have an hour meter. The dust loading on the filter papers was high enough that a second filter paper was used as a backing to prevent the paper from tearing. The starting and ending flow rates and the hour meter were used to calculate an average flow rate to determine total flow through the filters. It was also noted that the filter heads were positioned differently and were at different elevations above ground (1 foot to 4 feet) at different locations. The flow rates through the silica gel columns were checked with a bubble column and data recorded on individual sheets of paper for each sample station. Each canister was permanently marked with a bar code (which could be read with a scanner in the counting room) and English abbreviations (which could be read in the field).

The air sampling equipment was located in metal sampling houses and appeared to be in good condition. Rotameters and thermometers (on ovens on tritium sample lines) are calibrated by, and related equipment maintained by, the Calibration and Maintenance-Electromechanical Laboratory. This laboratory performs calibrations on a routine schedule in accordance with its calibration scheduling analysis printout (computer printout which shows what instruments are due for calibration the next week). Minor maintenance and adjustments such as replacing tubing and adjusting flow rates are performed by the EH&SF technician. There are no written training procedures, training signoff sheets for various activities, or any certification or documentation to indicate what training the technician has had and what activities or functions he is capable of performing properly.

Sampling of wells and the analyses of these samples are performed by contractors for specific sites. At the 4.5-acre site formerly owned by DOE, the prime contractor is Haztech for well installation and sampling, with Wadsworth/ALERT Laboratories (WAL), Inc., Atlanta, Georgia, performing the laboratory analyses. On-site near the East Pond, at what is called the northeast site, the contractor is CH₂M Hill for well installation, sampling, and laboratory analyses.

Haztech and WAL do have a QA project plan for the 4.5-acre site (S&ME/Haztech, 1985) which was reviewed. The sampling and chain-of-custody procedures met EPA requirements.

Sampling of wells on the 4.5-acre site by Haztech personnel was observed by Survey team personnel. Appropriate procedures were followed in order to obtain a representative sample and not contaminate the sample. The instruments used were in good condition and were properly calibrated. Logbooks were maintained to record readings; preservatives were added to samples; preprinted sample labels (on which the requested analyses could be checked) were used; and custody seals were installed on the sample bottles. Chain-of-custody records were prepared and samples were properly packed in coolers for shipment to WAL.

CH2M Hill does have a QA project plan (CH2M Hill, 1987b) which was reviewed. The sampling and chain-of-custody procedures met EPA requirements. No sampling was performed while the Survey team was on-site so sampling could not be evaluated.

4.4.1.2 Laboratory Analyses

Environmental Laboratory

The on-site EL (176-Area) performs the analyses for most of the environmental samples collected on-site as shown in Table 4-10. Well water analyses and a few parameters that the EL cannot readily perform on the Wastewater Neutralization Facility are analyzed off-site by contract laboratories who are certified under the EPA CLP or Florida certification program. The EL is not certified.

The EL does have a QA plan (GENDP, 1986) for environmental analyses based upon ANSI-NQA-1. Current written procedures are maintained in the laboratory in three-ring binders. However, the format is inconsistent, some procedures do not specify the basis for the procedure (such as EPA Methods for Chemical Analysis of Water and Wastes or Standard Methods for the Examination of Water and Wastewater), and some steps reference other subprocedures (such as ion exchange or electrodeposition) which are not numbered or dated.

The samples brought into the laboratory did not have standardized labels. Turnover of samples that were observed were directly from the sampler to the person performing the analysis, but it was noted that there was an area in the laboratory where samples could be left.

No analytical request forms were received with the samples. Schedules for submission of samples from EH&SP or Operations personnel are typically supplied to the laboratory by EH&SP on an annual basis via letter. Requests for specific analyses are documented on a Plant Laboratory Service Request form (PLSR), which is in multiple copies, and copies of this form are returned to the requester with the results.

Information on dilutions and calculations were written in a logbook used by a number of people. The final results are recorded on a PLSR which is reviewed by the Primary Chemist and approved by the Chemistry Manager. A copy is retained by the manager's secretary, who is the records custodian for the laboratory, and the remaining copies of the PLSR are sent to the requester.

The QC program uses reference standards, spikes, blanks, multiple analyses, and interlaboratory comparison programs to maintain quality. The reference standards used are traceable to the National Bureau of Standards (NBS) or other standards laboratories such as Sandia National Laboratory (SNL). During the Survey, it was observed that reagent blanks were used and that multiple samples were analyzed. Low-level radioactivity samples (for tritium) were counted multiple times together with a blank and standard. EH&SP arranges for unknown interlaboratory comparison samples and compares the data that the EP reports. These samples are obtained from EPA, the DOE Environmental Measurements Laboratory and Environmental Resources Associates (a private company).

Maintenance and calibration of equipment are performed by vendors and on-site personnel. For major pieces of equipment, a service contract with the vendors is maintained. The records and operating manuals for equipment are maintained near each piece of equipment. For smaller pieces of equipment, the Electromechanical Calibration Laboratory performs the calibration according to a preset schedule. Calibration labels with due dates were noted on equipment. Equipment which requires calibration before use, such as a pH meter, had "Calibrate Before Use" labels.

Personnel must meet minimum educational and ability requirements as specified in the job description. Senior personnel train more junior personnel to verify they can

perform the analyses properly. There are no official training programs, classes or signoff sheets or any training records to indicate that a particular individual is qualified on a particular analysis. However, personnel observed performing analyses appeared to be qualified.

Contractor Laboratories

Wadsworth/ALERT Laboratories performs analyses on well water samples from the 4.5-Acre site sent by Haztech sampling personnel. Its QA project plan (QAPP) (S&ME/Haztech, 1985) was reviewed. The laboratory has appropriate chain-of-custody procedures and uses EPA-approved analytical methods. It is certified under the EPA CLP. The laboratory was not visited.

The CH₂ M Hill Laboratory performs analyses on well water samples from the north-east site sent by CH₂M Hill sampling personnel. Its QAPP (CH₂M Hill, 1987b) was reviewed. The laboratory has appropriate chain-of-custody procedures and uses EPA-approved analytical methods. It is certified under the EPA CLP and by the State of Florida. The laboratory was not visited.

Haines Testing Laboratory performs selected analyses, not readily performed by the EL, on a once-a-month, 24-hour proportional sample of the Wastewater Neutralization Facility. The sample is analyzed for trivalent chromium, hexavalent chromium, total chromium, mercury, and phenolics. This laboratory is certified by the State of Florida. It was not visited.

4.4.2 Findings and Observations

4.4.2.1 Category I

None

4.4.2.2 Category II

None

4.4.2.3 Category III

None

4.4.2.4 Category IV

1. Formal control of sampling procedures is lacking. The quality of the environmental samples may be affected because of inconsistency in application of correct procedures. There is no control system to control preparation, format, review, approval, issuance, and revision of environmental sampling procedures.

Procedures which were not current, had missing information, or no approval signatures were being used to collect effluent and environmental samples. An example of this is the operations procedure to collect an effluent sample for the HP Tank and the EH&SP sample-collection procedures. The procedure had steps to collect a second sample which has not been required for many months. Although the procedure was revised and signed off approximately 2 months previously, the steps were not deleted. Operations personnel just ignore the steps; this practice of ignoring or verbally countermanding steps in approved procedures on other than an emergency basis is setting a bad precedent and may cause vital steps to be ignored. In a sample book obtained from EH&SP there were multiple copies of procedures from different periods, some of which had handwritten notes on them. It was difficult to tell if the current procedures were in effect since there was a blank by the revision number (rather than having revision 0 as is common) and the procedures had no approval signatures to show they had been approved and were in effect (except for the procedures relating to Operations).

2. There is a lack of formal control of analytical procedures. The quality of the analytical data on environmental samples may be affected because of inconsistency in the application of correct procedures.

There is no formal control system to control preparation, format, review, approval, issuance, and revision of laboratory analytical procedures. Procedures that were not numbered, dated, or approved were being used to

perform analyses. The format between procedures is also inconsistent. As an example, the Table of Contents in one three-ring binder had a list of the procedures with preparation dates (August 1986) and the manager's initials under a review heading. However, there was no date indicating when the review occurred or if the manager had initially approved the various procedures. The format is inconsistent, and some procedures do not specify the basis for the method (such as EPA methods or Standard Methods for the Examination of Water and Wastewater). The steps in some of the procedures referenced other subprocedures (such as ion exchange or electrodeposition) which are not numbered or dated. A complete current listing of all procedures was not available in the laboratory as required by the QA plan.

3. Chain-of-custody procedures are lacking. Without chain-of-custody procedures for effluent and environmental samples, it would be difficult to verify results by tracing the sample data reported to the sample collected, and therefore, it would be difficult to legally defend the analytical data reported by the EL.

The Pinellas Plant does not have chain-of-custody procedures to handle the samples that Operations or EH&SP personnel collect which are analyzed on-site by the EL or sent off-site for analysis (such as the monthly Wastewater Neutralization Facility sample). When samples and sample data are brought into the EL, the data are in various formats rather than on a standardized form. As an example, sample information on the HP tank was written on the cardboard sample bottle cap; data for particulate air filters were written on sample envelopes; and data for silica gel canisters were written on separate slips of paper. Samples did not have discrete sample numbers assigned for tracking purposes.

4. There is a lack of documented training or testing of sampling and analysis personnel. The lack of documented training or performance testing of S&A personnel makes it difficult to verify that personnel are qualified on current procedures and that they are consistently applying them so that the environmental data are representative, have a known accuracy, and are comparable.

There is no documented formal periodic education or training of Operations or EH&SP personnel (who perform effluent or environmental sampling) or laboratory personnel (who perform the analyses) on the environmental procedures and methods needed to properly perform their jobs. There is no documented performance testing to ascertain and document that personnel can perform each required job function to standards, or documentation of what the plant considers adequate standards.

PRELIMINARY

4.5 Inactive Waste Disposal and Contamination Sites

This section presents a description of possible and actual significant sources of environmental pollution as a result of inactive waste disposal and contamination sites (including spills and leaks) at the Pinellas Plant. It also identifies environmental findings that will require attention in the overall Survey prioritization of environmental problems at all DOE facilities.

On April 26, 1985, DOE Headquarters issued Order 5480.14 to provide instructions for implementing a program to identify and evaluate inactive waste disposal sites on DOE installations and to effect remedial actions where necessary to improve control of hazardous substance migration from these sites. The Albuquerque Operations Office (AL) initiated the Comprehensive Environmental Assessment and Response Program (CEARP) in mid-1984 to help fulfill the DOE commitment to operate under a policy of full compliance with applicable environmental regulations within the AL complex.

CEARP is a phased program that identifies, assesses, and corrects existing or potential environmental problems, and its five phases parallel DOE Order 5480.14. Phase I, Assessment of the Installations, assesses present compliance with environmental laws and ascertains the magnitude of potential environmental concerns. The CEARP Phase I tasks were carried out at the Pinellas Plant, and the Phase I: Installation Assessment report (May 1987 Review Draft) was used as a basis for the Survey efforts. The Phase I report identifies 16 potential Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at the Pinellas Plant, three of which have no planned future action under the CEARP/CERCLA Order. Some of these sites are aggregates of smaller yet distinct waste disposal areas. The identification was based on a search of available environmental records, interviews with General Electric Company-Neutron Devices Department (GENDD) employees, and site inspections. In addition, the Survey efforts identified 11 potential inactive waste disposal and contamination areas which are not identified in the CEARP. These areas as well as the CEARP sites are described in the following section.

4.5.1 General Description of Pollution Sources and Controls

The Pinellas Plant has undergone a number of expansions since it began operations in January 1957 for the production of neutron generators. The physical growth of the Pinellas Plant is depicted in Figure 4-6. During its 30-year period of operation, the waste handling procedures have undergone numerous significant changes to accommodate the increasing types and volumes of wastes generated by an expanding product line. These changes have resulted in the generation of many potential and actual inactive waste disposal and contamination sites on the Pinellas Plant property.

Sources identified in the CEARP Phase I report as well as additional potential sources identified during the Environmental Survey are discussed in the following sections. The CEARP sites, listed in Table 4-11, are described in Section 4.5.1.1. The non-CEARP sites (sites identified by the Survey team) are listed in Table 4-12 and are described in Section 4.5.1.2. The locations of these sites are shown in Figures 4-7 and 4-8, respectively.

4.5.1.1 CEARP Sites

Wastewater Treatment System

A number of systems involving various areas on the Pinellas Plant property have been used historically in the treatment of the plant's wastewaters. This includes systems for the on-site treatment of sewage, industrial wastewater, radioactive (tritium) wastewater, photographic laboratory effluent, cooling tower blowdown, incinerator scrubber water, and surface/storm water runoff. Untreated effluent from these sources entered the ditch southwest of the plant near the railroad tracks (southwest ditch) for various periods from 1957 to 1973, and East Pond for various periods from 1968 to 1972.

An on-site wastewater treatment system utilizing spray irrigation of the wastewaters on a 10-acre plot of land along the northern plant border was initiated in 1972. This system eventually redirected all of the plant's wastewaters to West Pond, where it was pumped out and sprayed onto the spray irrigation area to the

FIGURE 4-6

NEUTRON DEVICES DEPARTMENT PLANT GROWTH, PINELLAS PLANT

**TABLE 4-11
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES IDENTIFIED IN THE CEARP**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
1	Northeast Site	Prior to 1968	Storage	Drummed wastes (possibly resins) & construction debris	Unknown	Contaminant Assessment in progress
2	East Pond	7/68-9/6/72 1968-present 4/14/69-11/72 12/2/70-9/6/72 12/23/70-9/6/72 (?) 1970-1972 9/5/72-4/83	Disposal " " " " "	Industrial wastewater Storm water runoff Cooling tower blowdown Tritium-contaminated wastewater Solids incinerator scrubber water Photographic lab effluent Spray irrigation field underdrain	Unknown	---
3	West Pond	1957-1959 1974-1975 9/6/72-12/1/82 9/6/72-1973 11/72-12/1/82 1972-1982 10/11/73-8/29/82	Disposal Treatment " " " "	Rejected parts Lumber contam. w/H ₃ , H ₂ SO ₄ Industrial & tritium-contaminated wastewater Solids incinerator scrubber water Cooling tower blowdown Photographic lab effluent Sewage treatment plant wastewater	Unknown	Cleanup of rejected parts in 1966
4	Spray Irrigation Site	9/5/72-4/83	Treatment	West Pond effluent	Unknown	Underground collection lines remain
5	4.5-Acre Site	~1962	Disposal	Waste resin, slurry wastes from water softener	~100 drums	Drums and soil removed in 1985; FS in progress
6	Trenches	Unknown	Disposal	Slurry wastes from water softener, cooling tower sludges	Unknown	---

**TABLE 4-11
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES IDENTIFIED IN THE CEARP (continued)**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
7	Solids Incinerators Area	1) 1965-1973 2) 1973-12/82	Disposal "	Tritium-contaminated paper, lead paper (1 month), rubber, plastics, Class O trash, dried sewage sludge	Unknown	Removed
8 A&B	Liquids Incinerator Areas (2)	3/73-9/82	Disposal	Flammable liquids	Unknown	Deconned/removed
9	Southwest Ditch	1957-7/68 1957-12/2/70 1957-10/11/73 1957-4/14/69 1965-12/23/70 1965-1967 Prior to 7/68** -Present (?)	Disposal " " " " " "	Industrial wastewater Tritium-contaminated wastewater Sewage treatment plant wastewater Cooling tower blowdown Solids incinerator scrubber water Methylene chloride, possibly other solvents and acids Photographic lab effluent Surface water runoff	Unknown	---
10	Former Fire Training Site	1964-1972	Training	Flammable liquids	Unknown	Possibly not cleaned up prior to Bldg. 400 construction
11	Former Drum Storage Site under NW of Bldg. 100	Prior to 1960	Storage	Epon 828 resin bottoms in drums	Unknown	Possibly not cleaned up prior to Bldg. 100 construction

**TABLE 4-11
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES IDENTIFIED IN THE CEARP (continued)**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
12	Pistol Range	Unknown	Fill	Soil from East Pond & SE of Fire Training Area	Unknown	Still present
		Prior to mid-1960s	Possibly fill & berm	West Pond Soil	Unknown	Still present
		9/72	Backstop	East Pond sediments	Unknown	Most fill removed in 1985; deposited
		? - present	Training	Small arms ammunition, shells, etc.	Unknown	Visible contamination
13	Metallic Anomaly	Discovered 1984	Unknown	Unknown	Unknown	Sampling & Analysis requested
14	Diesel Fuel Spill	Discovered 1/21/83	Storage	#2 Diesel fuel oil	2,000-12,000 gal	Cleaned up upon discovery
15	Construction Debris Site	Prior to late 1960s	Disposal	Construction debris, possibly others	Unknown	Debris possibly not removed prior to paving
16	Industrial Drain Leaks	Mid-late 1970s	Leaks	Various wastewaters	Unknown	Leaks repaired upon discovery
***	Acid & Alkali Spills	1970s-1980s	Storage	HF, H ₂ SO ₄ , HNO ₃ , etc.	Variable	Cleaned up/neutralized

**TABLE 4-11
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES IDENTIFIED IN THE CEARP (continued)**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
***	Temporary Plant	7/56-5/19/57	Various	Tritium, deuterium; resins, solvents, acids, metals, etc.	Unknown	Dismantled & decontaminated; 1 building later razed

* See Figure 4-7 for site locations.

** The disposition of this effluent from 7/68-1970 is unknown.

*** Not identified by the Survey team as a potential area of concern
Source: DOE, 1987

**TABLE 4-12
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES NOT IDENTIFIED IN THE CEARP**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
17	Ditch West of Bldg. 700	1965-12/23/70 1965-1967	Disposal Disposal "	Solids incinerator scrubber water Methylene chloride, possibly other solvents & acids Surface runoff from west side of tractor shed	Unknown	Pipeline later buried under ditch
18	Current Fire Training Site	1972-present	Training	Flammable liquids (kerosene, diesel fuel, lacquer thinner, used crankcase oil, isopropyl alcohol, etc.), reactive metals, tear gas (inside Bldg.)	Unknown	In use
19	Former Thermal Treatment Site (adjacent to above)	1975-1983	Treatment	Heat powder, heat paper, other explosives	Unknown	Pans removed, pad steam-cleaned. Closure 1/84
20	Underground Storage Tanks	See Table 4-14	—		—	—
21	Drum Storage Pad near Bldg. 700	?-10/83	Storage	Methylene chloride, ignitable liquids, arsenic, calcium chromate solids, etc.	Variable (18' x 77' area)	Pad steam-cleaned & closed 10/83

**TABLE 4-12
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES NOT IDENTIFIED IN THE CEARP (continued)**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
22	Drum Storage Area North of Bldg. 600	Late 1960s-1972	Storage	Solvents	Unknown	Cleanup status unknown
23	Drum Storage Building under NW of Bldg. 100 (in old Area 191)	7-5/82	Storage	Misc. lab wastes; spill of nickel waste reported	Unknown (20' x 50' area)	Floors steam-cleaned; closed 5/82
24 D, L & P	Calcium Chromate Facility	1975-1983	Process Development Laboratory/Production	Liquid containing calcium chromate, ammonium chromate, ammonium hydroxide; & dichromates & chromic acid. Solid (composition not available)	Liquid: ~100,000 gal Solid: Unknown	Dismantled ~1983
25	Septic NW of Bldg. 100	Unknown	Domestic Use	Domestic wastes	Unknown	Removed
26	Temporary Off-Loading Area (now Area 348)	~1 yr. (date unknown)	Receiving	Epoxy resins, possibly other chemicals	< 55 gal (leak), possibly other incidents	Possibly not cleaned up prior to Bldg. 300 construction

**TABLE 4-12
POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES NOT IDENTIFIED IN THE CEARP (continued)**

Site No.	Site	Period of Activity	Activity	Waste Types	Quantity	Status
27	Former Cooling Towers	1956 - 1982(?)	Treatment	Biocide/East Pond Contaminants	Unknown	Towers removed; basins remain
28	Abandoned Underground Pipelines	Various	Waste/Chemical Transfer	Various	Unknown	Possibly not cleaned out prior to being abandoned
29	Miscellaneous Undefined Sites	See Text	—	—	—	—
30	Off-site Waste Disposal Facilities	See Table 4-13	—	—	—	—

Source: DOE, 1986b

POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES IDENTIFIED IN CEARP

FIGURE 4-7

Source: DOE 1986

POTENTIAL INACTIVE WASTE DISPOSAL AND CONTAMINATION SITES
NOT IDENTIFIED IN CEARP

FIGURE 4-8

east. A series of underdrains comprised of plastic pipe buried 6 feet below the surface collected this water which had percolated through the soil, and directed it to three sumps located south of this area. The water was then pumped to East Pond where it was discharged via a series of drainage ditches. From early 1968 to April 1978, this discharge flowed north along Belcher Road, west to the Lake Seminole Bypass Canal, and south to Long Bayou. Since April 1978, the discharge from East Pond has flowed south along Belcher Road, east to a ditch, then south to the Cross Bayou Canal and Cross Bayou. Both Cross Bayou and Long Bayou discharge into Boca Ciega Bay. The Pinellas Plant ceased operation of its spray irrigation system in 1982 and began discharging its wastewaters to a POTW on August 29 for sewage effluent and on December 1 for the other wastewaters. However, any storm water runoff which enters East Pond is still discharged via the pathway south along Belcher Road. The historical operation of the wastewater treatment system is given in more detail in Section 3.3.

In addition to their use as part of the wastewater treatment system, West Pond and East Pond have been involved in other site activities. Prior to its use as a pond, West Pond was used as a borrow area for the plant. From 1957 to 1959, it was used for the disposal of rejected parts from the plant, such as power supplies, timers, and controllers potted in epoxy disks similar in size and shape to hockey pucks (DOE, 1987). When the pond was enlarged in 1965, many of the faulty parts and a few drums containing these parts were removed by dredging. The parts were sorted on the ground prior to being placed in 55-gallon drums. Where these drums were disposed of is not known. In 1974 or 1975, lumber (2 x 6 or 2 x 8, about 3 feet long) contaminated with tritium and sulfuric acid was discarded in the southern third of West Pond. The lumber was attached to five-gallon buckets of concrete and sunk in the pond. Approximately two to four of these assemblages were disposed of, with each assemblage being about four layers high. The source of this lumber is not known. Soil contaminated as a result of a leak of No.2 diesel fuel was also placed east of West Pond (northeast of the current fire-training area) in 1983 to allow the fuel to evaporate.

East Pond was constructed next to a swampy area in 1968, and soil removed during the deepening of the pond in 1972 was used to cover the swampy area. Prior to the construction of East Pond, however, this swampy area was used for storage of drums of waste (possibly resins) and construction debris which was supposed to

have been removed prior to pond construction. Some activity is shown in this area in 1965 aerial photographs. In October 1984, two empty drums and one drum containing construction debris were found near East Pond. A 1985 USGS electromagnetic (conductivity) study indicated the possible presence of buried drums/metal in the area. Subsequent groundwater monitoring indicated high levels of chlorinated and unchlorinated solvents in the area, and the Florida Department of Environmental Regulation (FL DER) was notified in August 1986 of the existence of a possible waste site. This area is now referred to as the "Northeast Site." A Contaminant Assessment is now under way, and is being conducted by CH2M-Hill.

4.5-Acre Site

In approximately 1962, drums filled with waste resin from plant operations were disposed of in a triangular area northwest of the present plant property prior to that area being sold to a private citizen in 1972. Disposal consisted of excavating an area, placing about 20 drums in the hole, and backfilling.

In 1985, Pinellas Plant personnel discovered a drum buried near the surface during devegetation activities in preparation for a U.S. Geological Survey (USGS) magnetometer study in that area. The subsequent study revealed several metallic anomalies, and Haztech performed a detailed site assessment and cleanup. During this operation, 83 drums and 303 tons of waste were removed and disposed of at the GSX, Inc. hazardous waste landfill in Pinewood, South Carolina. A Contaminant Assessment Report was prepared by Soil and Material Engineers, Inc. (S&ME, 1986), the parent firm of Haztech, in May 1986, and a Feasibility Study is in progress to determine the appropriate remedial action for the site. Groundwater sampling by Haztech/S&ME revealed contamination in the phreatic, shallow, and deep aquifers with vinyl chloride, toluene, 1-2-trans-dichloroethylene, trichloroethylene (TCE), acetone, and/or methylene chloride, as well as some metals. For a more detailed discussion of the groundwater at this site, see Section 3.4.

Trenches

In addition to being disposed of in an off-site sanitary landfill, lime slurry wastes cleaned annually from a water softener used on-site from 1970 to 1979 were reportedly disposed of in trenches located between West Pond and the 4.5-acre site.

Some of these wastes were also found buried with the drums in the 4.5-acre site. These wastes may have contained contaminants from East Pond since water from the pond was used in the deionized water system (after chlorination) as well as for cooling tower makeup water. Sludges cleaned annually from the cooling towers were reportedly buried in the trenches, and possibly in other areas on plant property, in addition to being disposed of at Toytown Sanitary Landfill or Struthers Trash and Debris Landfill prior to RCRA. These sludges were found to be EP toxic for chromium and/or lead. Evidence of some ground disturbances in the southern portion of the spray irrigation field (now under Building 1200) were apparent on historical aerial photographs reviewed by the Survey team for 1965 and 1970; however, a 1970 photo shows no activity in that area. The sludges have gone to an authorized TSD facility since the RCRA program was initiated.

Incinerator Areas

Both solids and flammable liquids have been incinerated on-site in the area northwest of Building 100. From 1965 to 1973, a single-stage, flooded-air incinerator was used to continuously burn dried sewage sludge, paper contaminated with tritium and lead, rubber, plastics, and general Class O trash. Until 1970, this incinerator discharged its scrubber water to a ditch nearby (west of the present Building 700), which discharged south to an underground pipeline running west of Building 100 before emptying into the southwest ditch. From 1970 until 1972, the discharge was to East Pond, until the spray irrigation system began operation.

The second solids incinerator, which replaced the first one and was placed in the same location, was a two-stage batch unit with an afterburner. It operated from 1973 to 1982 and burned the same wastes as the first solids incinerator. The ash produced during incineration is believed to have been disposed of in a local landfill (Toytown Sanitary Landfill). The solids incinerators reportedly had pavement around them and were on a concrete pad. They were not decontaminated upon cessation of use, and may have been sold as scrap. The second solids incinerator was reportedly stored for a period in the north parking lot prior to being disposed of in approximately December 1982.

The liquids incinerator operated from March 1973 to September 1982. During the first 4 to 5 years, it operated west of Building 700. It was later moved north of that building near the solids incinerator, where it remained until its removal. This incinerator was fed by an underground pipeline from a storage tank also located in the vicinity. The contents of the tank were sampled to determine the chlorine content; only wastes with a chlorine content less than 2000 parts per million were allowed to be incinerated. All other wastes were to be disposed of off-site. Curbing present around the incinerator fed to the tractor wash sump and then to the industrial system of the wastewater treatment plant.

When the liquids incinerator was decommissioned, the storage tank was steam-cleaned, and the incinerator fuel pipes were flushed with water which was then burned in the incinerator. Both the incinerator and tank were sold as scrap.

Former Fire-Training Site

From 1964 to 1972, fire-training exercises were conducted behind and northwest of Building 400. These exercises consisted of pouring flammable liquids on water in a tank 10 to 12 feet in diameter, lighting it, and then extinguishing the flames. The tank was on a limestone or clay pad with approximately 50 concrete blocks surrounding it in a semicircle. One-third of the pad area is now under the west side of Building 400. No cleanup records of this area after the cessation of operations exist.

Former Drum Storage Site

This area was used prior to 1960 for the drummed storage of EPON 828 resin as bottoms. Drums were reportedly tipped over to drain any remaining materials present in the drums. It is not known whether any wastes were buried in this area. This site is now under the northwest portion of Building 100, and may not have been cleaned up prior to the construction of the building.

Pistol Range

The area west of West Pond is currently used for the firing of small arms (pistols) for security training. In September 1972, when East Pond was deepened, material from

the pond was used for the backstop of the pistol range. Most of this soil was removed in 1985 to an unknown location. Prior to the mid-1960s, soil was removed from West Pond, creating a separate, small L-shaped extension to the pond. This soil may have been used as fill and berm material for the Pistol Range.

During the Environmental Survey activities, a mound of fill littered with construction debris was present north of the pistol range, apparently brought there in two to three different time periods based on an examination of its vegetation. The Survey team was told by plant personnel that this fill was from East Pond prior to its construction, and from an area southeast of the current fire-training building where a driveway is being constructed. The soil immediately around the pistol range itself was littered with shells from the firing of weapons. A new pistol range is being constructed along the new Security Building.

Metallic Anomaly

A preliminary USGS geophysical study conducted in 1984 revealed the presence of a metallic anomaly north of Building 600 at the southwest edge of the spray irrigation field. This anomaly could indicate the presence of buried drums, other sources of hazardous materials, or simply other (nonhazardous) metal objects (empty drums, construction debris, etc.). No documentation of disposal activity exists for this area.

Diesel Fuel Spill

A spill occurred when an underground pipeline leading from a storage tank of No. 2 diesel fuel ruptured. The leak was discovered in the north parking lot on January 21, 1983. Cleanup of oil (approximately 2000-12,000 gallons) and contaminated soil was accomplished by A & A Coastal Pollution Cleanup Company, and the oil/water mixture was taken to Tim's Oil Recovery, Inc., for recovery of the usable fuel oil. Approximately 50 to 60 cubic yards of fuel-impregnated soil were spread adjacent to the fire-training area to allow for fuel oil evaporation. Soil cores indicated an oil concentration up to 24 parts per million remaining in the soil.

Construction Debris Site

Because of the large amount of expansion and construction at the Pinellas Plant, a lot of construction debris was generated. When the east parking lot was built in the late-1960s, construction debris was encountered. It is not known whether the debris was removed prior to paving.

Industrial Drain Leaks

During the mid- to late-1970s, deteriorated industrial drain lines under Building 100 resulted in a number of leaks to the soil. Although the lines were repaired when the leaks were discovered, an undetermined amount of wastewater escaped to the soil. There are also reports of drain lines being undersized, chemical and sanitary drains backing up, and recommendations to change the drainage system in the oil storage area of Building 800 to catch any spills (DOE, 1980, 1986a).

Acid and Alkali Spills

Acid and alkali materials have been present in a number of areas at the plant and may have been released to their environs. Details on possible releases are as follows:

Area	Incident	Time
N of Building 500	Acid and alkali spills	1970s, 1982-1983
NW of Wastewater treatment plant	Possible acid and alkali spills	1970-1980
140-Area	Possible acid spills	Unknown years
117-Area	Acid leaks	Late 1970s
NE of Building 100	Acid leaks (HF, H ₂ SO ₄ , HNO ₃)	Unknown years
Chemical cleaning room	Acid leak from drain (HNO ₃)	1971

Because of the natural buffering effects of the calcareous soil, however, the Survey team believes these incidents have not resulted in any environmental impacts. However, this has not been verified.

Temporary Plant

Prior to and during construction of the current Pinellas Plant, General Electric Company (GE) rented two warehouses in St. Petersburg for offices and training activities associated with the production of neutron generators. Both warehouses were used during the same time period, from approximately July 1956 to the conclusion of operations on May 19, 1957. Tritium was first received at the temporary plant (referred to as the "TP") on December 12, 1956 (GE Annual Hazardous Materials Reports, 1970-1979). Personnel and equipment from the TP began to be phased in at the Pinellas Plant in approximately January 1957.

The address of the temporary plant was 2601 24th Street North. However, sometime between 1957 and 1971, this building was razed and another built facing the south. The address of this building, which has been occupied by Precisionaire of Florida, Inc. (a business unrelated to DOE activities) since approximately 1971, is 2399 26th Avenue North (see Figure 4-9). Interviews with GENDD employees conducted during the Environmental Survey indicated that the warehouses were two concrete buildings split by railroad tracks. An apparently conflicting story indicates that one building was on the north side of the street while the other was on the south side of the street, with railroad tracks on both sides of the plant. Assuming this second story was the true situation (the majority opinion according to informal interviews conducted by the DOE Environmental Survey team), the locations of the two buildings are as shown on Figure 4-9, which was drawn after a visit to the area during the Environmental Survey. During this visit conducted by the Survey team, Precisionaire tractor trailer trucks were parked at the loading dock on the south side of the street, indicating that this building also is utilized by Precisionaire (see photos in Appendix F).

TEMPORARY PLANT, ST. PETERSBURG, FLORIDA

FIGURE 4-9

Interviewees who worked at the TP indicated that the north building was used mostly as a warehouse for equipment and tool storage, soldering training, quality control (voltage testing of product capacitors, testing incoming parts, checking physical dimensions of parts, etc.), shipping and receiving, and possibly maintenance. The GENDD employees interviewed by the Survey team believed that no chemicals were stored in this building.

The building on the south side of the street was used for offices and for manufacturing. Operations occurring in the manufacturing section were similar to those now used in neutron generator production, except they were on a smaller scale. These operations included hydrogen furnaces for brazing, air-fire furnaces, the introduction of tritium into tubes, tube exhaust (with tritium and deuterium), resin casting, epoxy encapsulation, a glass shop for glass beads (ceramic was not used then), hydrogen torch training/glass blowing, vapor blasting, an electrical systems engineering lab, and one room which was a cleared area where product testing of timers was conducted. Chemical substances used include methylene chloride, methyl ethyl ketone, RTV (silicon rubber coating), EPON 828 and possibly other resins, acetone, possibly TCE, and sulfuric acid. The only unusual incident reported was the evacuation required when sulfuric acid was poured into a galvanized sink. It is not known whether any chemical (segregated) floor drains existed at the plant. It was estimated that from 34 to more than 200 employees may have worked at the TP.

Interviewees believed that no materials were buried or spilled on the site. Reportedly, wastes (gloves, uniforms, glassware, etc.) were placed in drums and taken off-site for disposal. At least some of these wastes were possibly sent to the Savannah River Plant. No information is available regarding the disposition of chemical wastes such as acetone, resins, and epoxies.

At the conclusion of TP operations, at least some of the equipment from the TP was transferred to the Pinellas Plant, including hydrogen furnaces, glass systems on the tube exhaust, and the tritium transfer system. The wooden walls of the building were reportedly taken to a dump, and smears (counts) were done to decommission the plant. A memo from the Pinellas County Health Department certified that the dismantling and decontamination of the building and equipment were done satisfactorily (McCall, 1979). The neighborhood during the period of operation was

mostly residential and small manufacturing. Nearby were Crest Leather Company, a building supply store, a drugstore, and a school. The area now is northeast of a freeway overpass.

The CEARP Phase I report lists two former plant facilities: one where employees were trained to manufacture tubes for RTGs, and another where activities associated with the production of neutron generators were temporarily conducted. The Survey team believes these two facilities are the same as those discussed above.

4.5.1.2 Non-CEARP Sites

Off-Site Waste Disposal Facilities

Various facilities were used historically by the Pinellas Plant for the off-site disposal of chemical, radioactive, and mixed wastes. The disposer, disposal facility, dates used, waste types, and quantities disposed of (when known) are given in Table 4-13. Empty containers for pesticides, herbicides, and MOCA (a carcinogen) may have also been disposed of off-site, possibly to Tottown, a local sanitary landfill.

In addition to these sites, drums containing defective parts were reportedly disposed of in the Gulf of Mexico in approximately 1959. The "olive drab" drums were approximately 18 inches in diameter and 24 inches high, and contained crushed tube encasement assemblies (TEAs) from which all radioactive parts were removed (DOE, 1986c). The number of drums disposed of in this manner is not known.

The above information was compiled from personal interviews and available facility documents, and may or may not be complete.

Ditch West of Building 700/"On-Site Landfill"

The ditch area west of Building 700 to which the first solids incinerator discharged was also used for the disposal of methylene chloride and possibly other wastes in the early- to mid-1960s. A sloped concrete area southeast of this ditch was used for

**TABLE 4-13
OFF-SITE WASTE DISPOSAL PRACTICES**

Off-Site Disposer	Type of Disposal Facility	Dates Used	Waste Types	Quantity
Arrow Septic Service	Struthers Trash and Debris Landfill 7751 Park Blvd. N Pinellas Park, FL 33565	1958 (?) to April 1970	Mixed solvents containing chlorinated compounds and waste oils. (NDD directed disposer to discontinue use of trash and debris landfill).	Total unknown. Estimated 4-5 drums/week.
Arrow Septic Service	Toytown Sanitary Landfill SR 686 St. Petersburg, FL 33709	May 1970 to January 1974	Mixed solvents containing chlorinated compounds and waste oils (Although approved by the Pinellas County Health Department, disposal of solvents in the landfill was discontinued by NDD during July 1972)	Quantity unknown
Inland Chemical Company 1120 Bush Street Toledo, Ohio 43608	Unknown	July 1972 to July 1973	Mixed solvents containing chlorinated compounds and waste oils	Quantity unknown
Erny Supply Company 5406 No. 59th Street Tampa, FL 33609	Unknown	January 1974 to March 1978	Mixed solvents containing chlorinated compounds and waste oils	505 ea. - 55 gallon drums
Rollins Environmental Services Inc. P.O. Box 738 Baton Rouge, LA 70807	Incineration and chemical secure landfill	July 1977 to present (?)	Mixed solvents containing chlorinated compounds and waste oils Aqueous wastes containing chromium compounds Material contaminated with chromium compounds	Total unknown. Up to 10,000 gallons by 1979 Total Unknown. Up to 15,000 gallons by 1979 Total unknown. Up to approximately 60 ea. - 55 gallon drums by 1979

**TABLE 4-13
OFF-SITE WASTE DISPOSAL PRACTICES (continued)**

Off-Site Disposer	Type of Disposal Facility	Dates Used	Waste Types	Quantity
DuPont DeNemours Company EI Savannah River Plant Aiken, S.C. 29802	Secured landfill, DOE controlled	1958 to present	Radioactive waste	DOE classified secret-restricted data
Unknown	Gulf of Mexico	1959	Drums of crushed TEAs (with radioactive parts removed)	Unknown
Peak Oil Company Rt #3, Box 24 Tampa, FL 33619	Oil reclamation	1978 to 1979	Waste petroleum lubricants and oils	Total unknown. Up to 4,000 gal by 1979
Seminole Oil Company *	Unknown	February 15, 1978	Waste oil	Approximately 1,500 gal
City Chemicals Orlando, Florida	Reclamation	August 1979?	Waste 1,1,1-trichloroethane; possibly alcohols, acetone, and freons also	At least 700 gal
Chemical Waste Management of Alabama, Inc. Emelle, Alabama	Unknown	February 1980?	Waste solvents	Unknown
Tim's Oil Recovery, Inc.	Reclamation	1983 (diesel fuel spill)	#2 Diesel fuel oil	2,000-12,000 gal

*Verbal company identification by truck driver on one occasion; no accounting records of contact with this company exist.

Source: Gray, weekly, monthly, and annual letter reports to EH&SP management, 1969-1982; Simons, 1979; PIN, 1984; DOE, 1986, 1987.

drying of sand-blasting materials in the past. The disposal location of this material, reportedly in an "on-site landfill," is not known. It may have been disposed of behind the pistol range, with construction debris under Building 1200, or under the north parking lot.

Current Fire-Training/Former Thermal-Treatment Sites

Fire-training activities similar to those conducted at the former fire-training site have been conducted for plant personnel as well as area fire departments east of West Pond from 1972 to the present. A building (Building 900) is immediately to the northeast of the tank area, where tear gas is occasionally used in addition to the flammable liquids used for fire fighting. A two-foot-by-two-foot pan made of firebrick inside the building is used to burn isopropyl alcohol. Water is collected in a sump which reportedly runs off on the grass behind the building. All charred debris is disposed of either in a dumpster or through the plant's waste management group.

Adjacent to the southern portion of the tank are two rectangular metal pans now used for fire extinguisher training. These pans are surrounded by a bed of gravel, and were used for the thermal treatment (detonation) of explosives from 1975 to 1983. The pans were removed and steam-cleaned in January 1984.

Underground Storage Tanks

On-site interviews and document reviews conducted during the Environmental Survey indicated that a number of underground storage tanks (USTs) have been used at the Pinellas Plant. These tanks have either been abandoned in place, removed, or are still in use. Available information on these tanks is shown in Table 4-14, while the approximate tank locations are indicated on Figure 4-10.

Storage Areas

Numerous areas on the Pinellas Plant property have been used throughout the years for storage of hazardous materials. The areas not identified in the CEARP are described below.

**TABLE 4-14
UNDERGROUND STORAGE TANKS AT THE PINELLAS PLANT**

Tank No. *	Tank Location	Size (gal.)	Content	UST Material	Piping	Monitoring	Status	Date Installed	Date of Last Use
1	North of Bldg. 500	20,000	#2 Diesel	Fiberglass	Corrosion Resistant Coated	Not Req'd	In Use	1974	NA
2	North of Bldg. 500 (replaced #9)	5,000	#2 Diesel	Painted/asphalted Steel	"	Not Req'd	Filled with Water	1968	1983
3	Old HP Tanks SW of Bldg. 100	10,000	Tritiated Water	Painted/asphalted Steel	"	Manually Sampled Wells	Not in Use	1957	4/20/86
4	Old HP Tanks SW of Bldg. 100	10,000	Tritiated Water	Painted/asphalted Steel	"	"	"	1957	4/20/86
5	Old HP Tanks SW of Bldg. 100	10,000	Tritiated Water	Painted/asphalted Steel	"	"	"	1969	4/20/86
6	North of Bldg. 1200	1,000	#2 Diesel	Fiberglass	"	Not Req'd	In Use	1986	NA
7	South of Bldg. 700	Unknown	Fuel	Unknown	Unknown	Unknown	Removed	Unknown	Removed 1984
8	South of Bldg. 700	Unknown	Fuel	Unknown	Unknown	Unknown	Removed	Unknown	Removed 1984
9	Under Bldg. 500	2,520	Fuel Oil	Unknown	Unknown	Unknown	Removed	1963	Removed 1968
10	Area 131	~500	Diesel Fuel	Unknown	Unknown	Unknown	Removed	Unknown	Removed 1982
11	West of Bldg. 1200	2,000	Pistol Range Wash	Fiberglass	Unknown	Unknown	In Use	1986	NA

TABLE 4-14
UNDERGROUND STORAGE TANKS AT THE PINELLAS PLANT
(continued)

Tank No. *	Tank Location	Size (gal.)	Content	UST Material	Piping	Monitoring	Status	Date Installed	Date of Last Use
12-16**	West of Area 192 (under old Bldg. 600)	300-500 gal. ea.	Unknown liquids from chemical drains	Concrete w/steel lids	Unknown	Unknown	Removed	Unknown	Removed 1983
17**	South of Bldg. 600	~400	Flammables	Concrete	Unknown	Unknown	In Use	1980(?)	NA
18**	South of Bldg. 600	~400	Acids	Concrete	Unknown	Unknown	In Use	1980(?)	NA
19**	South of Bldg. 600	~400	Alkalines	Concrete	Unknown	Unknown	In Use	1980(?)	NA
20**	South of Bldg. 600	~400	Oxidizers	Concrete	Unknown	Unknown	In Use	1980(?)	NA
21**	South of Bldg. 600	~400	Toxics	Concrete	Unknown	Unknown	In Use	1980(?)	NA

* See Figure 4-10 for tank locations.

NA - Not Applicable

** Sumps.

Sources: DOE, 1986; Watson & Company, 1968, 1983a, b, c.

U.S. DEPARTMENT OF ENERGY PINELLAS PLANT
UNDERGROUND STORAGE TANK LOCATIONS

FIGURE 4-10

- Drum Storage Pad. A drum storage pad was located between Building 700 and Building 100 and covered an area of 18 by 77 feet. It was used from an unknown date until closure in October 1983 for the storage of containerized waste, and was equipped with a drain system/containment system. Upon closure, the stored wastes were shipped to Chemical Waste Management's Emelle, Alabama, facility. The pad and drain system were steam-cleaned and rinsewater pumped from the sump and disposed of at the above facility.
- Drum Storage Area. This area was located north of Building 600 near the former fire-training area. It was used from the late-1960s until the fire-training practices were moved to the current area (approximately 1972) for the storage of solvents in drums. It is not known whether these solvents were used in the fire training practices, or whether the area was cleaned up after its use ceased.
- Drum Storage Building. This area was used for the storage of miscellaneous laboratory wastes from an unknown date until closure in May 1982. The building location, covering an area of 20 by 50 feet, is now under the northwest portion of Building 100, and was in the old 191-Area. The floors were steam-cleaned upon closure.
- Storage Trailers. Two 40-foot trailers were used to temporarily store hazardous waste from May 1982 until closure in January 1984. These trailers were located north of Building 600 and at the time of closure, contained 26 drums of ignitable and corrosive liquids, dichloromethane solution, and calcium chromate solids. No spills were reported in the trailers, and the drums and trailers have been removed. Therefore, this area is not perceived as a potential environmental problem by the Survey team, but is only included for completeness.

- Bonded Stock East Building. This building is located south of Building 600 and stored miscellaneous chemicals in their original containers for less than 90 days, and drums of "off-spec" lithium and calcium batteries for greater than 90 days. The batteries were shipped to Battery Disposal Technology in New York state for disposal. Reportedly no spills occurred, which was verified by no liquids being present in the floor sump during closure. Therefore, no decontamination of the facility took place. The building was in use from an unknown date until closure in September 1983. This area is not perceived as a potential environmental problem by the Survey team, but is only included for completeness.

Calcium Chromate Facility

In 1975, a process was developed by GENDD personnel to produce high-quality calcium chromate for use in thermal batteries. Development on the process was done from approximately 1976 to 1977, and production occurred from approximately 1977 to 1983. Enough product was produced to satisfy all of the plant's projected needs, and approximately 6000 pounds is now stored in Building 600 for use as needed. The process was as follows (GE, ca. 1980):

Chromic acid + ammonium hydroxide → ammonium chromate

Ammonium chromate + lime solution → calcium chromate (CaCrO_4)

Process development was done in what is now-132 Area (on the second floor of Building 100), with some preliminary work and later product analysis done in the laboratory in the southwest section of Building 100. Approximately 200 pounds of product was made during this year. Production was done in what is now 110-Area or 138-Area, where a total of 8000-10,000 pounds of product was produced in 200-pound batches (100 to 150 pounds CaCrO_4 /batch). Wastes produced included liquid waste which was piped to a 6000-gallon fiberglass holding tank east of the outside wall of the area, and solid waste which was placed in 55-gallon steel drums. The liquid waste solution, comprised of dichromates and other chromates, ammonia by-product, and chromic acid from container rinsing, was picked up approximately monthly by Matlock Trucking of Louisiana for disposal. It is estimated that 100,000 gallons of liquid waste were produced in the 3 years of production. The solid waste,

whose composition and generation rate are unknown, may also have been disposed of in Louisiana.

One spill was reported to have occurred in 1976 during the development phase where some calcium chromate foamed up over the tank. The calcium chromate was produced only in 10-pound batches, so the amount spilled was less than this quantity. The overflow was cleaned up and disposed of off-site. The tank reportedly had a pan six to eight inches high around it for containment, which was on a platform on a tile floor. GENDD employees interviewed by the Survey team indicated that there were no floor drains in the room.

Any spills during the production phase should have been well-contained. The tanks and equipment were surrounded by full curbing which directed spills to a drain leading to a waste storage tank. The waste storage tank was diked to contain the contents of the tank. However, there was a report of a spill of two to three gallons of calcium chromate solution onto the macadam near the calcium chromate storage tank in the early-1980s. Building 100 now covers the site.

The calcium chromate production facility was dismantled in 1983. The equipment was dismantled and scrapped as solid hazardous waste, and probably shipped to Louisiana. The waste tank and equipment were possibly stored in the north parking lot for a brief time before being disposed of. It is not known where the concrete pad and curbing from under the equipment or the HEPA filters were disposed of, or whether the sump from the floor drains was removed.

Septic Systems

One known location of a septic system exists at the Pinellas Plant. This location is now under the northwest corner of Building 100, formerly under old Building 600. This was a domestic system used by a home previously located on the plant property, and was removed (date unknown).

A second septic system was planned to be located at the northeast end of Building 500 (now under the building) and connected to a lavatory in that building, according to a facility building plan. However, the location of the lavatory was moved to the west end of the building during construction in 1964, and a small lift

station was built at the west end of Building 500 for the sanitary wastes. Therefore, this septic system was never installed.

Temporary Off-Loading Area

A 55-gallon drum of epoxy resin leaked when it was punctured while being handled by a fork-lift. This occurred in an area temporarily used for about 1 year as an off-loading area while a new receiving area was being built. It is believed that the site of the temporary off-loading area is now 348-Area built in 1969. However, site personnel indicated that the area was used prior to the receiving areas at the northwest of Building 100 or at Building 600 being used; these were built in 1983 and 1980, respectively. Therefore, either the location or the date of use must be incorrect. It is not known whether this area was decontaminated after its use ceased.

Former Cooling Towers

The four old (wooden) cooling towers, located northeast of Building 100, appear on the 1956 aerial photographs (two towers), and on the 1961 photos (four towers), and apparently operated from 1956 to between 1975 and 1982 when the current towers appear on the photo. These towers were removed, and their basins left in place and buried. Disposition of the lumber from the towers is not known.

Old Health Physics Tanks

Two 10,000-gallon underground wastewater holding tanks were installed at the Pinellas Plant in 1957, a third was installed in 1969. Control of wastewater containing tritium was provided by this system. In the early 1970s, an unknown quantity of tritium-containing water contaminated with metals escaped from the tanks to surface areas around them. This release of wastewater from the old health physics tanks to the surface soils resulted in the introduction of contaminants to the soils and groundwater. The sediments that were collected in the tanks from December 1981 to July 1986 were extraction procedure (EP) toxic for lead (51.6 milligrams per liter). Chromium (3.1 milligrams per liter), cadmium (0.82 milligrams per liter), and tritium (0.0073 microcurie per gram) were also detected in the sediment (see Section 3.4).

Abandoned Underground Pipelines

In various areas at the Pinellas Plant, underground pipelines were abandoned in place and buildings constructed over the area. For example, approximately 6 feet of abandoned chemical line lie under what appears to be the center of the western portion of 194-Area. This pipeline is oriented in a north-south direction on a site plan released for construction on August 2, 1983. Piping from five underground storage tanks (USTs) located approximately 30 feet west of Building 192 was also left in place when the tanks were removed in 1983. A pressurized-water line was also discovered during construction of the eastern addition of Building 500. The source of this line is not known. Assuming that it was left in place, it is probably buried beneath Building 500.

Potential TEA Site

During repair of a water line from Building 100 to the Wastewater Neutralization System (WNS) which was broken by a contractor in 1982 or 1983, one Tube Encasement Assembly (TEA) was found. No records of disposal exist in this area. It is possible that the TEA may have been brought in with fill dirt from West Pond. This area is believed to be now under Building 800.

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

4.5.2.3 Category III

1. CEARP sites are potential/actual sources of environmental contamination. The CEARP Phase I report identified 16 potential CERCLA sites at the Pinellas Plant.

Of these, three sites have no planned future action under CEARP, as shown in Table 4-15. The DOE Environmental Survey team concurred with the identification of the 13 remaining CEARP sites as potential areas of concern. In addition, the Survey team feels that the construction debris site should also receive further study. The acid/alkali spills and the temporary (former) plant are not viewed as potential environmental problems by the Survey team. The natural buffering action of the soil should mitigate any pH fluctuations caused by the acid and alkali spills. Since the temporary plant reportedly did not release or dispose of any contaminants on-site during its operation, and was cleaned up to the satisfaction of the Pinellas County Health Department (McCall, 1979), no environmental problems are anticipated. The findings listed in the CEARP are discussed below and are listed in Table 4-11.

a) Northeast Site/East Pond

The Northeast Site/East Pond area activities have resulted in groundwater and potentially surface water/sediment contamination in the area, with the potential for off-site migration via both of these pathways. Off-site surface water migration via the ditches may result in potential public exposure through contact with the water and sediments, or may degrade the water quality of Cross Bayou and Boca Ciega Bay.

The groundwater has been confirmed to contain volatile organic compounds resulting from the past storage of drums of wastes in this area. A list of the major contaminants and their concentrations is given in Section 3.4. A 1985 USGS conductivity study of the area revealed the possible presence of buried drums. East Pond itself had been used from 1968 to early 1983 to receive both treated (spray-irrigated) and untreated industrial and tritium-contaminated wastewater as well as other intermittent discharges. In 1982, the sediments of the pond were found to contain priority pollutants (mainly the following coal tar derivatives: anthracene, pyrenes, and chrysene at concentrations ranging from 220 to 5500 micrograms per kilogram) (Fernandez, 1985) presumably from surface water runoff from the parking lot. It also contained some low levels of pesticides (up to 28 micrograms per kilogram) and polychlorinated

TABLE 4-15

POTENTIAL CERCLA SITES IDENTIFIED DURING CEARP PHASE I

Site	Planned Future Action
Northeast Site (including East Pond)	Confirmation (Phase II)
West Pond	Confirmation (Phase II)
Spray Irrigation Site	Confirmation (Phase II)
Resin Drum Disposal Site (4.5-Acre Site)	Remediation (Phase IV)
Trenches	Installation Assessment (Phase I Supplemental)
Incineration Site (solids and liquids)	Installation Assessment (Phase I Supplemental)
Southwest Ditch	Installation Assessment (Phase I Supplemental)
Fire Department Training Tank	Installation Assessment (Phase I Supplemental)
Old Drum Storage Site	Installation Assessment (Phase I Supplemental)
Pistol Range	Installation Assessment (Phase I Supplemental)
Metallic Anomaly	Installation Assessment (Phase I Supplemental)
Diesel Fuel Spill	Compliance and Verification (Phase V)
Construction Debris Site	None
Industrial Drain Leaks	Installation Assessment (Phase I Supplemental)
Acid and Alkali Spills	None
Former Pinellas Plant Facilities	None

Source: DOE, 1987

biphenyls (PCBs) (340 micrograms per kilogram). The area is currently being investigated by CH₂M-Hill, and a Contaminant Assessment Report is forthcoming.

b) West Pond/Spray Irrigation Site

West Pond and the Spray Irrigation Site, which were the initial steps in the facility's wastewater treatment system, may have resulted in surface water, sediment, soil, and groundwater contamination. These areas were used from 1972 to 1982 to treat the facility's wastewater. West Pond also received rejected parts (1957 to 1959) and lumber contaminated with tritium and sulfuric acid (1974 to 1975). Although the three sumps south of the Spray Irrigation Site have been removed, the underground collection lines at the site have not been removed, providing a possible continuing source of contamination to the groundwater. Sampling of West Pond in 1982 only revealed the presence of one hazardous material (phthalate) in the sediment, and 1985 sampling revealed 230 micrograms per kilogram of PCBs in the sediment (Fernandez, 1985).

c) 4.5-Acre Site/Trenches

Historical disposal activities in the 4.5-acre site northwest of the current plant property and in nearby trenches have resulted in groundwater contamination with volatile organic compounds. These contaminants in the shallow groundwater are migrating toward the boundaries of the 4.5-acre site (now owned by a private citizen) and may continue to migrate off-site.

A total of 83 drums and 5000 cubic feet of contaminated soil/waste were excavated by Haztech in 1985 and disposed of at GSX in South Carolina (a total of 303 tons of material) (S&ME, 1986). Haztech's parent firm, S&ME, installed a total of 37 monitoring wells on-site. There also are two USGS, three GENDD, and 12 temporary monitoring wells in the area.

Based on October 24 to November 19, 1985 data, three plumes of groundwater contamination with volatile organics have been identified in the phreatic, shallow, and deep zones. This is discussed further in Section 3.4.

During the excavation of drums from the 4.5-acre site, some slurry wastes from water softeners were also removed. Reportedly, these wastes, as well as cooling tower sludges, were also disposed in trenches to the southeast of this site and northwest of West Pond. Whether these wastes were disposed in any other areas on-site is not known. Both the slurry wastes and the cooling tower sludges have the potential to contain contaminants from East Pond since this water was used in the deionized water system and for cooling tower makeup water.

d) Incinerator Areas

The areas where solids and flammable liquids incinerators were located may have potentially contaminated soil and groundwater. These areas were used from 1965 to 1982 for incineration of various wastes, including solvents, miscellaneous trash and plastics, and tritium-contaminated paper. A solvent storage tank with an underground pipeline feeding into the liquids incinerator was nearby, which could have leaked or spilled. Scrubber water from the solids incinerator discharged into a former ditch in the area. The two solids incinerators were not cleaned up as hazardous waste units upon cessation of operation.

Sampling and analysis is being performed in this area to determine any impact of past activities on the soil and/or groundwater.

e) Southwest Ditch

The ditch southwest of the plant may be providing a continuing source of potential off-site surface water/sediment contamination. These contaminants may be washed further downstream and impact other surface water bodies. The southwest ditch received treated and untreated wastewaters since the beginning of the plant's operations in 1957. This included industrial, radioactive (tritium), and sewage treatment plant effluent, as well as cooling tower blowdown, incinerator scrubber water, and waste solvents. Sampling and analysis is being performed as per the discussion in Section 3.3.

f) Former Fire -Training Site

The former fire training area located northwest of Building 400 is a potential source of groundwater and soil contamination. This area was used from 1964 to 1972 for training practices similar to those conducted currently near West Pond, where the soil is visibly contaminated. Sludge from the bottom of the current fire-training tank was found to be EP toxic for lead, possibly from the burning of leaded motor fuels and/or motor oil, or from contaminants in waste solvents. It is not known whether this area was cleaned up prior to the construction of Building 400 over part of the site.

Sampling and analysis is being performed in this area to determine any impact of past activities on the soil and/or groundwater.

g) Former Drum Storage Site

An area now under the northwest corner of Building 100 may be a source of potential groundwater contamination. Prior to 1960, drums containing EPON 828 resin as bottoms were stored here. Drums were reportedly tipped over to empty them. It is not known whether this area was cleaned up prior to the construction of Building 100.

h) Pistol Range

The past and present activities in the pistol range area may have resulted in potential soil and groundwater contamination, and potential contamination of West Pond. Potentially contaminated fill from various locations on-site have been placed in this area. This includes material from East Pond used for construction of the backstop in 1972; soil from West Pond possibly used as fill and berm prior to the mid-1960s; and a mound of soil containing construction debris reportedly from East Pond prior to its construction and from an area southeast of the current fire training area. Most of the soil from the backstop was removed for security reasons in 1985 to an unknown location. The soil immediately around the pistol range itself was littered with shells during the

Survey from the firing of weapons, which possibly could leach metals into the soil and be washed into nearby West Pond.

Sampling and analysis is being performed in this area to determine any impact of past or present activities on the soil and/or groundwater.

i) Metallic Anomaly

Possible buried drums/metallic objects may be remnants of a past disposal site which may potentially contaminate groundwater. If a source of contamination is present, it may result in problems similar to those at the 4.5-acre site.

A 1984 geophysical study done by the USGS revealed the presence of a metallic anomaly north of Building 600 at the southwest edge of the spray irrigation field. Similar studies at the plant resulted in the discovery of the buried drums in the 4.5-acre site and the northeast site contamination, which now have documented groundwater contamination.

Sampling and analysis is being performed in this area to determine any impact of past activities on the groundwater.

j) Diesel Fuel Spill

A spill of 2000-12,000 gallons of No. 2 diesel fuel from a ruptured underground pipeline may have resulted in groundwater contamination. In addition, any remaining sources (contaminated soil) may result in further potential for contamination of the groundwater.

An underground pipeline (nine to 14 inches deep) between a fuel storage tank and a supply tank was ruptured, probably during construction activities in the summer of 1982. The leak, at the northwest corner of the north parking lot, was detected after heavy rains on January 21, 1983. An approximate 40-foot-by-40-foot area of the lot was covered with oil, which drained into the catch basin and eventually to East Pond. A&A Coastal Pollution Cleanup Services, Inc., of Tampa provided cleanup of 12,000 gallons of oil/water, which was sent

to Tim's Oil Recovery, Inc. Approximately 50 to 60 cubic yards of oil-laden soil was excavated and spread adjacent to the fire-training area to allow the oil to evaporate.

k) Construction Debris Site

An area now under the east parking lot where construction debris was found may also contain hazardous wastes, which would provide a potential source of groundwater contamination. Hazardous wastes have a high potential to be buried with construction debris since both were found in other areas at the plant (e.g., the northeast site/East Pond area). It is not known whether the debris was removed when the parking lot was constructed in the late-1960s, or whether other disposal areas are present on-site.

l) Industrial Drain Leaks

Historical leaks from industrial drain lines under Building 100 and possibly other areas may potentially contaminate the soil and groundwater. The continued occurrence of leaks in old drain lines which go undetected will cause eventual contamination of the groundwater. During the mid- to late-1970s, deteriorated industrial drain lines under Building 100 resulted in numerous leaks to the soil. An undetermined amount of wastewater escaped prior to the lines being repaired.

2. Non-CEARP sites are potential/actual sources of environmental contamination. In addition to the sites identified both in the CEARP and during the Survey as existing or potential environmental problems, 11 potential problems have been identified which were not recognized in the CEARP. These sites are listed in Table 4-12, and the findings are as follows.

a) Off-Site Waste Disposal Facilities

A number of off-site facilities have been used for the disposal of waste solvents and possibly other chemicals. The facilities used by the Pinellas Plant are listed in Table 4-13, as well as the dates used, waste quantities and waste

types disposed, when known. This information was compiled from personnel interviews and available facility documents, and may or may not be complete.

b) Ditch West of Building 700

A former ditch west of Building 700 used for waste disposal may have resulted in soil and groundwater contamination. For a few years in the mid-1960s, a ditch located near the former incinerators was used for the disposal of waste methylene chloride and possibly other wastes (alcohols, acids, etc.). Interviews conducted during the Survey indicated that wastes in 5-gallon cans from the chemical cleaning area were poured directly into the ditch during this period. The cans were wheeled 100 feet to an area near a storage shed approximately once every 3 months. The ditch reportedly contained water during this period, but was later dammed off and the water pumped to the neutralization facility in the early-1970s. This ditch, oriented in a northeast-southwest direction, also received runoff from the west side of the tractor shed, and scrubber water from the first solids incinerator. A pipeline was later buried under the ditch. Prior to this, the ditch discharged south to the storm drain system via an underground pipeline, and emptied into the southwest ditch.

Sampling and analysis is being performed in this area in conjunction with that of other potential sites nearby to determine any impact of past activities on the soil and/or groundwater.

c) Current Fire Training/Former Thermal-Treatment Site

The area which was used in the past for thermal treatment and the historical practices at the current fire-training area may have resulted in soil, surface water, and groundwater contamination. This area is directly east of West Pond, and it is likely that hazardous constituents from fuel oil and other flammable liquids and solids have been washed into the pond.

The soil currently is visibly contaminated, and past analyses of the sludge at the bottom of the tank tested EP toxic for lead. The current tank and former burn pans are rusted and are underlain only by gravel. Residue from the burning of heat powder (iron shavings and potassium perchlorate) and paper

(metallic zirconium and barium chromate) as well as the detonation of explosives tested EP toxic for chromium. The fire-training area has been used since 1972, and the thermal treatment area was used from 1975 to 1983. For the latter, the pans were removed and replaced, and the pad steam-cleaned prior to closure in January 1984. Fifty to 60 cubic yards of soil from a spill of No. 2 diesel fuel was placed in this area to allow the fuel to evaporate.

Sampling and analysis is being performed in this area to determine any impact of past or present activities on the soil and/or groundwater.

d) Underground Storage Tanks

Twenty-one past or presently used underground storage tanks (USTs) were identified at the Pinellas Plant during the Environmental Survey, and may have contaminated the groundwater via spills and/or leaks.

Information collected during the Survey indicates that 13 of these tanks have been taken out of service and eight remain in service. Of these, nine are known to have been removed (see Table 4-14 and Figure 4-10). A spill of fuel oil occurred during refilling of the tanks south of Building 700; and the HP tanks, containing tritium and possibly chemical wastes, have overflowed to the surface (this is listed as a separate finding below). Any leaks or spills from the other tanks are not known but are likely to have also occurred.

Sampling and analysis of selected areas is being performed in conjunction with that of other potential sites nearby to determine any impact of past activities on the soil and/or groundwater.

e) Miscellaneous Drum Storage Sites

Three former areas used for the drummed storage of organic and inorganic wastes may have resulted in soil and groundwater contamination. Spills, leaks, and/or inadequate cleanup of these areas may be the source of future groundwater contamination if not remediated. These areas include a drum storage pad near Building 700 (closed in 1983), a drum storage area north of Building 600 near the former fire-training area (cleanup status unknown; used

from late-1960s to 1972), and a drum storage building in old 191-Area, now under the northwest portion of Building 100 (closed in 1982).

The drum storage pad was present in the area from an unknown date until it was steam-cleaned and removed in 1983. The pad was used to store containerized waste on an 18-foot-by-18-foot area equipped with a drain system/containment system. The possibility of uncontained spills and/or inadequate cleanup of this area exists. Recommendations were made to increase the containment system in this area in 1980 (DOE, 1980). It is not known whether this work was ever performed.

Little information is available concerning the wastes at the drum storage area, except that they were solvent wastes which may also have been used for fire-training, since the area was used only until training ceased in this area.

The former drum storage building, covering an area of 20-by-50 feet, was used for an undetermined period to temporarily store (for <90 days) laboratory chemical wastes in drums prior to shipment off-site. The building was decontaminated and removed in May 1982; the date it began being used is currently unknown. During construction of an elevator shaft in what is now 146-Area, an organic (solvent) odor was stated to be present by a plant employee. It is not known whether this odor is related to any of the activities which occurred in the former drum storage building. Groundwater in this area of the plant property is believed to flow to the southeast, which would be from the former drum storage building toward the elevator shaft location. The only documented spill in this area, however, involved a nickel waste.

Sampling and analysis of selected areas is being performed in conjunction with that of other potential sites nearby to determine any impact of past activities on the soil and/or groundwater.

f) Calcium Chromate Facility

The past production of calcium chromate in the northeastern portion of Building 100 may have resulted in chromium contamination of soil and groundwater. Production occurred in this area from 1977 until the facility was

dismantled in 1983. A small (<10 lb) spill occurred during the development phase, and one spill of two to three gallons was also reported during production. The latter occurred onto the macadam near the calcium chromate storage tank in the early 1980s. Building 100 now covers the site. The occurrence of any other releases or the extent of cleanup prior to removing the equipment is not known.

g) Septic Systems

A domestic septic system used prior to plant operations may be a potential source of groundwater contamination. This system, formerly located northwest of Building 100, was a domestic system into which household chemicals may have been disposed. Although the tank was removed (see Table 4-12), contaminants present in any leach field, and any which may have leaked out into the soil and groundwater from the tank prior to removal, may provide a source of continuing contamination.

Sampling and analysis of this area is being performed in conjunction with that of other potential sites nearby to determine any impact of past activities on the soil and/or groundwater.

h) Temporary Off-Loading Area

The area now under Building 300 which was used as a temporary off-loading area for receiving of materials may have resulted in potential soil and groundwater contamination. At least one occurrence of a leak (from a drum of epoxy resin) occurred in this area, which (it is believed) now is under 348-Area. Other spills or leaks may also have occurred. The presence of a spill-containment system in this area is not known, and no cleanup records exist for the area.

i) Former Cooling Towers

Past operations and possible inadequate cleanup of the old cooling towers may provide a source of potential groundwater contamination. The former wooden cooling towers, then located northeast of Building 100, were

removed when the new towers were built. However, they were broken off at their concrete basins (the basins were 3 feet deep) and filled in, and are now underneath and north of 347-Area. The sumps, which were 12-to-14 feet deep, were broken off 4 feet below the ground and left in place. These remaining structures, plus any spills or leaks which may have occurred during operation, may result in groundwater contamination with the substances present in the biocides and sludges (see Section 3.3 for a discussion of these contaminants), as well as other substances. Water from East Pond was used as cooling tower makeup water for 1 to 2 years in the mid-1970s.

j) Old Health Physics Tanks

The release of wastewater from the old health physics tanks to the surface soils resulted in the introduction of contaminants to the soils and groundwater. The sediments which were collected in the tanks from December 1981 to July 1986 were EP toxic for lead (51.6 milligrams per liter). Chromium (3.1 milligrams per liter), cadmium (0.82 milligrams per liter), and tritium (0.0073 microcurie per gram) were also detected in the sediment.

k) Abandoned Underground Pipelines

Potential undetected releases from abandoned underground pipelines will impact the soil and eventually the groundwater on-site, thus providing a potential migration route for contaminants. Abandoned underground pipelines were documented during the Survey in 194-Area and approximately 30 feet west of Building 192. A pressurized water line was also discovered during construction of the east addition of Building 500. It is not known whether this line was removed or whether any of the lines were cleaned out prior to being abandoned.

l) Miscellaneous Undefined Sites

Numerous possible sources of groundwater contamination exist at the Pinellas Plant which cannot be exactly defined. Some areas are suspected disposal or release sites with a known general location; other sites are for wastes which are known to have been disposed or released on-site but whose locations are

unknown; and a third group represents wastes which may or may not have been disposed of on-site. This list was derived from a review of facility documents as well as from interviews conducted during the Survey. These suspected sites include the following:

1. Suspected sites with known locations

- a. Tube Encasement Assembly (TEA) disposal between Building 100 and the wastewater treatment plant (believed to be now under Building 800)
- b. Storage of equipment (calcium chromate production, solids incinerator) in north parking lot
- c. Spill of a few gallons during PCB/oil filtration in 137-Area (second floor in 1965); cleaned up by Florida Power Company
- d. Flooding of Tube Processing Area (108-Area); radioactive water was placed in drums; subsequent water disposal unknown

2. Unknown on-site disposal/release locations

- a. Area where dredged parts from West Pond were segregated (1966)
- b. "Landfill" reportedly used for disposal of sand-blasting materials (possibly disposed behind pistol range, with construction debris now under Building 1200, or under the north parking lot as well as off-site with ash from the solids incinerator)
- c. Lime slurry wastes and cooling tower sludges disposal area(s)
- d. Leakage of mineral oil due to oil switch rupture outside a transformer (possibly containing PCBs)

3. On-site or off-site disposal locations

- a. Area where drums of dredged parts from West Pond were disposed of (1966)
- b. Area where backstop material from the pistol range was disposed of (1985)
- c. Disposal of thermal treatment and fire-training sludges
- d. Disposal of lumber from former cooling towers (possibly in West Pond)
- e. Disposal of empty containers of MOCA (a carcinogen), pesticides, and herbicides (possibly in Toytown Sanitary Landfill)

Sufficient information does not currently exist to warrant exclusion of these areas from consideration in further studies.

4.5.2.4 Category IV

1. The Pinellas Plant has not complied with DOE Order 5480.14 of April 26, 1985. This DOE Order requires a Phase I Installation Assessment be performed by April 26, 1986 "to evaluate site history and records, (and) to locate and identify those inactive hazardous wastes disposal sites that may pose a risk to health, safety and the environment as a result of migration of hazardous substances." The Phase I Installation Assessment format is spelled out in detail and includes a physical inspection, and a rating of nonradioactive sites with the CERCLA Hazard Ranking System (HRS) and the rating of radioactive sites with DOE's Modified Hazard Ranking System (MHRS). The Pinellas Plant did not submit a Phase I Installation Assessment in compliance with DOE Headquarters Order 5480.14.

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PRELIMINARY

APPENDIX A

SURVEY PARTICIPANTS

PRELIMINARY

PINELLAS PLANT
SURVEY PARTICIPANTS
MAY 11 - 22, 1987

DOE

Team Leader
Assistant Team Leader

V. Fayne
H. Carwell

CONTRACT PERSONNEL

Coordinator
QA/Toxics
Surface Water
Air
Radiation
Waste Management
Inactive Waste Sites
Hydrogeology

K. Walter (NUS)
J. Connelly (NUS)
K. Walter (NUS)
R. Lanza (ICF)
C. Roberts (NUS)
G. Gartseff (NUS)
M. Hlavacik (NUS)
D. Riddle (NUS)

APPENDIX B

SITE SPECIFIC SURVEY ACTIVITIES

PRELIMINARY

B.1 Pre-Survey Preparation

The DOE Office of Environmental Audit, Assistant Secretary for Environment, Safety and Health, selected a Survey team for the Pinellas Plant in the spring of 1987. The site is operated for the DOE by the General Electric Company-Neutron Devices Department (GENDD). Mr. Vincent Fayne was designated the DOE Team Leader, and Ms. Hattie Carwell, the Assistant Team Leader. The remainder of the team was composed of contractor specialists from the NUS Corporation and ICF Corporation.

The Survey team members began reviewing the Pinellas Plant general environmental documents and reports in February 1987. Messrs. Fayne, Walter, and Lanza conducted a pre-Survey site visit on March 30 - April 1, 1987 to gain familiarization with key DOE and GENDD personnel and the site. They toured the facility and completed a cursory review of the data generated in response to an information request of March, 1987. The request listed environmental information of interest to the Survey team for planning purposes. The Survey team intensively reviewed the information generated during the pre-Survey visit, and on April 9-10, 1987, prepared a Survey plan for the Pinellas Plant. This plan discussed the specific approach to the Survey for each of the technical disciplines and included a proposed schedule of activities for on-site activities. The Survey plan was transmitted to the Albuquerque Operations Office on April 1, 1987, and to the GENDD through the Pinellas Area Office during the week of April 20, 1987.

B.2 On-site Activities

The on-site portion of the Survey was conducted during the period of May 11-22, 1987. The opening meeting held on May 11, 1987, at the site was attended by representatives from DOE Headquarters, the Albuquerque Operations Office, and Pinellas Area Office, GENDD, and the Survey team members. Discussions during this meeting centered on the purpose of the Survey, logistics at the Pinellas Plant, and an introduction of the key personnel involved.

During the Survey, team members reviewed file materials, permits and applications, background studies, engineering drawings, accident reports, and operating logbooks. The production process was thoroughly analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed.

Extensive interviews were conducted with plant personnel regarding environmental controls, operations, monitoring and analysis, past operations, regulatory permits, and waste management.

Daily meetings of the Survey team members were held to report observations and compare findings. A representative from the Environment, Health, and Safety Programs Division of GENDD met daily and often more frequently with the DOE Team Leader, Assistant Team Leader, and the NUS Coordinator to arrange for specific site personnel and facilities to be available, as needed, on the following day. GENDD personnel accompanied Survey team members on all field reconnaissances.

The Survey team members identified further sampling and analysis (S&A) requirements necessary to complete the Survey effort. The S&A requirements were discussed by the team on May 20, 1987, and the request package was presented to Battelle, Columbus Division (Battelle) representatives present at the last week of the summary. Battelle was designated by DOE to provide a sampling team for the Pinellas Plant and to perform the laboratory analytical services.

A site closeout briefing was held on May 22, 1987, where the DOE Team Leader presented the preliminary observations of the Survey team. These observations were classified as preliminary, because additional research and, in some cases, additional field sampling were required to positively confirm the observations.

B.3 Sampling and Analysis

Battelle will perform the sampling and analysis portion of the Survey. Battelle evaluated the sampling requests made by the Survey team and determined sampling and analysis logistics, costs, and schedules. The sampling plan prepared by Battelle includes a quality assurance plan and a health and safety plan. The sampling plan will be completed during summer 1987 and the sampling team will begin work at the site during the early fall of 1987.

B.4 Report Preparation

An Environmental Survey Preliminary Report for the Pinellas Plant will be prepared to summarize the findings from the on-site Survey effort. This report will be

provided to the Albuquerque Operations Office and GENDD for review. The findings presented in the Preliminary Report are considered preliminary until comments are received and S&A results are available. At that time, the comments and S&A results will be evaluated and an Interim Report will be prepared.

PRELIMINARY

APPENDIX C

SURVEY PLAN

PRELIMINARY

ENVIRONMENTAL SURVEY
PINELLAS PLANT
May 11 through 22, 1987
Largo, Florida

1.0 INTRODUCTION

The Environmental Survey is a one time baseline inventory of existing environmental information and environmental problems and risks at DOE operating facilities. The Survey will be conducted in accordance with the principles and procedures contained in the DOE Environmental Survey Manual.

The Survey is an internal management tool to aid the Secretary and Under Secretary in allocating resources for maintaining aggressive environmental programs and for mitigating environmental problems at DOE facilities.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey at the Pinellas Plant will be managed by DOE Team Leader, Vincent Fayne and Assistant Team Leader Hattie Carwell. George Laskar and David Ingle will serve respectively as the Albuquerque Operations Office (AL) and Pinellas Area office (PAO) representatives on the Survey team. Technical support will be provided by contractor personnel as follows:

Radiological:	Craig Roberts, NUS Corporation
Surface Water/ Drinking Water:	Kevin Walter, NUS Corporation
Waste Management:	George Gattseff, NUS Corporation
Inactive Waste Sites/ Releases	Mara Hlavacik, NUS Corporation
Hydrogeology:	Douglas Riddle, NUS Corporation
QA/Toxic & Chemical Materials:	John Connelly, NUS Corporation
Air:	Robert Lanza, ICF Corporation

2.1 Pre-Survey Activities

Survey team members began reviewing Pinellas Plant general environmental documents and reports in March 1987. Messrs. Fayne, Walter, Lanza, and Piispanen (Battelle-Columbus Laboratory) conducted a pre-Survey site visit on March 29 through April 1, 1987 to gain a familiarization with key DOE staff and contractor personnel from General Electric Neutron Device Department (GENDD). We toured the facility and completed a cursory review of documents and discussed data that were generated in response to an information request letter of March 6, 1987. The letter proposed the Survey schedule and listed environmental information of interest to the Survey team for planning purposes.

A meeting was held with Pinellas County Sewer District and Pinellas County Health Department representatives at the Pinellas Area Office on April 1, 1987 to review environmental issues and explain the purpose and scope of the Survey. The Florida Department of Environmental Regulation and U.S. EPA Region IV were contacted via telephone to discuss the environmental status of the Pinellas Plant and to explain the purpose and scope of the Survey. These discussions identified issues on which the Survey team will focus.

This Survey Plan will be transmitted to the Albuquerque Operations Office and Pinellas Area Office prior to the Survey.

2.2 On-Site Activities

The Survey will be conducted from May 11 through May 22, 1987. The agenda will be as shown in Table 1, with modifications as appropriate to minimize disruption of site activities and to enhance the efficiency and effectiveness of the Survey.

At the end of Table 1, a listing of specific areas that each Survey team member will evaluate has been provided. This list is intended to assist AL and PAO in identifying the most appropriate technical contacts who should be matched with individual Survey Team members.

Interviews and consultations will be conducted with environmental, safety, operations, waste management, purchasing, and warehousing personnel, among others, in the course of the Survey. Also, the Survey team will continue their review of records and other documentation during the Survey. These records are identified in the "Records Required" sections of this plan. The Survey team has already reviewed some of these documents, so copies do not have to be made of documents previously submitted by AL and GENDD. However, the originals should be readily available for reference during the on-site activities.

2.3 Sampling and Analysis

Based on available site environmental information and the results of the on-site Survey activities, the sampling and analysis (S&A) phase of the Survey process will be implemented approximately 13 weeks after completion of the Survey. This effort will have a 2-10 week duration and will be conducted by the Battelle-Columbus Laboratory. Results of the S&A effort will be transmitted to the Survey Team Leader for incorporation into the Interim Report. If data are determined to be reportable pursuant to regulatory requirements, they will be immediately provided to AL and PAO.

2.4 Conclusions and Reporting on the Survey

A closeout briefing will be conducted during the second week of the Survey to describe the general conclusions of the on-site activities. Within 10-12 weeks of the on-site Survey team visit, an Environmental Survey Preliminary Report will be developed for the Pinellas Plant. Within 10 weeks of the availability of the analytical results from the sampling and analysis phase of the Survey, an Interim Report will be completed.

Table 1
Pinellas On-Site Survey Agenda*

	Air	Radiation
Week 1 (5/11/87)		
Monday	<p>(am) Site Briefing and Process Descriptions (unclassified)</p> <p>(pm) Site Tour Building 100 (Security Plan needed)</p>	<p>(am) Site Briefing and Process Descriptions (unclassified)</p> <p>(pm) Site Tour Building 100 (Security Plan needed)</p>
Tuesday	<p>(am) Site Tour Outside Areas and Other Buildings (including #200, 600, 1040, 400, 800, WWTP)</p> <p>(pm) 104 Area Machine Shop 105 Area Tool Room Degreased solvents/metal fumes Battery fabrication/foam injection Calcium chromate, potassium perchlorate 111 Area coil bobbing/FRP process 110 Area magnetics 124 Area maintenance</p>	<p>(am) Site Tour Outside Areas and Other Buildings (including #200, 600, 1040, 400, 800, WWTP)</p> <p>(pm) Process descriptions (classified)</p>
Wednesday	<p>(am) 182 Area Tube Development Engineering Tritium Receiving/Storage Tritium Unloading/Handling 181/183 Area Generator Development Ventilation System/Drain System Tritium Monitoring (Air) Chemical Exhausts</p> <p>(pm) 400 Bldg. RTG/Plutonium Heat Source Source Receiving/Storage Glovebox Operations Ventilation System (Gloveboxes/Hoods) Plutonium Monitoring (Air) HEPA Filtration System Vacuum Pump Exhaust Chemical Exhausts</p>	<p>(am) 182 Area Tube Development Engineering Tritium Receiving/Storage Tritium Unloading/Handling 181/183 Area Ventilation System/Drain System Tritium Monitoring (Air) Chemical Exhausts 400 Bldg. RTG/Plutonium Heat Source Source Receiving/Storage Glovebox Operations Ventilation System (Gloveboxes/Hoods) Plutonium Monitoring (Air) HEPA Filtration System Vacuum Pump Exhaust Chemical Exhausts</p>

Table 1
Pinellas On-Site Survey Agenda (continued)

	Air	Radiation
Week 1 (5/11/87) (continued)		
Thursday	<p>(All Day) <u>108/109 Area Neutron Generator Tube Process</u> Tritium Receiving/Storage Tritium Unloading/Handling Generator Tube Loading Ventilation System/Drain System Chemical Exhausts <u>MEZZ Area Old Tritium Recovery System</u> <u>New Tritium Recovery System</u> Tritium Monitoring (Air) <u>126 Area Tube Production Area</u></p>	<p>(All Day) <u>108/109 Area Neutron Generator Tube Process</u> Tritium Receiving/Storage Tritium Unloading/Handling Generator Tube Loading Ventilation System/Drain System <u>MEZZ Area Old Tritium Recovery System</u> <u>New Tritium Recovery System</u> Tritium Monitoring (Air) <u>109 AreaRad Flo - Tube Test Unit</u> <u>Krypton - 85 Monitoring (Air)</u> <u>Carbon - 14 Monitoring (Air)</u></p>
Friday	<p>(All Day) <u>138/139 Area Resin Casting/Final Prep</u> <u>Solvent/Resin/MEDA</u> Vapor Blasting/Metal Fumes Ventilation System <u>117/117F Area Metallize/Plating</u> Solvent Cleaning Plating Furnaces <u>140/143 Area Chem Clean Area /H₂</u> Furnaces Etching Degreasing furnaces <u>145 Area Ceramics Machining</u> <u>113 Area Water Pollution/Rad Analytical</u> Laboratory</p>	<p>(am) <u>800 Bldg. Accelerator Test Facility</u> <u>Old (Decommissioned) Health Physics Tanks</u> <u>New (active) Health Physics Tanks</u> Liquid discharge - Tritium monitoring (observe sampling of HP tanks if possible) <p>(pm) <u>113 Area Water Pollution/Rad Analytical</u> Laboratory</p> </p>

Table 1
Pinellas On-Site Survey Agenda (continued)

	Air	Radiation
Monday	(All Day) 100 Building/300 Building 185 Mat Engr, 165 Laboratory, 163 Model Shop 156 Chemical Lab, 160/162 Chem/Met Lab 315, 325, 350, 351 Resonator oscillator assembly 353 Iron disulfide	(All Day) 100 Building/300 Building Rad/Mixed Waste Storage Ageas 200 Building Tritium Sources Revisit Productions Areas 108, 109, 132 Laboratory areas 155, 157, 158B, 165, 182B
Tuesday	(am) 100 Building/300 (pm) Document review	(am) Observe collection of rad ambient environmental monitoring sampling (air, water and other media as available) (inside and outside site fence) with QA specialist
Wednesday	(All Day) Sampling and Analysis Meeting	(All Day) Sampling and Analysis Meeting
Thursday	(All Day) Coordination with Sampling Team - Meetings Pre-closeout Meeting with Survey Team Leaders	(All Day) Follow up inspection and records review Pre-closeout meeting with Survey Team Leaders
Friday	Closeout Meeting	Closeout Meeting

Table 1
Pinellas On-Site Survey Agenda (continued)

	Surface Water/Drinking Water	Waste Management
Week 1 (5/11/87)		
Monday	<p>(am) Site Briefing and Process Descriptions (unclassified)</p> <p>(pm) Site Tour Building 100 (security plan needed)</p>	<p>(am) Site Briefing and Process Descriptions (unclassified)</p> <p>(pm) Site Tour Building 100 (security plan needed)</p>
Tuesday	<p>(am) Site Tour Outside Areas and Other Buildings (incl. # 200, 600, 1040, 400, 800, WWTP)</p> <p>(pm) Wastewater sampling (can be moved to actual day of samples) and WWTP review, HP tanks aboveground and nonferrous product tanks</p>	<p>(am) Site Tour Outside Areas and Other Buildings (incl. # 200, 600, 1040, 400, 800, WWTP)</p> <p>(pm) Process descriptions (classified)</p>
Wednesday	<p>(All Day) Wastewater Sources - 100 Bldg (Industrial & Sanitary)</p> <p>Manufacturing Areas 195, 123, 105, 118, 163, 152, 164, 165, 166, 151, 101, 104, 144, 103, 106, 146, 145, 143, 140, 117, 142, 141, 112, 138, 126, 107, 134, 128, 131, 109, 110, 139, 116, 347, 336, 330, 348, 349, 350, 351</p>	<p>(All Day) Waste handling and storage</p> <p>Manufacturing Areas 195, 123, 105, 118, 163, 152, 164, 165, 166, 151, 101, 104, 144, 103, 106, 146, 145, 143, 140, 117, 142, 141, 112, 138, 126, 107, 134, 128, 131, 109, 110, 139, 116, 347, 336, 330, 348, 349, 350, 351</p>
Thursday	<p>(All Day) Wastewater Sources 100 Bldg (Industrial & Sanitary)</p> <p>Engineering Areas</p> <p>194, 193, 191, 192, 183, 184, 162, 161, 160, 159, 185, 181, 180, 179, 158, 157, 156, 155, 175, 176, 154</p>	<p>(All Day) Waste Handling and Storage</p> <p>Engineering Areas</p> <p>194, 193, 191, 192, 183, 184, 162, 161, 160, 159, 185, 181, 180, 179, 158, 157, 156, 155, 175, 176, 154</p>

Table 1
Pinellas On-Site Survey Agenda (continued)

	Surface Water/Drinking Water	Waste Management
Week 1 (5/11/87) (continued)		
Friday	<p>(am) Wastewater Sources 100 Bldg (Radiological) 108, 182 Wastewater sources other buildings (industrial, sanitary, radiological) Bldg. 200, 400, 800</p> <p>(pm) Office record review, sampling and analysis request preparation</p>	<p>(All Day) Waste Handling and Storage (Radiological) 108, 182 Wastewater sources other buildings Bldg. 200, 400, 800 and Bldg. 1040 Thermal treatment, reactive metal treatment, all waste tanks (Sludge holding tank, container storage building)</p>

Table 1
Pinellas On-Site Survey Agenda (continued)

	Surface Water/Drinking Water	Waste Management
Week 2 (5/18/87)		
Monday	(am) Review of records of old wastewater treatment system (pm) Old discharge monitoring report review	(All Day) RCRA permit File Review
Tuesday	(am) Stormwater system inspection review (pm) Record review and followup inspections	(All Day) Followup inspections and records review
Wednesday	(All Day) Sampling and Analysis Meeting	(All Day) Sampling and Analysis Meeting
Thursday	(All Day) Pre-closeout meetings with Survey Team Leaders	(All Day) Pre-closeout meetings with Survey Team Leaders Followup Records Review
Friday	Closeout Meeting	Closeout Meeting

**Table 1
Pinellas On-Site Survey Agenda (continued)**

	Inactive Waste Sites/Releases (CERCLA)		Hydrogeology
Week 1 (5/11/87)			
Monday	(am) (pm)	Site Briefing and Process Descriptions (unclassified) Site Tours Building 100 (security plan needed)	(am) (pm) Site Briefing and Process Descriptions (unclassified) Site Tours Building 100 (security plan needed)
Tuesday	(am) (pm)	Site Tour Outside Areas and Other Buildings (including #200, 600, 1040, 400, 800, WWTP) Inspection of on-site potential contaminant sources. This includes: East and West ponds, the old spray irrigation area, effluent ditches, the pistol range, the swamp area west of the East pond, the trenches between the West pond and 4.5 acre site, abandoned underground and aboveground tanks and historic spill and leak areas.	(am) (pm) Site Tour Outside Areas and Other Buildings (including #200, 600, 1040, 400, 800, WWTP) Inspection of on-site potential contaminant sources. This includes: East and West ponds, the old spray irrigation area, effluent ditches, underground and aboveground tanks, and historic spill areas.
Wednesday	(am) (pm)	Continuation of Tuesday pm inspections. Inspection of 4.5 acre site. Document and aerial photo review of former plant facilities and 4.5 acre site.	(am) (pm) Continuation of Tuesday pm inspections. Inspection of all on-site and 4.5 acre site wells. This includes Hnu readings from well headspace.
Thursday	(am) (pm)	Offsite reconnaissance of 2 former plant facilities Terrain conductivity survey of building perimeter and areas south, east and west of Building 100.	(am) (pm) Terrain conductivity survey of selected areas near East and West Pond, the spray range, on area and effluent ditches. Terrain conductivity survey of building perimeter and areas south, east and west of Building 100.
Friday	(am) (pm)	Inspection of former incineration site (north of Bldg 700), and former and present thermal treatment areas (explosive) Perimeter and off-site reconnaissance for potential source areas and well locations	(am) (pm) Observe sampling of groundwater from two wells within the 4.5 acre site. One well should be a "phreatic" screened well; the other should be a well with a fully-saturated screened interval. Off-site reconnaissance for potential source areas and well locations

Table 1
Pinellas On-Site Survey Agenda (continued)

	Inactive Waste Sites/Release (CERCLA)	Hydrogeology
Week 2 (5/18/87)		
Monday	<p>(am) Review of site files which contain information on historical spills, leaks and disposal practices; abandoned production processes (CERCLA); and waste generation reports. These data include both historic and new data, draft reports and internal memos.</p> <p>(pm) Follow-up including library searches as required.</p>	<p>(am) Review of site files which contain ground-water data. These data include both historic and new data, draft reports and internal memos. Includes classified documents. Follow-up including library searches as required.</p> <p>(pm)</p>
Tuesday	<p>(am) Inspection of buildings, leak/spill areas, waste generation practices, abandoned processes and former storage tanks and interviews of site and/or contractor personnel.</p> <p>(pm) Preparation of sampling and analysis requests.</p>	<p>(am) Interviews of site and/or contractor personnel regarding current groundwater studies, future plans, and historic data.</p> <p>(pm) Preparation of sampling and analysis requests.</p>
Wednesday	(All Day) Sampling and Analysis Meeting	(All Day) Sampling and Analysis Meeting
Thursday	(All Day) Follow-up interviews, document reviews and inspections. Pre-closeout meeting with Survey Team Leaders.	(All Day) Follow-up interviews and inspections. Pre-closeout meeting with Survey Team Leaders.
Friday	(am) Closeout meeting.	(am) Closeout meeting.

Table 1
Pinellas On-Site Survey Agenda (continued)

	QATSCA	
Week 1 (5/13/87)		
Monday	(am) (pm)	Site Briefing and Process Description (unclassified) Site Tours Building 100 (security plan needed by site)
Tuesday	(am) (pm)	Site Tour Outside Areas and Other Buildings (including #200, 600, 1040, 400, 800, W.WTP) a. Chemical & Toxic Material Overview Specialist Meeting (including PCB, asbestos, pesticides). Discussion with EH&SP staff on policies, procedures, locations, users and contacts (EH & SP Office) b. Obtain copies of policies & procedures Quality Assurance (QA) Overview (regarding environmental sampling, sample handling and analyses, data handling and report preparation) plus sampling schedule and contacts. Obtain copies of lab QA programs, plus analytical procedures (EH & SP office) c. Observe collection of wastewater samples (with Surface Water Specialist)
Wednesday	(am) (pm)	a. Environmental Laboratory Overview (on-site & off-site). Obtain copies of procedures b. Industrial Hygiene data review (MSD sheets, toxic procedures) (EH & SP office) Inspection of toxic receiving, storage and transfer areas. (Bldg. 600; Bldg 1040; Bldg 100, Areas 105, 137 and area north of 124 Area)

Table 1
Pinellas On-Site Survey Agenda (continued)

	QA/TSCA
Week 1 (5/11/87) (continued)	
Thursday	<p>(am) Inspection of toxic chemical use areas (Engineering Labs - Bldg 100, Areas 176, 153, 154, 175, 185, 181, 180, 155, 156, 157, 158, 184, 183, 193, 191, 182, 157, 160, 161, 162, 192, 194</p> <p>(pm) Inspection of toxic chemical use areas (Production Areas - Bldg 100, Areas 195, 124, 123, 118, 152, 151, 163, 164, 165, 166, 154, 168, 150, 103, 106, 104, 105)</p>
Friday	<p>(am) a. Review laboratory QA procedures, off-site lab procedures and data, QA sample data, analysis records</p> <p>b. Observe collection of radioactive liquid effluent samples (HP Tanks) with Radiation Specialist</p> <p>(pm) Follow-up records review</p>

Table 1
Pinellas On-Site Survey Agenda (continued)

	QA/TSCA
Week 3 (5/18/87)	
Monday	<p>(am) Inspection of toxic chemical use areas (Production Areas - Bldg 100; areas 146, 145, 143, 140, 142, 141, 117, 112, 138, 126, 107, 130, 128, 131, 114, 109, 111, 110, 130, 116, 351, 350, 349, 349, 307, 316, 348, 330, 347, 336, 353)</p> <p>(pm) Revisits (possible inspection of off-site warehouse & other miscellaneous buildings on-site for toxic chemicals, asbestos, and pesticides)</p>
Tuesday	<p>(am) Observe collection of rad ambient environmental monitoring sampling (air, water, and other media as available) (inside & outside site fence) with Radiation Specialist</p> <p>(pm) Tour of Environmental (water pollution/rad analytical) Laboratory. Observe analyses, use of procedures, data recording and handling in lab, chain of custody of samples. (Bldg 100 area)</p>
Wednesday	(All Day) Sampling and Analysis Meeting
Thursday	(All Day) Follow-up inspection and records review. Pre-closeout meetings with Survey Team Leaders
Friday	Closeout Meeting

* Note: The QA/TSCA and Inactive waste sites/release (CERCLA) specialists are unclear. All other specialists are Q cleared.

TABLE 1

PINELLAS PLANT ON-SITE SURVEY

AREAS OF INTEREST FOR TECHNICAL SPECIALISTS

WASTE MANAGEMENT

G. Gartseff - Hazardous Waste
Non-Hazardous Waste
Underground Storage Tanks
RCRA/Solid Waste Permits
Mixed Waste

RADIOLOGICAL

C. Roberts - Radioactive Emissions and Effluents
Source Controls and Monitoring
Environmental Monitoring - Rad
Laboratory Analysis - Rad
Radioactive Waste

AIR

R. Lanza - Meteorology
Local Air Quality Data
Emission Sources, Control and Monitoring
Environmental Monitoring - Air
Air Permits and Air Emissions Inventory

SURFACE WATER

K. Walter - Effluent Sources
Wastewater (Process and Sanitary Treatment
Facilities
Cooling Water System
Drinking Water Distribution
Stormwater Management
Spill Prevention, Control and Countermeasure Plan

HYDROGEOLOGY

D. Riddle - Waste Storage and Disposal Sites (Past and
Active)
Spill/Accident Locations
Regional Geology and Groundwater
Well Inventory and Construction
Groundwater Monitoring Program and Studies

TABLE 1

PINELLAS PLANT ON-SITE SURVEY AGENDA (Continued)

INACTIVE WASTE SITES

M. Hlavacik	-	Past Waste Site Locations
D. Riddle	-	Characterization Studies
		Spill/Accident Locations
		Remediation Work
		Former Production Locations

QUALITY ASSURANCE

J. Connelly	-	Environmental Sampling Program
G. Gartseff	-	Environmental Analytical Program
		Data Management and Handling
		QA Program Overview

TOXIC AND CHEMICAL MATERIALS

J. Connelly	-	Process Chemicals and Substances Inventory
G. Gartseff	-	Asbestos Removal and Disposal
		PCBs In-Service, Storage, and Disposal
		Pesticide Use, Storage, and Disposal
		Warehousing and Storage Tanks for Process Chemicals

3.0 AIR

3.1 Issue Identification

The radioactive and regulated/hazardous air-related Survey activities involve an assessment of the plant-wide air emissions, emissions controls and monitoring equipment, and the acquisition and processing of ambient air quality data. Areas of investigation will include the process and laboratory emissions of tritium, Krypton-85, Carbon-14, nitrogen and sulfur oxides, acid fumes, toxic metals and organics, volatile hydrocarbons (VOCs), and the emissions of nitrogen and sulfur oxides from fuel burning equipment. Operational and procedural practices associated with emission controls and monitoring equipment will be evaluated. Fugitive sources of radioactive and regulated/hazardous particulate and gaseous emissions, including emissions from chemical and waste storage/handling areas, will be investigated.

The general approach to the Survey will involve a review of existing environmental reports, chemical inventories, operating procedures, ventilation diagrams, stack monitoring reports, radioactive effluent reports, and other relevant documents to identify significant sources of air emissions. Following the document review will be the physical inspection of significant processes, control and monitoring equipment, and potential fugitive sources. The Survey will identify air contaminants from significant processes and fugitive sources in the plant, identify and evaluate the existing control equipment for the air contaminants, and assess the potential for environmental problems from the emissions.

The radiological air monitoring system assessment will involve inspection of the ambient air samplers and review of data acquisition, documentation and procedures, calibration procedures, data validation, and processing. The primary emphasis of the monitoring program review will be to determine the environmental impact of plant operations and evaluate the collected data.

Several areas for specific investigation have been identified during a review of available documentation:

- o Process and fugitive airborne releases of tritium, Krypton-85 and Carbon-14 including potential for accidental releases and evaporation from storage/disposal areas;
- o VOC emissions from the 100 Building and other areas, including process and fugitive emissions;
- o Toxic metal and organic emissions from the 100 Building and other areas, including process and fugitive emissions;
- o Emissions from process area furnaces;
- o Ambient air concentrations of ozone (volatile organic compounds), on and off-site, and evaluation of the effect of plant emissions on air quality;
- o Plutonium source handling and plutonium monitoring (400 Building); and

- o Potential/actual emissions of regulated/hazardous pollutants and toxic substances from unpermitted and/or uncharacterized sources.

3.2 Records Required

The following records should be available for on-site review:

- o Source and emissions inventories for both radiological and regulated/hazardous process and fugitive emission sources and chemical inventory lists;
- o Tritium, Plutonium-238/239, Krypton-85, and Carbon-14 emissions monitoring data, and handling/control system description;
- o Local ambient air quality data for both radiological and criteria pollutants (e.g., ozone);
- o Identification of significant fugitive/accidental release points;
- o Ambient air dispersion calculations and dose calculations, environmental monitoring reports;
- o Descriptive documentation on existing and proposed add-on emission controls and ventilation system drawings;
- o Operating, testing, and maintenance procedures for control equipment;
- o Correspondence between the Pinellas Plant and regulatory agencies related to air/radiological issues;
- o Reports on accidental releases/unusual occurrences relating to radiological and regulated/hazardous and toxic airborne releases;
- o Radiological ambient air monitoring program procedures/documentation;
 - Sample collection procedures.
 - Calibration procedures and records.
 - Laboratory procedures and quality assurance.
 - Ambient air monitoring data.
- o Radiological stack monitoring/sampling program procedures/documentation; and
 - Calibration procedures and records.
 - Stack monitoring/sampling data.
 - Laboratory procedures and quality assurance.
- o 1986 Environmental Monitoring Report.

4.0 RADIOLOGICAL

4.1 Issue Identification

The radiological aspects of the Environmental Survey will involve identification of the species and quantities of radioactive materials processed at the facility since its inception and determining whether hazardous quantities of those materials could or do currently exist. If radionuclides other than tritium, Plutonium 238/239, Krypton-85, and Carbon-14 have been used, information concerning the past water streams will be collected and the possibility of hazardous quantities remaining will be examined.

If current practice is representative of past experience, the Environmental Survey will involve an assessment of the site-wide radioactive releases control and on-site and off-site monitoring equipment, and the associated impact on the environment and general off-site population. The radiological assessment will encompass three major areas: 1) airborne radioactive emissions; 2) liquid radioactive effluents; and 3) liquid and solid radioactive waste management. Because of overlaps, the radiological assessment will be coordinated with the air, surface water, waste (CERCLA/RCRA), hydrogeology, and quality assurance specialists.

On the basis of reviews of available documents, it may be concluded that airborne releases of radionuclides from the site are larger in terms of curies than the liquid releases. Historically, radioactive air emissions have been the most significant contributors to radiation exposure from the site to the general public. However, the potential impacts to the environment and the public from the other sources will also be assessed.

The assessment will determine whether radioactive materials released to the environment from the site, or potentially released, create any actual or potential environmental problems. Existing environmental standards, regulations, and guidelines will be used for comparison to assess the potential magnitude of these problems. The review will also determine if appropriate actions are being taken or planned to minimize accidental releases and/or mitigate the consequences of such releases and whether there are conditions that potentially may lead to environmental problems.

Several areas for specific investigation have been identified during a review of available documentation.

- o Accidental releases (both airborne and liquid) from process/laboratory facilities;
- o Normal releases, both airborne and liquid, from process/laboratory facilities;
- o Underground and aboveground wastewater tanks (HP tanks) mitigation activities, and future remedial plans; and
- o Radioactive solid waste including mixed waste management practices, and storage and disposal methods.

4.2 Records Required

The following records should be available for on-site review:

- o Radiological sampling and analysis methods and data, such as;
 - Radioactive material inventory
 - Radioactive waste shipments
 - Overall effluent monitoring manual
 - Overall environmental program manual
 - Effluent sampling schedule
 - Effluent data (radionuclides, concentrations, and curies released by release point/facility)
 - Environmental sampling schedule (soil, ambient air, surface water)
 - Environmental sampling data (related to facility or area if possible)
 - Radioanalytical procedures, related QA procedures and documentation
- o Radioactive emission reports (air and surface water discharges);
- o Environmental monitoring and sampling equipment calibration and maintenance records;
- o Documents on the selection of sampling locations and design of monitors;
- o Status reports on effluent and environmental controls and monitoring systems upgrades;
- o Radioactive waste management procedures;
- o Reports on accidental releases;
- o Reports on radioactive wastewater storage tanks;
- o Any classified effluent or environmental monitoring reports; and
- o Description of dose calculation programs.

5.0 SURFACE WATER/DRINKING WATER

5.1 Issue Identification

A number of documents provided in response to the information request have been reviewed with regard to the surface water technical specialty area.

The Survey will concentrate on areas of acknowledged concern including discharge of heavy metals and radiological contaminants into the county sewer system. Those constituents with sewer use ordinance limitations, as well as, those that are or may potentially be discharged for which the county has no ordinance limits will be reviewed.

The Survey will also include an identification of potential discharge to surface waters not included in the county sewer system discharge documentation or other documents, and potential cross-contamination between industrial, sanitary radiological, and storm water sewer systems. Specific attention will be paid to possible unknown or potential discharges into an inappropriate sewer system which might cause a particular contaminant to miss analytical detection or pretreatment. This will be accomplished by a thorough review of site facilities in conjunction with a review of standard operating procedures (SOP's) for the operation and maintenance of wastewater discharge equipment followed by record review, personnel interviews and observation of procedure. A walkthrough of the entire plant will be made to identify wastewater streams from plant processes and other liquid waste discharges to the environment.

A review of past wastewater conveyance and disposal systems will also be accomplished during the Survey to evaluate what current environmental problems may exist as a result of past practices, if any. Site surface, drainage features, including channels, swales, culverts and catch basins will also be reviewed.

Several areas for specific investigations have been identified during a review of available documentations:

- o Pinellas County Sewer System discharge monitoring procedures, frequency, and parameters;
- o Cross-connections between industrial, sanitary, and radiological sewers;
- o The past operations of the spray irrigation and collection system as part of the liquid effluent treatment process;
- o Unknown continuing discharge of contaminants to groundwater by septic systems or discharge to the old pond system;
- o Discharge of heavy metals, biocides from cooling water overflows, and radionuclides to the Pinellas County Sewer System; and
- o Liquid and atmospheric releases of biocides used in the cooling towers.

5.2 Records Required

Records that may be reviewed during the visit to obtain information include:

- o Information reported to the Pinellas County Sewer System;
- o Analytical data used for preparation of discharge monitoring reports;
- o Analytical data on influent process water or process waste streams;
- o Past wastewater treatability or characterization studies;

- o Wastewater treatment operation's log books and reports;
- o Sampling log books;
- o Chemical usage and toxicity data on cooling water biocides used presently or in the past;
- o Treatment plant and monitoring equipment maintenance records and/or logs;
- o Water balance calculations and drawings;
- o Records of water consumption;
- o Water distribution and sewer drawings;
- o Records of Spill Prevention, Control, and Countermeasures (SPCC) plan implementation or notification of spills; and
- o Accidental release, unusual occurrence reports that may relate to potential past discharge to the wastewater system (industrial, sanitary, radiological, or stormwater).

6.0 WASTE MANAGEMENT

6.1 Issue Identification

The waste management review will place emphasis on the identification of hazardous/non hazardous waste management activities that have potential for an adverse environmental effect. The Pinellas Plant RCRA Permit Part A application revision of October 29, 1986 contains a diagram of existing facilities that includes a listing of all known active hazardous waste facilities on-site. Of particular concern are satellite collection areas located throughout the 100 building, and the collection and storage procedures between these areas and the waste storage areas or disposal areas. The Survey will determine whether the Pinellas Plant hazardous/non hazardous waste management activities are conducted to prevent unauthorized releases to the environment. Appropriate sections of the Part B application will be reviewed for completeness. In addition, any operating and permitting deficiencies for hazardous waste treatment, storage, and disposal (TSD) units will be defined. Solid waste management units (SWMUs) will also be identified and evaluated.

The waste management review will be coordinated with the Toxic and Chemical Material, and the Surface Water/Drinking Water investigations to help identify possible releases. The Pinellas Plant will be examined to determine hazardous/non hazardous waste generation points, and to characterize current and past waste disposal practices.

Several areas for specific investigation have been identified during a review of available documentation:

- o Waste storage in tanks;
- o Waste oil management practices;
- o Hazardous Waste disposal procedures, and documentation;
- o Solid waste disposal procedures and waste segregation practices; and
- o Storage and disposition of scrap/salvage materials.

6.2 Records Required

The following records should be available for on-site review:

- o Part B permit application (records and documentation);
- o Inspection documentation (State and Federal);
- o Groundwater monitoring, sampling, and analytical documentation relating to RCRA;
- o Waste inventory documentation, and reports on waste generation;
- o Enforcement action documentation; and
- o Internal documentation relating to waste TSD or generation inspection.

7.0 INACTIVE WASTE SITES/RELEASES

7.1 Issue Identification

The inactive waste sites/releases specialty area review will identify environmental problems associated with the historical handling, storage and disposal of hazardous and radioactive substances at the site. The review will evaluate information developed in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) regulations. The Survey will focus on current and future environmental problems related to past land disposal practice and past spills/releases.

Information on potential or documented disposal sites will be examined to better assess environmental contamination from inactive waste sites. Since groundwater contamination is often a result of buried waste, the CERCLA portion of the survey effort will be closely coordinated with the Hydrogeological portion of the survey to document these waste sources. Furthermore, past wastewater treatment activities at the site will be evaluated to aid in determining the source(s) of any present or potential environmental contamination. Information pertaining to stormwater and surface drainage or unknown/unpermitted subsurface disposal of water that may form a migration pathway will be obtained. A determination will also be made

of the influence of past handling and disposal of hazardous and mixed chemicals/wastes regarding the existence of undocumented inactive waste sites/releases.

Several areas of concern have been identified during a review of available documentation. Major areas of investigation include:

- o The 4.5 acre site northwest of the plant used for resin drum disposal;
- o The East Pond, West Pond, and former spray irrigation area; and
- o The swampy area west of the East Pond where drums were disposed.

Other possible areas of investigation include:

- o Existing and former facilities that have handled hazardous, mixed, and low-level radioactive wastes;
- o Areas where past undocumented disposal may have occurred;
- o Areas where leaks, spills, or inadvertent disposal may have created ongoing sources of contamination of traceable plumes of surface or subsurface contamination; and
- o Additional past waste disposal areas not previously identified.

Information reviewed in the Comprehensive Environmental Assessment and Response Program (CEARP) Draft Phase I Report for the site indicated that facility activities were conducted at two off-site locations prior to and during the construction of the current Pinellas Plant. The facilities at these locations were reportedly decommissioned and demolished. This matter should be pursued to ensure that any potential CERCLA issues are addressed for these locations.

7.2 Records Required

The following records should be available for on-site review:

- o Phase I Installation Assessment Report for the Pinellas Plant as per DOE CERCLA Order 5480.14, as well as any addenda prepared as a result of newly discovered sites, and the documentation used to prepare these reports;
- o Past and ongoing CERCLA related studies and remediation reports;
- o Records of historical production facilities, locations, operations, processes and substances used, and methods of materials and waste handling and disposal;
- o Historical files on past site operations and processes, substances used, and methods of handling and disposal;

- o Description of all inactive waste management facilities, including buried tanks and structures;
- o Descriptions and notifications of inactive waste sites and potential areas of contamination;
- o Listing of inactive areas used for hazardous substances use, storage, receiving and shipping, and disposal;
- o Descriptions of corrective actions;
- o Historical standard operating procedures (SOPs) regarding management of hazardous substances, disposal areas, and storage areas;
- o Hazardous substances inventories;
- o Waste generation reports and characterization studies;
- o Waste management plans (past and current);
- o Files on past off-site waste handling and disposal;
- o Historical aerial photographs and site plans that may provide clues to undocumented disposal;
- o Descriptions and notification of spills/releases (Unusual Occurrence Reports and Minor Release Reports); and
- o Records of facility expansion and building rubble disposal.

8.0 HYDROGEOLOGY

8.1 Issue Identification

The preliminary review of documentation on the Pinellas Plant indicates that shallow groundwater has been contaminated in at least two areas. One area, known as the 4.5 acre site, is no longer owned by the DOE. This area historically was used for random disposal of waste. Shallow groundwater is known to be contaminated with toluene, vinyl chloride, trans-1,2-dichloroethene, trichloroethene and acetone. Similar contamination has also just recently been identified in the groundwater near East Pond. It appears that wastes were also disposed of in this area. The 4.5 acre site has been partially remediated with the removal of 83 drums and miscellaneous debris in July of 1985.

There is no routine groundwater monitoring program being conducted at the Pinellas Plant. According to the documents reviewed, the only groundwater monitoring performed is in relation to specific studies on identified waste sites. Spills and historic discharges of industrial and sanitary effluents to surface waters and the land surface via spray irrigation suggest that additional impacts to groundwater may have occurred. Although radionuclides are used and discharged from the site (principally tritium), there is no record of analyses being performed for radionuclides in groundwater.

A major concern for the Survey is the status of ongoing investigations of groundwater contamination. In addition, the potential impacts of the existing contamination on the deeper Floridan aquifer need to be assessed by the Survey team. Furthermore, the potential impacts of off-site movement of contaminated groundwater in the shallow aquifer are also of concern. An estimated 132 wells are located within 8000 feet of the plant. Twenty-two water supply wells are also located in this area.

A general review of data collection efforts that have taken place will be required to determine the usefulness, for the purposes of the Survey, of existing information. This will include a review of sampling procedures, chain-of-custody and quality assurance/quality control procedures and compatibility of data from various sources. The reliability, construction, and placement of wells used for groundwater monitoring will be examined. Interviews with site personnel will be conducted.

Several areas for specific investigations have been identified during a review of available documentation:

- o The 4.5 acre site;
- o The East and West Ponds;
- o The former spray irrigation area;
- o Underground storage tanks; and
- o Off-site sources and potential impact areas.

8.2 Records Required

The following documents should be available for on-site review:

- o New and recent data and reports on groundwater quality;
- o Off-site well inventories (154 reported wells by USGS) which include location, depth, size and owner of the well;
- o Well sampling procedures;
- o Well installation reports, boring logs and as-built drawings;
- o Groundwater work plans; and
- o Historic memos, aerial photographs, topographic maps, etc.

9.0 QUALITY ASSURANCE (QA)

9.1 Issue Identification

The quality assurance review of the environmental program will be primarily directed at the evaluation of site sampling and analytical capabilities. The

QA aspects of the environmental sampling program performed by the Environmental Health and Safety Programs (EH&SP) personnel will be evaluated. QA programs for on-site environmental laboratories (and off-site laboratories) will be reviewed.

The intent of this review will be to verify the quality assurance procedures for obtaining process effluent and environmental samples, performing the analytical work to identify pollutants, and the handling and reporting of data. All aspects of the QA program relating to environmental monitoring and analysis of the Pinellas Plant will be reviewed.

The environmental sampling performed by the EH&SP personnel will be evaluated by reviewing procedures, data handling, records, and logbooks. Field techniques will be observed to determine actual sampling practices.

The analytical laboratories will be reviewed through an evaluation of procedures and records, and observation of laboratory operations. Off-site laboratories will be evaluated by using documents at the Pinellas Plant. No visits to off-site laboratories are anticipated for these operations.

Several areas for specific investigations have been identified during a review of available documentation:

- o Operator and technician training;
- o Equipment and instrument calibration/maintenance;
- o Precision and accuracy studies;
- o Blank, split, and spiked sample analyses;
- o Sample handling and chain-of-custody procedures;
- o Data reduction and validation;
- o Data reporting and documentation; and
- o Calculation and logbook reviews.

9.2 Records Required

The following records should be available for on-site review:

- o Analytical laboratory and environmental sampling quality assurance plans and manuals;
- o QA audits of laboratory and sampling program;
- o Reports for precision and accuracy;
- o External performance standard results (e.g., DOE Environmental Measurements Laboratory and other outside agencies);

- o Laboratory and sampling procedures manuals;
- o Operator and technician training records (laboratory and sampling);
- o Instrument maintenance and calibration records (laboratory and sampling); and
- o Laboratory and sampling calculations, workbooks, and standard data reporting forms.

10.0 TOXIC AND CHEMICAL MATERIALS-TSCA

10.1 Issue Identification

The toxic and chemical materials review will address the raw materials and process chemicals used at the Pinellas Plant. The use, handling, and disposal of Polychlorinated Biphenyls (PCBs), asbestos, pesticides, and herbicides will also be within the scope of this effort.

Several areas for specific investigation have been identified during a review of available documentation:

- o All toxic materials purchased, used, or manufactured by GENDD will be surveyed. Tracking, control, and management of these substances will be reviewed. Records of usage will be examined to assess the potential for entering effluent streams;
- o An inventory of PCB-contaminated electrical equipment in use at the facility areas will be obtained. The condition of this equipment, its potential for leakage, and the quantity of contaminated fluids will be assessed;
- o Obsolete or used PCB items and contaminated items in storage will be inspected for proper packaging, adequate storage protection requirements, and inventory controls. Procedures to be used to remove and dispose of the double ended transformers with PCBs will be reviewed;
- o Disposal practices for current and past inventories will be reviewed to determine the method(s) of disposal and location(s) of disposal sites;
- o Procedures for PCB analysis, removal, handling, and disposal will be reviewed;
- o The presence of asbestos building materials and insulation at the site will be identified. Specifications or plans for modification/removal projects will be reviewed;
- o Procedures for asbestos modification/removal, handling, and disposal will be investigated;

- o Training and certification of asbestos workers will be reviewed. Practices will be reviewed to determine disposal methods and locations; and
- o The usage of pesticides and herbicides on the site will be reviewed, as well as personnel training, application records, and storage and disposal practices.

10.2 Records Required

The following records should be available for on-site review:

- o Inventory of toxic materials and purchasing records;
- o Toxic materials labeling and tracking system;
- o Procedures for handling, control, and management of toxic materials;
- o Annual PCB status reports;
- o Inventory of in-service PCB-contaminated equipment and fluids;
- o PCB handling, storage, and disposal procedures;
- o Storage records of PCB items;
- o Disposal records for PCB items;
- o Asbestos handling, removal, and disposal procedures;
- o Locations of buildings containing asbestos;
- o Asbestos disposal records, including method and location of disposal;
- o Inventory of pesticides/herbicides;
- o Pesticide/herbicide training, handling, storage, and disposal records; and
- o Standard operating procedures for pesticides/herbicides.

APPENDIX D

CHEMICAL SYMBOLS, ABBREVIATIONS AND ACRONYMS

PRELIMINARY

LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS

α -	Alpha particles (radiation)
AIHA -	American Industrial Hygiene Association
Alox	Aluminum Oxide
β -	Beta particles (radiation)
BOD -	Biochemical Oxygen Demand
BTU	British Thermal Units
C -	Degrees centigrade
CaCrO ₄	Calcium chromate
cc -	Cubic centimeters
CEARP	Comprehensive Environmental Assessment & Response Program
CERCLA -	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Chlorofluorocarbon
CFM	Cubic Feet Per Minute
Ci -	Curie
cf	cubic feet
CO	Carbon Monoxide
cpm -	Counts per minute
CTBN	Trade name resin product
cy	Cubic yards
DOE -	U.S. Department of Energy
DOE -	U.S. Department of Energy, Albuquerque Operations Office
dpm -	Disintegrations per minute
EP -	Extraction procedure
EPA -	U.S. Environmental Protection Agency
EPON 828	Trade name resin product
F -	Degrees fahrenheit

LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS (continued)

FL DER	Florida Department of Environmental Regulation
ft ² -	Square feet
ft ³ /yr -	Cubic feet per year
g -	Gram
gal	Gallon
GE	General Electric Company
GENDD	General Electric-Neutron Devices Department
gm	Gram
GMB	Glass Micro Balloons
GPD	Gallon Per Day
GPH	Gallons Per Hour
GPM	Gallons Per Minute
ha -	Hectare
HEPA -	High-efficiency particulate air (filter)
HP	Health Physics
HP	Horse Power
HW -	Hazardous waste
HYSOL	Trade name resin product
IH -	Industrial Hygiene
ILW -	Intermediate-level waste
K -	Kilo (1000)
Kg -	Kilogram
Km -	Kilometer
l -	Liter
lb	pound
Li/Si	Lithium/Silicon
LLW -	Low-level waste
m -	Milli (1/1000)
μ -	Micro (10 ⁻⁶)

LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS (continued)

mCi -	Millicurie (1/1000 curie)
μCi -	Microcurie (10 ⁻⁶ curie)
μCi/g	Microcuries per gram
mg -	Milligram (1/1000 gram)
mgd -	Million gallons per day
μg -	Micrograms (10 ⁻⁶ gram)
ml	Milliliter
mR -	Milliroentgen (1/1000 roentgen)
mrem -	Millirem (1/1000 rem)
μR -	Microroentgen (10 ⁻⁶ roentgen)
mCi/l -	Millicurie per liter
M ³	Cubic Meter
Mb/Mn	Molybdenum/Manganese
MCL -	Maximum contaminant level
MDA	Minimum Detectable Activity
MDA	Methylene Dianiline
MOCA	
MSDS -	Material Safety Data Sheet
MW -	Mixed waste
NBS -	U.S. National Bureau of Standards
NEPA -	National Environmental Policy Act
NESHAP -	National Emission Standards for Hazardous Air Pollutants
NO _x	Nitrogen Oxides
NPDES -	National Pollutant Discharge Elimination System
NPH -	Normal paraffin hydrocarbon
O&G -	Oil and grease
OSHA -	U.S. Occupational Safety and Health Administration
P -	Pico (10 ⁻¹²)
PbO	Lead Oxide
pCi-	Picocuries (10 ⁻¹² curies)
pCi/g	Picocuries per gram
pCi/l -	Picocuries per liter

LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS (continued)

PCB -	Polychlorinated biphenyls
POTW	Publicly Owned Treatment Works
ppb -	Parts per billion
ppm -	Parts per million
PVC -	Polyvinyl Chloride
QA -	Quality assurance
QC -	Quality control
R -	Roentgen
R&D -	Research and development
RCRA -	Resource Conservation and Recovery Act of 1976
RTV	
RTG	Radioactive thermal generator
Si/Ge	Silicon/Germanium
SO ₂	Sulfur Dioxide
SPCC -	Spill Prevention, Control, and Countermeasure Plan
T -	Temperature
TCA -	Trichloroethane
TCE -	Trichloroethylene
TDI	Toluene Diisocyanate
TEA	Tube encasement assembly
TLD -	Thermoluminescent dosimeter
TOC -	Total organic carbon
TOH -	Total organic halogens
TP	Temporary Plant
TRU -	Transuranic
TSCA -	Toxic Substances Control Act
TSD -	Treatment, storage, and disposal
TSP -	Total suspended particulates
TSS -	Total suspended solids
USGS -	United States Geological Survey

LIST OF SYMBOLS, ABBREVIATIONS, ACRONYMS (continued)

UST -	Underground storage tank
VOC -	Volatile organic compound
WWTP	Wastewater treatment plant

PRELIMINARY

APPENDIX E

SUPPLEMENTAL GROUNDWATER DATA

PRELIMINARY

**APPENDIX E TABLE E-1
WATER QUALITY PARAMETERS ANALYZED FOR 1984 USGS
RECONNAISSANCE**

Residue upon evaporation	Lead, total
SiO ₂ , dissolved	Manganese, total
Total Hardness as CaCO ₃	Mercury, total
Alkalinity as CaCO ₃ , total	Selenium, total
Calcium, dissolved	Silver, total
	Zinc, total
Magnesium, dissolved	
Strontium	Herbicides:
Sodium, dissolved	Silvex
Potassium, dissolved	2,4-D, total
Water temperature (°C)	2,4-DP, total
	2,4,5-T, total
Specific conductance, field (μS/cm)	
Field pH (units)	Insecticides:
Bicarbonate	Aldrin, total
Chloride, dissolved	Chlordane, total
Sulfate, dissolved	DDP, total
Fluoride, dissolved	DDE, total
	DDT, total
Nitrogen, total NO ₂ as N	
Nitrogen, total NO ₂ + NO ₃ as N	Dieldrin, total
Nitrogen, total NH ₄ as N	Edosulfan, I, total
Nitrogen, total NH ₄ + organic as N	Endrin, total
	Gross PCB's, total
Phosphorus, total ortho as P	Gross PCN's, total
Phosphorus, total	
Phosphorus as P	Heptachlor, total
Arsenic, total	Heptachlor, epoxide, total
Barium, total	Lindane, total
Cadmium, total	Methoxychlor, total
Chromium, total	Mirex, total
Copper, total	
Iron, total	Perthane, total
	Toxaphene, total

APPENDIX E TABLE E-1
WATER QUALITY PARAMETERS ANALYZED FOR 1984 USGS
RECONNAISSANCE (continued)

Herbicides:

2,4-D
2,4-DP
2,4,5-T
Silvex

Methyltrithion

Mirex

Parathion

Perthane

Insecticides:

Aldrin
Chlordane
DDD
DDE
DDT

PCB's

PCN's

Toxaphene

Trithion

Diazinon

Dieldrin

Endosulfan

Endrin

Ethion

Heptachlor

Heptachlor epoxide

Lindane

Malathion

Methoxychlor

Methylparathion

APPENDIX E TABLE E-1
WATER QUALITY PARAMETERS ANALYZED FOR 1984 USGS
RECONNAISSANCE (continued)

Acenaphthene	Hexachlorobutadiene
Acenaphthylene	Hexachlorocyclopentadiene
Anthracene	Hexachloroethane
Benzene	Indeno(1,2,3-cd)pyrene
Benzidine	Isophorone
Benzo(a)anthracene	Methylene chloride
Benzo(a)pyrene	n-Nitrosodi-n-propylamine
Benzo(b)fluoranthene	n-Nitrosodiphenylamine
Benzo(g,h,i)perylene	Naphthalene
Benzo(k)fluoranthene	Nitrobenzene
Bromoform	n-Nitrosodimethylamine
Butylbenzylphthalate	Pentachlorophenol
Carbon tetrachloride	Phenanthrene
4-Chloro-3-methylphenol	Phenol
Chlorobenzene	Pyrene
Chlorodibromomethane	Tetrachloroethylene
Chloroform	Toluene
Chrysene	Trichloroethylene
Bi-N-Butylphthalate	Trichlorofluoromethane
Di-N-Octylphthalate	1,1-Dichloroethylene
Dibenzanthracene	1,1-Dichloroethane
Dichlorobromomethane	1,1,1-Trichloroethane
Dichlorodifluoromethane	1,1,2-Trichloroethane
Diethylphthalate	1,1,2,2-Tetrachloroethane
Dimethylphthalate	1,2-Dichlorobenzene
4,6-Dinitro-2-methylphenol	1,2-Dichloroethane
Ethylbenzene	1,2-Dichloropropane
Fluoranthene	1,2,4-Trichlorobenzene
Fluorene	1,3-Dichlorobenzene
Hexachlorobenzene	1,4-Dichlorobenzene

APPENDIX E TABLE E-1
WATER QUALITY PARAMETERS ANALYZED FOR 1984 USGS
RECONNAISSANCE (continued)

1,2-Trans-Dichloroethylene
Bis(2-Chloroethoxy)methane
Bis(2-Chloroethyl)ether
Bis(2-Chloroisopropyl)ether
2-Chloronaphthalene

2-Chlorophenol
Bis(2-Ethylhexyl)phthalate
2-Nitrophenol
2,3,7,8-Tetrachlorodibenzo-p-dioxin

2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4,6-Trichlorophenol

2,6-Dinitrotoluene
3,3-Dichlorobenzidine
4-Bromophenyl phenyl ether
4-Chlorophenyl phenyl ether
4-Nitrophenol

APPENDIX E TABLE E-2

WATER QUALITY PARAMETERS ANALYZED FOR THE 4.5 ACRE SITE

Organic Compounds

Semi-volatile and
Non-volatile

Organic Compounds -

Volatile

Metals

Temperature*

pH*

Specific Conductance*

* These data are used only to verify well recharge.

APPENDIX E TABLE E-3

WATER QUALITY PARAMETERS ANALYZED FOR EXPANDED SITE STUDY 1986

Analysis for Wells C-1-C-12	
Calcium Dissolved	Total Alkalinity as CaCo3
Magnesium Dissolved	Total Carbon Organic
Strontium mg/L as Sr	Color
Sodium Dissolved	Nitr Tot NO ² As N
Potassium Dissolved	Nitr Tot NH ⁴ As N
Ammonia mg/L as NH ₄	pH (Laboratory)
	Phos Tot.
	ROE Dissolved At 180c
	Sp. Conductance
	Sulfate Dissolved
	GC/FID Scan

APPENDIX E TABLE E-3 (continued)

WATER QUALITY PARAMETERS ANALYZED FOR
EXPANDED SITE STUDY 1986

Analysis for Storm Water Wells	
Dichlorodibromomethane	Chrysene, total
Carbon tetrachloride	Diethyl phthalate, total
1,2-Dichloroethane	Dimethyl phthalate
Bromoform	Ethylbenzene
Dibromochloromethane	Fluoranthene, total
Chloroform	Fluorene, total
Toluene	Hexachlorocyclopentadiene, total
Benzene, total	Hexachloroethane, total
Acenaphthylene, total	Indeno(1,2,3-cd)pyrene, total
Acenaphthene, total	Isophorone, total
Anthracene, total	Methylbromide
Benzo (b) fluoranthene, total	Methyl chloride, total
Benzo (k) fluoranthene, total	Methylene chloride
Benzo (a) pyrene, total	n-Nitrosodi-n-propylamine, total
bis (2-chloroethyl) ether, total	n-Nitrosodiphenylamine, total
bis (2-Chloroethoxy) methane, total	n-Nitrosodimethylamine, total
bis (2-Chloroisopropyl) ether, total	Nitrobenzene, total
Butyl benzyl phthalate, total	4-Chloro-3-methylphenol, total
Chlorobenzene	Phenanthrene
Chloroethane	

APPENDIX E TABLE E-3 (continued)

WATER QUALITY PARAMETERS ANALYZED FOR
EXPANDED SITE STUDY 1986

Pyrene, total	4-Nitrophenyl, total
Tetrachloroethylene	4,6-Dinitro-o-cresol, total
Trichlorofluoromethane	Dichlorodifluoromethane
1,1-Dichloroethane	Phenols, total
1,1-Dichloroethylene	Naphthalene, total
1,1,1-Trichloroethane	Trans-1,3-dichloropropene
1,1,2-Trichloroethane	Cis-1,3-dichloropropene
1,1,2,2-Tetrachloroethane	Bis (2-ethyl hexyl) phthalate, total
Benzo (g, h, i) perylene, total	Di-n-butyl phthalate, total
Benzo (a) anthracene, total	Vinyl chloride
1,2-Dichlorobenzene, total	Trichloroethylene
1,2-trans-Dichloropropane	Hexachlorobenzene, total
1,2-trans-Dichloroethylene	Hexachlorobutadiene
1,2,4-Trichlorobenzene, total	Styrene, total
Dibenzo (a,h) anthracene, total	Pentachlorophenol, total
1,3-Dichloropropane	2,4-Dibromobenzene
1,3-Dichlorobenzene, total	
1,4-Dichlorobenzene, total	
2-Chloroethyl vinyl ether	
2-Chloronaphthylene, total	
2-Chlorophenol, total	
2-Nitrophenol, total	
Di-n-octyl phthalate, total	
2,4-Dichlorophenol, total	
2,4-Dimethylphenol, total	
2,4-Dinitrotoluene, total	
2,4-Dinitrophenol, total	
2,4,6-Trichlorophenol, total	
2,6-Dinitrotoluene, total	
4-Bromophenyl phenyl ether, total	

APPENDIX E TABLE E-4
WATER QUALITY PARAMETERS ANALYZED
FOR THE NORTH EAST SITE

Arsenic

Cadmium

Chromium

Lead

Mercury

Purgeable Halocarbons

Purgeable Aromatics

Total Organic Carbon (TOC)

Total Dissolved Solids (TDS)

Fluoride

Cyanide

Gross Alpha/Beta

Tritium

TYPICAL MONITORING WELL CONSTRUCTION (MW-2)
AT 4.5 ACRE SITE

FIGURE E-1

TYPICAL CONSTRUCTION DIAGRAM FOR
A SHALLOW MONITORING WELL—NORTHEAST SITE

FIGURE E-2

TYPICAL CONSTRUCTION DIAGRAM FOR
A DEEP MONITORING WELL—NORTHEAST SITE

FIGURE E-3

APPENDIX F

Photographs of Former Temporary Plant Site

PRELIMINARY

PHOTO 1. FORMER TEMPORARY PLANT SITE, NORTH BUILDING, LOOKING
NORTHWEST (5/14/87)

PHOTO 2. FORMER TEMPORARY PLANT SITE, SOUTHEAST END OF NORTH
BUILDING, LOOKING NORTH DOWN RAILROAD TRACKS (5/14/87)

PHOTO 3. FORMER TEMPORARY PLANT SITE, SOUTH BUILDING, LOOKING
SOUTHEAST AT INTERSECTION OF 26TH AVENUE NORTH & 24TH
STREET NORTH (5/14/87)

PHOTO 4. FORMER TEMPORARY PLANT SITE, CREEK ALONG WEST SIDE OF
SOUTH BUILDING, LOOKING SOUTH-SOUTHEAST (5/14/87)

PHOTC 5. FORMER TEMPORARY PLANT SITE, SOUTHWEST END OF SOUTH
BUILDING, LOOKING NORTH ALONG CREEK (5/14/87)

PHOTO 6. FORMER TEMPORARY PLANT SITE, SOUTHWEST CORNER OF
NORTH BUILDING, LOOKING NORTHEAST AT INTERSECTION OF
26TH AVENUE NORTH & 24TH STREET NORTH (5/14/87)

PHOTO 7. FORMER TEMPORARY PLANT SITE, 26TH AVENUE NORTH BETWEEN
NORTH & SOUTH BUILDING, LOOKING EAST FROM INTERSECTION
OF 26TH AVENUE NORTH & 24TH STREET NORTH (5/14/87)

APPENDIX G

RADIOLOGICAL CRITERIA

This section discusses radiological criteria, dose calculation and related topics.

To operate the Pinellas Plant, specific criteria must be met. These criteria stem from Federal and state laws and regulations, Executive Orders, and Department of Energy (DOE) Orders. Guidelines that address radiological criteria and, more specifically, dose to the members of the public are discussed below. Recent changes in DOE guidance warrant particular attention. The section on regulatory criteria is followed by a discussion of dosimetric terms used in the radiological protection regulations. A discussion on as-low-as-reasonably-achievable (ALARA) and guide values as well as dose calculations is also provided.

1.0 REGULATORY CRITERIA

The DOE has the responsibility under the Atomic Energy Act (AEA) to establish the necessary standards to protect members of the public from radiation exposures resulting from departmental activities. In addition, Presidential Order 12088, "Federal Compliance with Pollution Control Standards," requires that all Federal facilities comply with the legislative acts and regulations relating to the prevention, control, and abatement of environmental pollution.

1.1 DOE Criteria

This section presents those DOE regulations that establish dose standards for the general public.

1.1.1 DOE Order 5481.A

Until recently, DOE radiation protection standards were established in DOE 5480.1A, Chapter XI "Environmental Protection, Safety and Health Protection Program for DOE Operations" (revision 8/13/81). The exposure limits for individuals and population groups in uncontrolled areas (i.e., off-site) were:

Annual Dose Equivalent or Dose Commitment (mrem)

<u>Type of Exposure</u>	<u>Based on dose to individuals at points of maximum probable exposure</u>	<u>Based on average dose to a suitable sample of the exposed population</u>
Whole body, gonads, or bone marrow	500	170
Other organs	1,500	500

The limiting concentrations for specific radionuclides released to the environment in air and water were termed Concentration Guides (CG). The CGs, based upon the 500 mrem per year whole body exposure limits, were nearly identical to those used by the Nuclear Regulatory Commission (as promulgated in 10 CFR 20) and are based upon National Council on Radiation Protection and Measurements (NCRP) and International Commission on Radiological Protection (ICRP) recommendations originally set forth in ICRP 2.

1.1.2 Vaughan Memorandum

In 1984 in a paper providing guidance to the U.S. Environmental Protection Agency (EPA), the NCRP endorsed the recommendations of the ICRP to limit the continuous exposure of any member of the public from other than medical sources and natural background to 100 mrem per year whole body dose-equivalent. The previously recommended limit of 500 mrem per year was retained for non-continuous exposure. By memorandum, W. A. Vaughan, Assistant Secretary for Environment, Safety and Health (Vaughan, 85) put into effect these interim radiation protection standards, until they could be codified in a revision to DOE Order 5481.A. This reduction of the dose limit to 100 mrem per year for all pathways also reduced the discharge concentrations. Those new discharge concentrations, derived from the 100 mrem per year limit, were called Derived Concentration Guides (DCG).

The EPA limits from 40 CFR 61, Subpart H, which are 25 mrem per year to the whole body or 75 mrem per year to any organ, from air pathways only, were also included in the memorandum.

1.1.3 DOE Draft Order 5480.xx

A new draft DOE Order, DOE 5480.xx, "Radiation Protection of the Public and the Environment," was developed to integrate, consolidate, and update DOE public and environmental radiation protection standards and control practices. This draft order is discussed since it reflects the current policy regarding radiation protection and compliance with other Federal regulations. Specifically, DOE 5480.xx (revision 3/31/87) updates DOE 5480.1A, Chapter 11 (revision 8/13/81); adopts current guidance and standards issued by national and international authoritative bodies on radiation protection; incorporates current regulatory requirements applicable to DOE operations; and consolidates and upgrades DOE monitoring, surveillance, and control practices. The following paragraphs provide additional background on specific aspects of the Order which are of most interest.

DOE 5480.xx adopts and implements dose standards consistent with the recommendations of the ICRP. In 1977, ICRP recommended a system of dose limitations which has been adopted and implemented by essentially all countries with nuclear programs. The ICRP system of dose limitations provides a scientific basis for health protection and selection of dose limits. The system also reflects current information on health risks, dosimetry, and radiation practices, and promotes a more uniform and consistent application of radiation protection among diverse activities. The ICRP system is based on sophisticated analytical models, and requires computer capabilities for evaluations or use of conversion tables produced from such evaluations. Although the ICRP system is precise, the terminology is complex. This terminology is discussed in Section 2.0.

In addition to adopting radiation standards for its own operations, DOE is also required to implement applicable rules and regulations of other Federal agencies, most of which have not adopted the ICRP system. The result is a mixture of dose standards, terminology, and units which DOE cannot alter. Therefore, some dose limits in DOE 5480.xx are expressed in terms of effective dose equivalent consistent with current ICRP recommendations, while others are expressed in terms of dose

equivalent to specific organs as used by other Federal agencies consistent with pre-1977 recommendations of ICRP.

The primary DOE dose limit for members of the public which is based on ICRP recommendations, includes consideration of exposure modes to all man-made sources except those used for medical purposes. The primary dose limit is expressed as an effective dose equivalent, which is a term developed by the ICRP for their risk-based system that requires the weighted summation of non-uniform doses to various organs of the body. Additional dose limits are established by EPA regulations for exposures to several selected sources or exposure modes (pathways or conditions). Dose limits promulgated by EPA for selected exposure modes are generally expressed as dose equivalent, which does not include risk-based weighting and summation of doses to various organs. DOE activities are to be conducted, to the extent practicable, in accordance with the contemporary risk-based system for protection against radiation. DOE must also comply with applicable EPA regulations and guidelines (e.g., 40 CFR 61; and 40 CFR 191) including administrative and procedural requirements.

The EPA regulations included in 5480.xx are discussed in Section 1.2. It should be noted that these limits, although numerically lower than DOE values discussed below, are for doses from limited specific pathways whereas the higher DOE limit is for the total dose from all pathways.

The DOE dose limit for members of the public from all exposure modes from all DOE sources of radiation is as follows:

The exposure of members of the public to radiation sources as a consequence of routine DOE activities and remedial actions shall not cause any individual to receive, in a year, an effective dose equivalent greater than 100 mrem. In addition, the exposure shall not cause a dose equivalent for any tissue (including the skin and the lens of the eye) greater than 5 rem, in a year, for members of the public.

The 100-mrem dose limit specified above is the sum of the effective dose equivalent (or deep dose equivalent, if dosimeter data are used) from exposures to radiation sources external to the body during the year plus the committed effective dose equivalent from radionuclides taken into the body during the year.

Doses from all exposure modes which could contribute significantly to the total dose shall be evaluated. The limits apply to the doses to individuals who are exposed to radiation or contamination by radionuclides: (1) at sites where public access is permitted; and, (2) at sites subsequent to "remedial action" and as a consequence of the release of surplus equipment and material for unrestricted use.

Note that DOE operators are required to report DOE dose contributions of 25 mrem or more, in a year.

1.2 EPA Criteria

This section presents EPA regulations that establish dose standards which affect DOE facilities. These standards are also included in DOE 5480.xx (August 15, 1986 and March 31, 1987 versions).

1.2.1 40 CFR 61

The National Emission Standards for Hazardous Air Pollutants (NESHAPS) include a standard for radionuclides released in air from DOE facilities (Subpart H, "National Emission Standard for Radionuclide Emissions from DOE Facilities"). The regulation states that airborne emissions of radionuclides from DOE facilities shall not exceed those amounts that cause a dose equivalent rate of 25 mrem/yr to the whole body and 75 mrem/yr to a critical organ of any member of the public. Doses due to radon-222, and their respective decay products are excluded from these limits. To determine compliance with the standard, the regulation states that the dose equivalent to members of the public shall be determined using EPA codes AIRDOS-EPA and RADRISK or other procedures, including those based on environmental measurements, that EPA has determined to be suitable. In most cases, compliance is determined by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public resides or abides.

1.2.2 40 CFR 141

The National Interim Primary Drinking Water Regulations implement the Public Health Service Act as amended, and establish standards applicable to public water systems. They promulgate maximum contaminant levels for radioactivity in community water systems, which are defined as public water systems that serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. The regulations specify that the average annual concentration of man-made radionuclides in drinking water as delivered to the user by such a system shall not result in an annual dose equivalent to the total body or any internal organ greater than 4 mrem/yr.

Specific annual average concentration limits are established for certain radionuclides and are as follows:

Tritium	$2 \times 10^{-5} \mu\text{Ci/ml}$	$(20 \text{ pCi/ml} = 20,000 \text{ pCi/l})$
Sr-90	$8 \times 10^{-9} \mu\text{Ci/ml}$	$(0.008 \text{ pCi/ml} = 8 \text{ pCi/l})$
Ra-226,228	$5 \times 10^{-9} \mu\text{Ci/ml}$	$(0.005 \text{ pCi/ml} = 5 \text{ pCi/l})$
Total alpha (excluding Rn-222 & U)	$1.5 \times 10^{-8} \mu\text{Ci/ml}$	$(0.015 \text{ pCi/ml} = 15 \text{ pCi/l})$

1.2.3 40 CFR 91

The Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes establish radiation protection standards for protection of the general public from disposal facilities regulated by the Nuclear Regulatory Commission (NRC) or Agreement States in part 191.03(a) and Department of Energy (DOE) facilities in part 191.03(b).

Management and storage of spent nuclear fuel or high-level or transuranic radioactive wastes at all facilities for the disposal of such fuel or waste that are operated by the DOE and that are not regulated by the NRC or Agreement States shall be conducted in such a manner as to provide reasonable assurance that the combined annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation

from such management and storage shall not exceed 25 millirems to the whole body and 75 millirems to any critical organ.

This regulation does not apply to most DOE facilities. However, DOE does consider the Waste Isolation Pilot Plant (WIPP) a disposal facility subject to 40 CFR 191.

2.0 DOSIMETRIC TERMINOLOGY

The purpose of this section is to clarify the dosimetric terminology used in the regulatory guidance and identify definitions that have been used in the report. Specific methodology for calculating the types of doses discussed is presented in Section 3.0.

The following definitions have been taken from DOE Order 5480.xx (revision 3/31/87):

As Low as Reasonably Achievable (ALARA) is a phrase (acronym) used to describe an approach to radiation exposure control or management whereby the exposures and resulting doses are maintained as far below the limits specified for the appropriate circumstances as social, economic, technical, and practical considerations permit.

Derived Concentration Guide (DCG) is the concentration of a radionuclide in air or water which, under conditions of continuous exposure by one exposure mode (i.e., ingestion of water or submersion or inhalation of air), for one year, a "reference man" would receive the most restrictive of: (1) an effective dose equivalent of 100 mrem; or, (2) a dose equivalent of 5 rem to any tissue, including skin and lens of the eye. (DCG values are presented in Attachment 1 of 5480.xx.)

Dose Terms

- (1) Absorbed Dose is the energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest in that material. The absorbed dose is expressed in units of rad.
- (2) Deep Dose Equivalent, as used in this Order, means the dose equivalent at a depth of 1 centimeter in tissue from external (penetrating) radiation.

- (3) Dose Equivalent is the product of absorbed dose in rad in tissue, a quality factor, and other modifying factors. Dose equivalent is expressed in units of rem.
- (4) Effective Dose Equivalent is the summation of the products of the dose equivalent and weighting factor for each tissue. The weighting factor is the decimal fraction of the risk arising from irradiation of a selected tissue to the total risk when the whole body is irradiated uniformly to the same dose equivalent. These factors permit dose equivalents from non-uniform exposure of the body to be expressed in terms of an effective dose equivalent that is numerically equal to the dose from a uniform exposure of the whole body that entails the same risk as the internal exposure. The weighting factors recommended by the ICRP are used. For purposes of this Order, the effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides and the effective dose equivalent due to penetrating radiation from sources external to the body and is expressed in units of rem.
- (5) Committed Dose Equivalent is the predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of a radionuclide into the body. It does not include contributions from external dose. Committed dose equivalent is expressed in units of rem.
- (6) Committed Effective Dose Equivalent is the sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor. Committed effective dose equivalent is expressed in units of rem.
- (7) Collective Dose Equivalent and Collective Effective Dose Equivalent are the sums of the dose equivalents or effective dose equivalents of all individuals in an exposed population within 50 miles, for the purposes of this Order, and are expressed in units of person-rem. (This is often called the population dose.)

- (8) Quality Factor is the principal modifying factor used to calculate the dose equivalent from the absorbed dose. For the purposes of this Order, quality factors, which are consistent with ICRP Publication 30, are to be used.

3.0 ALARA AND GUIDE VALUES

ALARA is an acronym for a radiation protection concept (defined in Section 2.0) which means keeping the radiation dose as low as reasonably achievable. To ensure compliance with applicable regulations and to maintain and/or reduce off-site radiation doses consistent with the ALARA principle, the Pinellas Plant assigns to each major facility that releases radioactive effluents an annual release guide. These annual guide values are internal plant administrative guides, not regulatory limits, and are well below any values derived from regulatory limits. These plant guides should not be confused with DOE Concentration Guides (CGs) or their replacement, the new Derived Concentration Guides (DCGs) that are based upon limiting the off-site annual dose to 100 mrem. The latter values are regulatory limits.

Annual (plant) guides are target values used to keep releases ALARA. They are total quantities of specific radionuclides, rather than concentrations, that can be released from a facility annually. The guide values are determined each year by management based upon the control equipment available, the capacity of the facility, and/or its expected annual production (all of which affect releases). These annual guides are then divided by 12 to obtain monthly guide values. Guide values are sufficiently restrictive that 10 to 20 percent of the facilities may exceed one or more of the guides (target values) during the year.

4.0 RADIATION DOSE TO THE PUBLIC

Various regulations, such as DOE Orders and the EPA regulations previously discussed in Section 1.0, limit the annual radiation dose to personnel on-site (occupational workers) and to personnel off-site (general public). Because of these regulations, it is necessary for each site to calculate annual doses.

To comply with the differing regulations regarding radiation dose to members of the general public, different methods must be used to determine their dose. There are three general methods of determining the doses, which correspond roughly to the pathways (or exposure mode) of receiving the dose. The dose can be received by:

- 1) Direct radiation from an on-site facility or radioactive material stored there.
- 2) Radiation from the airborne effluents (radioactive materials released from the facility) while airborne or on the soil, and dose resulting from uptake through the food chain.
- 3) Radiation from liquid effluents (radioactive materials released from the facility), including uptake through the food chain, uptake through drinking water and radiation received from recreational activities.

For most civilian nuclear power plants and for most DOE sites, the predominant radiation dose delivered to the public is through the airborne effluent pathway. The second largest dose is usually delivered through the liquid pathway; direct radiation from on-site facilities is usually minimal. At the Pinellas Plant, the only possibly significant exposure pathway is atmospheric transport. An absence of farming/gardening and extensive dilution of tritium oxide in water bodies precludes the liquid pathway from becoming significant. The fact that no radionuclides are utilized that could deliver direct radiation precludes the direct radiation pathway.

The Pinellas Plant obtains liquid and airborne samples at the release point (effluent samples), near the site boundary, and outside the site (environmental samples). In the environmental samples, some radionuclides are near or below the limits of detection using standard analytical methods. Therefore, mathematical models must be used together with effluent measurements to calculate the concentration and resulting dose at the site boundary and at other off-site locations. The following effective dose equivalents were calculated for 1986:

Location	DOE Standard (mrem/yr)	Annual Effective Dose Equivalents From Plant Operations (mrem)
Individual at	100	0.009 (Tritium Oxide)
Site Boundary	100	<0.001 (Krypton-85)
Nearest	100	0.003 (Tritium Oxide)
Residential Area	100	<0.001 (Krypton-85)
80-km Radius	100	0.001 (Krypton-85)

The dose equivalent to the soft tissues of the maximally exposed person off-site in 1986, from both tritium and krypton-85 as calculated using AIRDOS-EPA, was less than 1.2×10^{-1} mrem (GEPP, 1987).

In 1986, the Pinellas Plant changed dose calculation methodology to comply with Secretary Vaughan's memo.

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PRELIMINARY

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