

<p>ORAU Team Dose Reconstruction Project for NIOSH</p> <p>Pinellas Plant – Introduction</p>	<p>Document Number: ORAUT-TKBS-0029-1 Effective Date: 04/11/2005 Revision No.: 00 Controlled Copy No.: _____ Page 1 of 7</p>
<p>Subject Expert: Mark D. Notich</p> <p>Document Owner</p> <p>Approval: <u>Signature on File</u> _____ Date: <u>04/06/2005</u> Mark D. Notich, TBD Team Leader</p> <p>Approval: <u>Signature on File</u> _____ Date: <u>04/06/2005</u> Judson L. Kenoyer, Task 3 Manager</p> <p>Concurrence: <u>Signature on File</u> _____ Date: <u>04/06/2005</u> Richard E. Toohey, Project Director</p> <p>Approval: <u>Signature on File</u> _____ Date: <u>04/11/2005</u> James W. Neton, Associate Director for Science</p>	<p>Supersedes:</p> <p style="text-align: center;">None</p>

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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
Draft	01/25/2005	00-A	New technical basis document for the Pinellas Plant – Introduction. Initiated by Mark D. Notich.
Draft	02/08/2005	00-B	Incorporates internal review comments. Initiated by Mark D. Notich.
Draft	03/16/2005	00-C	Incorporates NIOSH review comments. Initiated by Mark D. Notich.
04/11/2005	04/11/2005	00	First approved issue. Initiated by Mark D. Notich.

ACRONYMS AND ABBREVIATIONS

EEOICPA Energy Employees Occupational Illness Compensation Program Act

GEND General Electric Aerospace, Neutron Devices

KUB Kidneys, Ureters, Bladder

LAT lateral X-ray

NIOSH National Institute for Occupational Safety and Health

PA posterior-anterior X-ray

TBD technical basis document

U.S.C. United States Code

1.0 INTRODUCTION

This Site Profile represents support for documentation of historical practices at the Pinellas Plant (Pinellas). Dose reconstructors can use this Site Profile to evaluate internal and external dosimetry data for monitored workers and as a supplement to individual monitoring data. For unmonitored workers, this Site Profile contains information that will enable estimations of internal and external doses. It contains technical basis information dose reconstructors can use to evaluate total occupational radiation doses for Energy Employees Occupational Illness Compensation Program Act (EEOICPA) claimants.

In addition, this Site Profile provides supporting technical data to evaluate the total Pinellas occupational radiation dose that could reasonably be associated with worker radiation exposures. This dose results from exposure to external and internal radiation sources in Pinellas facilities, to occupationally required diagnostic X-ray examinations, and to onsite environmental releases. The Site Profile includes techniques to estimate the dose that could have occurred while an employee was not monitored or inadequately monitored, or dose that could have been missed due to analytical detection limits or if monitoring records are incomplete or missing (i.e., missed dose). Over the years, Pinellas has used new and more reliable scientific methods and protection measures. This Site Profile identifies the methods needed to account for these changes.

The analyses for this Site Profile used the National Institute for Occupational Safety and Health (NIOSH) Interactive RadioEpidemiological Program and the Integrated Modules for Bioassay Analysis computer program to evaluate doses. Information on measurement uncertainties is an integral component of the NIOSH approach. This Site Profile describes how to evaluate uncertainty associated with Pinellas exposure and dosimetry records.

Technical basis documents (TBDs) and Site Profile documents are general working documents that provide guidance concerning the preparation of dose reconstructions at particular sites or categories of sites. They will be revised in the event additional relevant information is obtained about the affected site(s). These documents may be used to assist NIOSH in the completion of the individual work required for each dose reconstruction.

In this document the word "facility" is used as a general term for an area, building or group of buildings that served a specific purpose at a site. It does not necessarily connote an "atomic weapons employer facility" or a "Department of Energy facility" as defined in the EEOICPA (42 U.S.C. § 7384I (5) and (12)).

2.0 SCOPE

The Site Profile has six major parts: this Introduction, Site Description, Occupational Medical Dose, Occupational Environmental Dose, Occupational Internal Dose, and Occupational External Dosimetry. Some parts have attachments that provide critical data for the dose reconstructors.

The Site Description TBD (ORAU 2005a) describes facilities and processes that manufactured neutron generators and other components for nuclear weapons. The manufacture of neutron generators required equipment, facilities, and expertise that could be applied to a variety of specialty components.

The neutron generators consisted of a miniaturized linear ion accelerator assembled with pulsed electric power supplies. The ion accelerator, or neutron tube, required ultra-clean, high-vacuum technology; hermetic seals between glass, ceramic, glass-ceramic, and metal materials; and high-

voltage generation and measurement technology. Pinellas manufactured only neutron generators for its first 10 years of operations. It later manufactured other products including neutron detectors, radioisotopic thermoelectric generators, high-vacuum switch tubes, specialty capacitors, and specialty batteries (DOE 1990). As part of its program to promote commercial uses of the site, the U.S. Department of Energy sold most of the Plant to the Pinellas County Industry Council in March 1995 and leased back a portion through September 1997 to complete safe shutdown and transition activities (DOE 1996).

The Occupational Medical Dose TBD (ORAU 2005b) provides information about the dose individual workers received from X-rays that were required as a condition of employment. The Pinellas Plant operations contractor, General Electric Neutron Devices (GEND), required preemployment physical examinations as part of its occupational health and safety program. In general, the dose from these exposures was not measured, considered, or included as part of the occupational exposure of the employee, although it is clearly related. Under the EEOICPA program, diagnostic medical X-rays administered in conjunction with routine or special physical examinations required for employment are recognized as a valid source of occupational exposure. These medical examinations typically included diagnostic posterior-anterior (PA) and infrequent lateral (LAT) chest X-rays.

Review of about 10% of the GEND medical X-ray files indicates that, since the start-up of the Plant to closure in 1997, employees received annual PA chest X-rays with infrequent LAT chest X-rays. Other X-rays offered to employees included KUB (hip), lumbar spine, cervical spine, hand, ankle, foot, sinuses, and wrist. As far as it is known, these X-rays were not in conjunction with employment and are not included in doses under EEOICPA.

X-ray equipment and the techniques used for taking X-rays have changed over the years covered by this Site Profile. This analysis took these factors into account in estimating the dose a worker would have received from the X-ray. The parameters considered included the tube current and voltage, exposure time, filtration, source-to-skin distance, the view (PA or LAT), and any other factor that could affect the dose received by the worker.

The analysis calculated doses to other exposed organs from the chest X-ray. The calculated dose takes into account the uncertainty associated with each of the parameters mentioned above. Tables list the doses received by the various organs in the body for convenient reference for dose reconstruction.

The Occupational Environmental Dose TBD (ORAU 2005c) principally applies to workers whom Pinellas did not monitor for external or internal radiation exposure. Workers received the environmental dose when working on the site from inhalation of radioactive materials in the air, direct radiation from process equipment, contact with particles on the skin, and direct exposure to radionuclides.

Inhalation of environmental radionuclides results in internal dose to the whole body or body organs. Whole- or partial-body external dose results from deposited radionuclides or submersion in a cloud of radioactive material.

The Environmental Dose TBD provides historical environmental dose information for Pinellas Plant workers about onsite exposure to Plant radiological releases to air and ambient conditions. The information is based on the available literature on the site, which consists primarily of environmental monitoring reports and site environmental reports published between 1971 and 1995. No records could be found to demonstrate that environmental dose monitoring was conducted on the site, such as with environmental thermoluminescent dosimeters. Because of the apparent lack of an

environmental dosimetry program that focused on monitoring workers, the analysis used an appropriate computer model and claimant-favorable assumptions to estimate environmental doses.

The Occupational Internal Dosimetry TBD (ORAU 2005d) describes the internal dosimetry program at Pinellas. The Pinellas program started when the site began operation in 1957. Tritium, ^{238}Pu , and ^{239}Pu were the isotopes of primary concern and the only radionuclides monitored routinely. The primary method for monitoring employees for radionuclide intake was urine bioassay. Carbon-14 and ^{63}Ni were used in much smaller quantities; therefore, no bioassays were acquired from workers.

There have not been a variety of methods used historically to analyze for tritium or plutonium at Pinellas. Liquid scintillation detection was always used for tritium analysis, and alpha spectroscopy after separation chemistry was always used for plutonium analysis. Starting in the 1960s, Pinellas used a Beckman multichannel liquid scintillation counter for tritium. At some point, the Pinellas chemistry counting laboratory used a series 100 Canberra alpha spectroscopy system for the analysis of plutonium.

The Internal Dosimetry TBD discusses interferences that could be encountered in the collection and analysis of urine samples, and the uncertainties in the urine analysis measurements. In addition, it presents information that could be useful in estimating possible missed doses due the limitation of monitoring practices and the limitations of equipment and techniques for radiation detection and measurement. It also presents methods for evaluating potential doses that could fall into this category.

The Occupational External Dosimetry TBD (ORAU 2005e) describes the external dosimetry program at Pinellas. It discusses dose reconstruction, similar practices and policies at the Portsmouth Gaseous Diffusion Plant, and dosimeter types and technologies for measuring dose from the different types of radiation. It also discusses the evaluation of doses measured from exposure to beta, gamma, and neutron radiation; sources of bias, workplace radiation field characteristics, responses to different beta/gamma and neutron dosimeters in the workplace fields, and adjustments to the recorded dose measured by these dosimeters during specific years.

The Pinellas Plant started an external dosimetry program in 1957 to monitor individual employees working in production areas for neutron generators. From 1960 to 1973, U.S. Atomic Energy Commission annual exposure summary reports indicate that 27.5% of the Pinellas labor force wore dosimetry (377 of an average yearly labor force of 1,372). In 1974, Pinellas contracted with R. S. Landauer Jr. & Company to be the principal supplier and processor of the dosimetry used at the site. This arrangement continued until Plant operations ended. In the 1980s, while the data are not completely available, from 170 to approximately 400 of 1,650 to 1,975 workers (approximately 10 to 20%) were monitored for radiation dose. This percentage appears to be representative of later radiation monitoring at the Plant (no documentation was found that shows all employees were monitored at any time during Pinellas operations). For most of the time of Pinellas operations, external dosimetry was exchanged and analyzed monthly. Beginning in January 1990, external dosimetry was exchanged and analyzed quarterly.

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