Hickman, John

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Sent: Wednesday, August 11, 2010 5:36 PM
To: Hickman, John
Cc: Roller, Paul James; Newey, John; Albers, John P; Baldwin, Thomas (DCPP); Rod, Kerry; Snyder, Robert A; Chad Hyslop; Griffin, John J
Subject: HBPP RESPONSE TO QUESTION 1
Attachments: 20100811140207.pdf

Follow Up Flag: Follow Up
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John,

The attached file is the Radiological Characterization Report developed for HBPP by Enercon, dated November 21, 2008, and responds to NRC Question 1 (concentrations expected in the waste) from your July 16, 2010 email to me, as discussed during our July 29, 2010 public meeting for the HBPP Alternate Disposal Exemption Request dated April 1, 2010.
In particular, reference to GEL laboratory reports are contained in Table 4-7 (page 40) and Table 4-9 (page 46).

It should be noted that surveys of highly impacted areas (much of Unit 3) do not apply to waste to be shipped under the exemption request.

Also, positive gross alpha results for Units I and 2 are naturally occurring nuclides in materials or lead paint. GEL results for fuel oil tank waste (previously shipped as non-radioactive) show this is the case. The contamination of the above ground structures of Units1/2 occurred from gaseous decay of Xe-137 to Cs-137 released from Unit 3 during operations from 1963 to 1976.

This is the final email that responds to NRC questions. Previous emails responded to NRC Questions 3, 5 and 6. PG&E will respond to NRC Question 9 in a letter submittal shortly. NRC Questions 2, 4, 7 and 8 were resolved during the July 29 public meeting.

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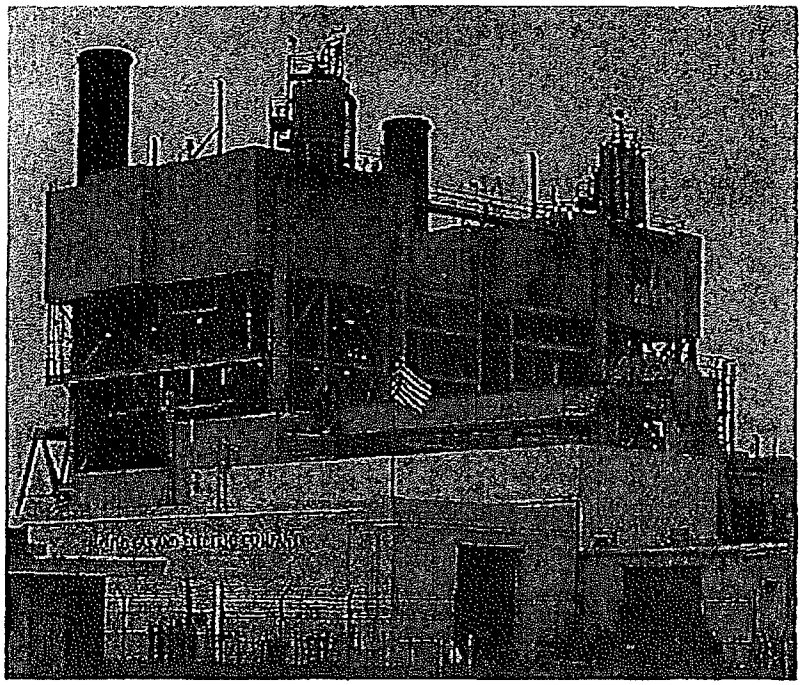
RADIOLOGICAL CHARACTERIZATION REPORT
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA



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HBPP-RPT-001
Revision 1

November 21, 2008

RADIOLOGICAL CHARACTERIZATION REPORT

HUMBOLDT BAY POWER PLANT

EUREKA, CALIFORNIA

HBPP-RPT-001

Revision 1

ENERCON Services, Inc.

Prepared by:	Dustin G. Miller, Health Physicist	Date:	11/21/08
Reviewed by:	Kurt Myers, Sr. Radiological Specialist	Date:	11/21/08
Approved by:	Gerald E. Williams, Project Manager	Date:	11/21/08

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List of Acronyms and Abbreviations

Acronym	Description
COC	Chain Of Custody
DCGL	Derived Concentration Guideline Level
DPM	Disintegrations Per Minute
DQO	Data Quality Objectives
FSS	Final Status Survey
FST	Field Sample Technician
GPS	Global Positioning System
HBPP	Humboldt Bay Power Plant
HSA	Historical Site Assessment
ISFSI	Independent Spent Fuel Storage Installation
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDC_{scan}	Minimum Detectable Concentration via Scan
NaI	Sodium Iodide
NIST	National Institute for Standards and Testing
PG&E	Pacific Gas and Electric
QA/QC	Quality Assurance/Quality Control
SAFSTOR	Safe Storage
USNRC	United States Nuclear Regulatory Commission
VSP	Visual Sample Plan©

1.0 Introduction

1.1 Project Background

Pacific Gas and Electric Company (PG&E) contracted ENERCON to perform site radiological characterization surveys at the Humboldt Bay Power Plant (HBPP) located at 1000 King Salmon Avenue, Eureka, California. A site map is shown in Appendix A, Figure A-1 . This Characterization Report, along with the supporting data, will support the development of the HBPP License Termination Plan (LTP). Radiological characterization activities consisted of a survey of Unit 1 and 2 structures; sampling of surface and subsurface soils and sediments within HBPP properties; and radiological measurements of construction materials at HBPP to assess background levels of radioactivity. This report summarizes the results of the characterization activities at HBPP. The data was collected per guidance in NUREG 1575, Revision 1, August 2000, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). ENERCON developed several planning documents for the characterization activities. These documents were approved as Vendor Procedures by the HBPP Plant Safety Review Committee and included in the HBPP Plant Manual. The documents included HBPP-PP-003, *Site Characterization Plan*, operating procedures, and survey packages. Field survey activities were conducted using PG&E Work Packages to support work control. Each Work Package implemented the HBPP Work Control process for one or more characterization survey packages. The Work Packages and Survey Packages are presented in Appendix B.

1.2 Purpose and Scope

The purpose of the HBPP Characterization activities was to assess the radiological status of the HBPP site in accordance with MARSSIM guidance. The characterization activities were guided by HBPP-PP-003, *Site Characterization Plan*, which used the MARSSIM DQO process to establish the necessary requirements and methods for obtaining high quality characterization data. The data collected using the Characterization Plan, as well as previous characterization data, is vital to developing the LTP. The information from the characterization surveys also provides guidance for decontamination and remediation planning.

The Characterization Plan outlined the following areas:

1. Site organizational structure, responsibilities, and training required for characterization activities;

2. Design of and instructions for the characterization survey packages;

3. Survey methods to be employed for different media;

4. The quality control measures to be implemented;

5. Personnel, public and environment safety requirements related to field activities; and

6. Characterization report requirements.

The scope of the characterization survey of the HBPP site was the following:

- Identify and quantify the nature and extent of radiological materials;

- Determine the distribution of radioactive material contamination in each area that contained radioactive materials contamination;

- Obtain data to provide guidance for decontamination/remediation activities planning;

- Obtain data to provide guidance for waste management planning;

- Provide information to support the development of the site-specific DCGLs; and

- Provided the information needed to develop the FSS for each survey area.

1.3 Summary of Technical Approach

A central concept of the technical approach was the initial classification of survey areas described in the HBPP Historical Site Assessment (HSA) developed by ENERCON in January 2007. The HSA collected historical documentation, i.e., radiological scoping surveys, Unit 3 operating reports, environmental reports, incident reports, etc. and then compared potential residual radiological contamination with potential release criteria. The release criteria used in the HSA was a very restrictive Resident Farmer scenario. The general criteria used to classify the survey areas were drawn from the regulatory guidance of NUREG-1575 (MARSSIM) as follows:

Non-impacted Area: Areas where there is no reasonable possibility (extremely low probability) of residual contamination. Non-impacted areas are typically off-site and may be used as background reference areas.

Impacted Area: Areas that could possibly contain residual radioactivity in excess of natural background or fallout levels. All impacted areas must be classified as Class 1, 2 or 3 as described in NUREG-1575.

Class 1 Area: Impacted areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys) above the anticipated Derived Concentration Guideline Level (DCGL).

Class 2 Area: Impacted areas that have a potential for residual radioactive contamination or known contamination, but are not expected to exceed the anticipated DCGL.

Class 3 Area: Impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the anticipated DCGL, based on site operating history and previous radiological surveys.

This characterization report contains the data necessary to update the HSA and to update the initial MARSSIM classifications listed in the HSA. Areas listed as Class 2 or Class 3, should be upgraded to a Class 1 area if contamination is found that is in excess of the DCGLs.

1.3.1 Survey Design

ENERCON developed survey packages for all survey units. The survey package development involved performing walk-downs of each area. During the walk-down details regarding the physical survey area were compiled in the survey package such as type of area (structure, system or environ), surfaces in the area (wall, floor, ceiling, surface soil, or other feature,) and dimensions. Data from previous HBPP characterization and scoping surveys were reviewed and utilized as appropriate. Each survey package contained the following eight sections of information:

1) Detailed description of the survey area and/or survey units

2) Photographs, drawing or drawings of the survey area and/or survey units

3) Survey area operational history including summary data from previous surveys.

4) Characterization survey instructions – Types and number of survey measurements and/or samples prescribed for the survey.

5) Survey support requirements such as shovels, scoops, ladders, GPS, and coring tools.

6) Health and safety requirements.

7) RWP requirements.

8) Characterization Data - Survey instrument data downloads, survey reports, and sample analysis reports.

For each survey area in a designated survey unit, ENERCON used 30 samples/measurements as a standard number of characterization survey locations for all areas that were designated as MARSSIM Class 2 or Class 3 at HBPP. The basis for using this number is that the quantity is an important standard number in Large Population Statistics and was used historically in NRC

guidance, NUREG/draft 5849, *Manual for Conducting Surveys in Support of License Termination.* NUREG 5849 states that for survey areas with a low potential for residual contamination, 30 random measurements should be collected to identify the condition of an area within a 95% confidence level. In regards to the statistical number of locations using MARSSIM, the number 30 corresponds to designing a survey using the more conservative relative shift of 1, which typically provides a sample number requirement of 29. These statistical methods are only able to work if all of the surfaces in the survey area have the same potential for having residual contamination, i.e. walls, floors, horizontal pipes/beams, ceilings, etc. For Class 1 areas such as the soils around Unit 3, a more direct bounding survey was used since the data would not be used for final status surveys since the area would most likely require remediation.

1.3.2 Training and Qualifications

ENERCON utilized qualified Health Physics Technicians as the Field Sample Technicians (FST) to complete the characterization effort. The training of every FST was documented using HBPP-OP-012, *Technician Training, Qualification and Authorization.* This procedure established the requirements for training, qualification and authorization of radiological technicians to perform scoping, characterization, remediation and final status surveys at Humboldt Bay Power Plant (HBPP). FSTs received training on all characterization operating procedure and instrumentation. The prospective FSTs were then observed in the field implementing the procedures and survey package instructions. Once the Survey Supervisor was satisfied with the training, a qualification and authorization form was completed and forwarded to HBPP for their concurrence.

1.3.3 Field Activities

Site Access

Field Sample Technicians participated in the HBPP training program in order to obtain unescorted access to the restricted area and to document their successful completion of training to conduct characterization survey operations. Access to areas for characterization surveys was coordinated with the area/unit supervisors. In addition, ENERCON attended the daily work planning meetings to ensure access was available.

Building and Structure Surfaces

The primary instrument for detecting surface contamination on building and structure surfaces was the Ludlum Model 2360 Alpha/Beta scaler/ratemeter with a Ludlum Model 43-68 gas proportional detector. This instrument/detector combination simultaneously detected alpha radiation and beta/gamma radiation. The meter is equipped with a discriminator switch enabling the user to read alpha only counts, beta plus alpha counts, and beta only counts. The beta plus alpha combination was used to obtain static measurements at prescribed locations to quantify the amount of radioactive material if present. This instrument was also utilized to scan large areas such as walls, ceilings, and structure surfaces.

General Area Dose Rates

The Ludlum Model 9 was used to obtain general area dose rates throughout survey areas. The general area dose rates gave a qualitative view of the background radiation and the possible contamination level of a room.

Loose Contamination Smears

Loose contamination smears were collected at the same location as static radiation measurements. The smears identified the amount of loose contamination at a location.

Support Equipment

Characterization surveys required the use of a large boom lift to survey the tops and sides of some buildings and structures. Equipment was handled safely in accordance with the ENERCON HASP and in accordance with Job Hazards Analyses.

Utility Clearance

Ground penetrations greater than 6" had an excavation permit completed per HBPP procedures. Utility clearance included the review of HBPP plant drawings and the use of a physical detection instrument, i.e. ground penetrating radar or magnetometer.

1.3.4 Sample Analysis

1.3.4.1 Identification of Contaminants of Concern

The radionuclides of concern were identified in the HBPP HSA and were derived from the operation of Unit 3 with the primary isotopes being Cesium-137 (Cs-137), Cobalt-60 (Co-60),

Tritium, Americium-241 (Am-241), Plutonium-239 (Pu-239), Iron-55 (Fe-55), and Nickel-63 (Ni-63). Additional radionuclides were also expected to be present but the relative fractions were expected to be minimal as compared to the primary radionuclides. All soil samples were analyzed for gamma emitting isotopes using Gamma Spectroscopy analysis. All analyses were not conducted for every sample due to the gamma to alpha ratios. Alpha contamination will not be present without Cs-137 and Co-60 present. Typically, samples with detectable Cobalt-60 or elevated Cs-137 were also analyzed for Am-241 and Pu-239.

1.3.4.2 Minimum Detectable Concentration

The minimum detectable concentration (MDC) is the concentration of radioactivity that an instrument can be expected to detect activity at a 95 percent confidence level. For instruments performing direct measurements and for laboratory analyses, the MDC goal was 10-50% of any applicable limit or DCGL.

For static (direct) surface measurements, with conventional detectors, the MDC was calculated using the formula:

$$\text{MDC (dpm/100cm}^2) = \left[\frac{3 + 3.29\sqrt{(Rb)(Ts)(1 + Ts/Tb)}}{(Ts)(\varepsilon)}\right]$$

Variables:

Rb = Background count rate (cpm)

Tb = Background count time (min)

Td = Sample Run Time (min)

Ts = Sample Count Time (min)

ε = Total Instrument Efficiency (MARSSIM section 6.6.1)

The MDC_{scan} for beta-gamma measurements was calculated by determining the Minimum Detectable Count Rate (MDCR). The MDCR is determined by first determining the minimum detectable net source counts using Formula 6-8 in the MARSSIM as below.

Minimum number of detectable source counts: $s_i = d'\sqrt{b_i}$

Where:

d' = value taken from Table 6.5 in the MARSSIM for applicable true and false positive rates

b_i = Number of background counts in a given time interval

The MDCR was calculated from Formula 6-9 in the MARSSIM:

Minimum detectable count rate: $MDCR = s_i * \frac{60}{i}$

Where:

i = Observed time interval

Finally, applying the detection efficiency correction resulted in an MDC_{scan} in standardized units (DPM/100-cm^2) from this formula:

Scan MDC: $$MDC_{scan} = \frac{MDCR}{\sqrt{p} * \varepsilon_i * \varepsilon_s * \frac{probearea}{100cm^2}}$$

Where:

ρ = Surveyor efficiency (value from a range between 0.5 and 0.75)

ε_i = Instrument efficiency

ε_s = Surface efficiency

probearea = total area of the detector face in cm^2

The value for ρ was developed in Draft NUREG/CR-6364 and NUREG-1507. It is a percentage estimate of the likelihood a surveyor will reliably detect an elevated count rate.

1.3.4.3 Survey Instrumentation

Radiological survey instrumentation was selected to ensure that sensitivities were sufficient to detect the expected radionuclides at the minimum detection requirements. A list of the survey instrumentation, radiations detected and calibration sources is provided in Table 1-1.

Table 1-1
Survey Instrumentation

Instrument/ Detector	Detector Type	Radiation Detected	Calibration Source	Use
Ludlum 2221 (2"X 2")	NaI Detector (gamma scintillator)	Gamma	Am--241	Qualitative Soil Contamination Measurement
Ludlum Model 2360 (126 cm^2 area)	Gas flow proportional	Alpha/Beta/ Gamma	Th-230/Tc-99	Surface static/scan measurements
Ludlum Model 19	NaI	Gamma	Cs-137	Area exposure measurements
Ludlum Model 2929	ZnS	Alpha/beta/ Gamma	Pu-239/Tc-99/I-131/C-14	Swipe/smear counting

Instrument Calibrations

Accurate and precise instrument calibrations are vital to the quality of a characterization survey. Portable electronic field instruments were calibrated in accordance with approved procedures to NIST traceable standards at frequencies not to exceed 12 months. Field instruments were calibrated by offsite commercial calibration facilities utilizing NIST traceable calibration sources. The commercial calibration facilities included Ludlum Measurements, Sweetwater, Texas; SEC, Oak Ridge, Tennessee; ERG, Albuquerque, New Mexico; and ENERCON, Murrysville, Pennsylvania.

The instruments were calibrated by Nuclear Regulatory Commission (NRC) licensed facilities using NIST traceable standard calibration sources. Calibration facilities operated under approved Quality Assurance Programs. Portable instruments were source checked daily using Cs-137 for gamma only measurements and Th-230/Tc-99 for Alpha/Beta/Gamma measurements.

During characterization activities, portable field instruments had a background and efficiency control chart established, per HBPP-OP-006, *Instrument Source and Response Check*, to monitor the performance of field instruments on a daily basis. Control parameters were established for instrument background and efficiency. At the beginning and end of the day, portable instruments were source checked daily using Cs-137 for gamma only measurements and Th-230 for alpha measurements and Tc-99 for beta measurements. These measurements were recorded on the established control chart. Instruments with elevated backgrounds required decontamination or

repair. Instruments with efficiencies out of tolerance were taken out of service until the issue was resolved and documented per approved instrument procedures. When an instrument was found to be out of tolerance at the end of the day, the data acquired by that particular instrument was suspect until verified to be accurate by independent measurement or else the data was discarded and new data collected. Instrument Calibration Certificates and source check records are attached in Appendix C.

FSTs were responsible for ensuring that pre-operational and post-operational checks were performed in accordance with approved instrument procedures. FSTs signed out and signed in instruments daily when used. FSTs annotated on radiation survey forms the type, model, serial number, efficiency, background, MDC, and other data as required by approved procedures and the survey package.

1.3.4.4 Sources

Sources used for daily source checks and efficiency determinations were selected to be representative of the instrument's response to the identified radionuclides and were traceable to the National Institute of Standards and Technology (NIST). Radioactive sources used for instrument response checks and efficiency determination were stored securely when not in use.

Radioactive sources used to perform instrument operational checks are listed below:

- Ludlum model 2360 Technetium 99- 5, 000 dpm and Thorium 230- 4,000 dpm.
- Ludlum model 2929 Thorium 230- 16,500 dpm and Technetium 99 – 11,700 dpm.
- Ludlum model 2221 Cesium 137 - 4.82 uCi.
- Ludlum model 19 Cesium 137 - 4.82 uCi.

1.3.5 Analytical Quality Assurance and Quality Control

Samples were sent to General Engineering Laboratories (GEL) in South Carolina for gamma spectroscopy analysis. GEL maintains there own in house QA Program for sample analysis traceability and are an approved PG&E vendor; therefore, it was unnecessary provide split or duplicate samples for Quality Assurance and Quality Control. GEL utilizes method blanks, blind

spikes and duplicate samples as part of their QA program. The results of these QA/QC sample analyses are included in the laboratory reports in Attachment D.

1.3.6 Data Management

Laboratory results received from GEL Laboratory were reviewed for anomalies and tabulated. Field measurements were documented on radiological survey report forms and reviewed by a Certified Health Physicist

2.0 Investigation Tasks

The following sections present the field tasks performed during the radiological characterization of soils, sediments, buildings and structures at HBPP. The field investigation was implemented using the initial MARSSIM Classifications described in the HBPP HSA. The initial Classifications were used to guide the level of effort necessary to characterize the area. Another key component was the identification of elevated measurements identified in the characterization effort by IT/Duratek in 1997.

2.1 Building and Structure Surveys

During the decommissioning process, Units 1 and 2 will be dismantled to provide laydown area for the decommissioning of Unit 3 as well as to eliminate the potential for cross contamination of Units 1 and 2 during Unit 3 decommissioning. Characterization of Units 1 and 2 focused on gathering data for waste disposition of the building and structures. The steel I-beams are a good candidates for recycling, however, they may need to be decontaminated before they are sent to a recycler or to a landfill.

The support buildings and structures outside of Unit 3 RCA have been impacted by the operation of Unit 3. However, these items should not require remediation and items may be able to be released for unrestricted use following HBPP procedures. The characterization data for buildings and structure to remain after license termination was collected primarily to assist in the design of the FSS. For items that will be demolished, dismantled or released from the site before license termination, the characterization data should aid in the disposition planning.

2.2 Gamma Radiation Walkover Survey

A walkover survey for gamma radiation was conducted over MARSSIM Class 2 areas adjacent to Units 1, 2, and 3 to characterize the gross gamma radiation within the surface soil column (0 to 6 inches) in conjunction with the collection of surface soil samples. The survey was conducted using a Ludlum Model 44-10 2x2 NaI detector coupled to a Ludlum Model 2221 Meter. The 2" x 2" NaI was used by walking over the land areas and collecting the measurements. The meter was connected to a Trimble® Pathfinder ProXR (or similar) Global Positioning System (GPS) unit to record the current ratemeter data along with the GPS coordinates.

2.3 Railroad Spur Drain Geophysical Surveys

A geophysical survey was performed near the end of the railroad track drain line in an effort to locate the end of the drain line and to collect samples to bound the contamination detected by the 1997 IT/Duratek Environmental Characterization.

2.4 Surface Soil Sampling

Surface soil sampling was conducted as part of the systematic and random sampling programs in Survey Units 001, 002, 004, 005, and 006 which are displayed in Figures A-7 through A-12 in Appendix A. Surface soils were defined as the top 6-inch layer of soil available for direct exposure. Engineered surfaces, including asphalt and gravel, although potential surface sources of radiation, were not included in the definition of surface soils.

2.5 Sediment Sampling

Sediment sampling was conducted in the discharge canal (Figure A-13 in Appendix A). Systematic sampling was conducted to provide a greater lateral and vertical profile of potential contamination since the primary sample locations used in the 1997 IT/Duratek study was straight down the middle of the discharge canal. Core samples of the sediment were collected from a floating barge using a hand sediment sampler to penetrate the sediment layer. Sediment samples were collected at a total of 19 locations. 18 locations were sampled at intervals of 0-1 feet and 1-2 feet in depth. 12 locations were able to be sampled at an additional depth interval of 2-3 feet.

2.6 Hand Auger Sampling

Hand Auger sampling was conducted as part of a judgmental sampling of subsurface soils for the Unit 3 RCA, the Humboldt Bay Repowering Project Area (HBRP), and to obtain subsurface soil data near radiologically contaminated drain and discharge lines. The targeted subsurface pipes and locations, shown in Figures A-3 through A-5, were the following:

- Radwaste Tankage Drain Line
- Radwaste Discharge Line
- North Yard Drain System
- Radiological Characterization Locations in the HBRP Area

The intent of the hand auger sample was to determine if the associated lines had leaked radioactive material and if so, how much had affected the subsurface soils. A utility locating company was used to specifically locate vertical and horizontal location of each of the lines in order to sample as close as possible to the lines. Once the line was located, the hand auger was advanced to the depth of the line and a sample was collected. A second sample was collected 3 feet below the line. A total of 46 hand auger sample locations were sampled.

2.7 Radiological Deep Vertical Bores

Radiological Deep Vertical Borings (RDVB), shown in Figure A-6, were advanced north of Unit 3 to a depth of approximately -85 feet below grade surface (bgs). Two RDVBs were advanced using a mud rotary truck mounted drill with a five-foot long wireline sampling system. One RDVB, however, was advance by hand after the rotary bit struck an unidentified water pipe due to incorrect drawings. The borings were sampled at 5 foot intervals. Prior to collecting a sample from the 5 foot long core, a Ludlum 44-9 detector was used to determine if an elevated contamination spot existed in the core. If no elevated area was detected, a sample was collected in the middle of the core sample.

3.0 Data Evaluation

The following sections provides a summary of analytical radionuclide data from samples collected in areas determined to be representative of background and in the HBPP survey units. Section 3.1 is a summary of natural background measurements for different types of material at HBPP, and Section 3.2 is a summary of the radionuclide measurements in the HBPP study area.

3.1 Background Radionuclide Measurements

Samples were collected and surface measurements were performed to provide data on natural background content. Natural Background Radioactivity for Building Material Surfaces were measured and evaluated as part of the HBPP characterization effort. Surface activity measurements were performed in areas where radioactive contamination was not suspected to be present based on operational and historical knowledge and based upon characterization results that indicated areas were not contaminated. The background determinations were completed at the end of the project to better select non-impacted areas. The results of the natural background study for HBPP building materials are presented in the Table 3-1 below.

Table 3-1
Natural Surface Radioactivity Levels for HBPP Building Materials

	95 % Confidence Interval Surface Alpha Activity Level* (dpm/100 cm^2)		95% Confidence Interval Surface Beta Activity Level* (dpm/100 cm^2)	
	Mean	2 Sigma	Mean**	2 Sigma
Unit 1 12' Elevation Concrete Floor	6.6	16.8	91.7	134
Unit 1 12' Elevation Cinder Block Walls	2.5	9	115.6	89.4
Unit 1 12' Elevation Structural Steel	8.4	17.7	-12.2	131
Relay Building Concrete Floor	9.1	21	219.6	164.3
Relay Building Cinder Block Walls	9.2	18.7	257.1	237.9
Steel Walls and Support Beams	8.2	21.7	-14.9	142

* Levels measured by a Ludlum Model 2221 Meter and Ludlum Model 2360 Gas Proportional Probe. The mean and 95% confidence level (2 sigma) values were determined from 30 static one minute measurements on uncontaminated surfaces with open air background levels subtracted.

** A negative mean value for the beta surface activity level indicates that the beta activity of the steel surface is less than the open air background reading of the detector for that area. Uncontaminated steel acts as a shield and essentially lowers the open air background beta activity levels

The concrete floor, the cinder block walls and the structural support steel of Unit 1 12' elevation were selected for background surface determinations since these materials are representative of the bulk of the building materials comprising Units 1 and2, and were found essentially non-impacted radiologically based on characterization results.

The concrete floors and cinder block walls of the relay/switchgear building were selected for background surface determinations as being representative of auxiliary type buildings found onsite at HBPP. The hazardous waste storage building was selected for background analyses because of its structural steel walls and support beams and non-impacted status.

Thirty random locations were picked from each surface and one minute static alpha and beta measurements were obtained simultaneously using a Ludlum Model 2221 meter and Model 2360 gas proportional probe. The same instrumentation was utilized during the characterization project. The instruments were calibrated and source checked prior to and post use. Open air background levels were determined by performing a 10 minute open air background count in each monitoring area. Open air alpha and beta background levels were then subtracted accordingly from the material readings

The characterization survey results for building surfaces presented in this report are biased high because the natural background of the building materials was intentionally not subtracted. Including natural background with the surface characterization results provides the most conservative results. Characterization results will be evaluated by the licensee to determine waste volumes for Low Level Radioactive Waste (LLRW), materials for recovery/recycle, waste materials for clean disposal, and materials to be interned on site.

3.2 Radiological Measurements in the HBPP Study Area

This section of the characterization report presents the results of the data collected. This section includes radiological survey results for facility grounds, buildings, Fossil Fueled Units 1 &2, and for some auxiliary buildings of the Unit 3 Nuclear Power Plant. The data presented in this report is comprised of results for surface radiological measurements for fixed and loose contamination listed in disintegrations per minute per 100 square centimeters (dpm/100 cm^2), area radiation measurements in micro-R per hour (uR/hr), and also surface/subsurface soil sample results in

picocuries per gram (pCi/g). The radiological characterization was conducted in accordance with applicable guidance found in MARSSIM to ensure data quality and appropriate radiological survey techniques. To ensure a high quality of radiological survey results, guidance from the MARSSIM was incorporated. MARSSIM was authored by several government and regulatory agencies to establish radiological survey methods and strategies for the final release of contaminated facilities. Although the characterization results presented in this report are not final release surveys the licensee could use the data to support final status surveys. The survey approach, documentation, personnel qualifications, and instrument calibrations presented in this report are guided by MARSSIM and have been successfully incorporated at other facilities to perform characterization and final status surveys.

Radiological Survey Criteria

Instrument sensitivities, scan rates, and measurements are based on Nuclear Regulatory Guide (NuReg) 1.86. Nu Reg 1.86 is referenced in Materials License DPR-7 as the guideline for the free release of materials that leave the Humboldt Bay facility. Radiological survey criteria was established to satisfy the Nu Reg 1.86 criteria. Radiological survey criteria for alpha activity was assumed for transuranic nuclides at 20 dpm/100 cm^2 for removable activity and 100 dpm/100 cm^2 for fixed activity. Release criteria for beta activity was assumed to be for Sr-90 at 200 dpm/100 cm^2 for removable activity and 1000 dpm/100 cm^2 for fixed activity. Radiological surveys were performed with a 95% Confidence Limit to ensure that the radiological survey criteria would be satisfied.

Instrumentation

To ensure that the radiological survey minimum detection criteria would be met hand held gas flow proportional instruments with 126 cm^2 detectors were utilized and the survey results were normalized100 cm^2. Gas flow proportional detectors are more sensitive to low levels of radiation than Geiger Mueller or sodium iodide type detectors. Minimum detectable activities are documented for the referenced instrument for each survey. The highly sensitive detectors and slow scan rates were capable of detecting less than the stated Regulatory Guide 1.86 criteria. Area radiation measurements were made with hand held exposure rate meters that incorporated sodium iodide (NaI) detectors with sensitivities below 1 micro rem. Smears (swipes) were counted using a calibrated ZnS (Ag) detector with 2 minute counting times to acquire established MDAs.

Field instruments were calibrated by licensed calibration facilities meeting the requirements established by American National Standards Institute (ANSI N93.1XZ). Source checks were performed twice daily and documented as required by approved procedures. Commercial analytical laboratories performing soil and water analyses maintained approved Quality Assurance Programs. The established Quality Assurance Programs required documentation of instrument calibration and performance checks.

Radiological Survey Technique

To meet the industry standard Nu Reg 1.86 release criteria with the stated instrumentation field survey techniques were adopted to establish adequate sensitivities. The field survey techniques were derived based on the MARSSIM guidance that set scan rates (rate to move the detector) at 5 cm/sec (2 inches/sec). Static (stationary) measurements were set at 1 minute each to establish instrument Minimum Detectable Activity (MDA).

Ceiling static measurements were sometimes increased from one minute to two minutes to adjust for decreased detection efficiency of the instrument because of longer detector to meter cables required to reach the elevated area being monitored. Smears (swipes) were collected on building surfaces to monitor loose radioactivity. Smears were collected by qualified and experienced FSTs implementing approved procedures and industry accepted practices. The MDA for removable (loose) contamination was calculated based on MARSSIM guidance and stated on the radiological survey report.

Characterization Personnel

Qualifications Field characterization personnel performing measurements and collecting data were trained regarding approved plans and procedures to ensure accurate implementation of survey package instructions, instrument use, and sample collection. Characterization personnel performing field measurements and collecting samples met general industry requirements for Radiological Control Technicians (RCTs).

Senior RCTs oversaw monitoring performance of Junior RCTs. Senior RCTs met the requirements ANSI 3.1 and several were qualified by the National Registry of Radiological

Protection Technologists (NRRPT). Field monitoring activities, sample collection, Quality Control, and data review was overseen by a Sr. Health Physicist Certified by the American Board of Health Physics (CHP). Survey data was reviewed for completeness and quality by a senior technician responsible for oversight of the survey and also by a certified health physicist for final review. Such parameters as survey completeness (i.e. survey date, number, maps, and signatures) were checked. Acceptable meter and counter backgrounds, efficiencies, and adequateness of MDAs were reviewed for both alpha and beta measurements. Survey monitoring points and locations were reviewed to be consistent with the requirements of applicable survey packages. Maps, photographs, and GPS coordinates are included in the survey packages in Appendix B to support the data for reproducibility and detailed orientation.

Because of ongoing Unit 1 operations the interiors of the Unit 1 boiler, ventilation, and firebox were not surveyed for surface radiological contamination due to the areas being inaccessible. In addition, this radiological characterization report does not include hazardous material characterization results. At the time of this report, PG&E's Corporate Environmental Department is conducting a hazardous materials investigation at the site in support of eventual decommissioning of the fossil power plant and to support construction of the New Generation Plant.

4.0 Summary of Results

The following sections summarize the results of the radiological characterization effort. For area specific information and to locate the exact locations, please refer to the supporting Appendices. All laboratory analysis reports are contained in Appendix D. All radiological measurement results, survey packages, work packages, areas pictures, sample locations, sample numbers, and safety analyses are contained in Appendix B.

4.1 Impacted Areas

Radiological surveys, past and present, show that Unit 3 has impacted all areas of HBPP. Impacted areas, as defined in Section 1.3 and in the MARSSIM, are areas having some potential for residual contamination. These impacted areas are further divided into Class 1, Class 2, and Class 3 areas, based primarily on the relative potential for elevated activity, as discussed in Section 1.3. For selected survey packages, a detailed description of the area, the history of the area, previous survey results, and an analysis of the results for that area are summarized in the subsequent sections. The areas are listed by classification in order by survey unit in table 4-1 below.

TABLE 4-1
HBPP Characterization Survey Unit List

001SS2 Land area on hill north of Unit 3. Contains spoils pile.
002SS2 Land Area east of Unit 3 RCA and around Discharge
003SS2 Asphalt and concrete areas north, west and south of Units
004SS2 Land area north of Units 1 and 2. Contains SWMU #1
005SS3 New Gen Area Surface Soils
006SS3 Land Area where New Gen Road is to be constructed.
007BS3 Sand Blast Building Floors
010BS2 Unit 2 Ventilation Intake
011BS2 Unit 1 Ground Floor (+12 ft elevation)
012BS2 Unit 1 Second Floor (+27 ft elevation)
013BS2 Unit 2 Ground Floor (+12 ft elevation)
014BS2 Unit 2 Second Floor (+27 ft elevation)
015BS2 Unit 2 Seal Oil Room
016BS2 Unit 2 Condenser
017BS2 Unit 2 Boiler
018BS2 2.4 KV Room
019BS2 Unit 2 Building Structures

020BS2 Unit 1 Seal Oil Room
021BS2 Unit 1 Condenser
022BS2 Unit 1 Boiler
023BS2 Unit 1 Building Structures
024BS2 Unit 1 and 2 Fireboxes.
025BS2 Cold Machine Shop
026BS2 Welding Shop
027BS2 Warehouse
028BS2 Office and Shop Structures
029BS2 Unit Oily Water Sump
031BS1 Unit 3 Condensate Demineralizer Room
032BS1 Unit 3 Seal Oil Room
044BS1 Unit 3 Propane Engine Generator
046BS1 Unit 3 Generator/Exciter
055BS1 Unit 3 Hot Shop and Calibration Facility
060BS3 Relay Building
061BS3 Steam Cleaning Station
062BS3 Oil/Water Separators
063BS3 Assembly Building
064BS3 Training Building
065BS3 Out of Stock Warehouse
066BS3 Intake Structure
067BS3 Switchyard Structures
068BS3 Riggers Shed
069BS3 Fuel Oil Service Tanks
070BS3 Hydrogen Bottle Storage
071BS3 Propane Tank
072BS3 Fresh Water Tank
073BS3 Fire Water Pump House
074BS3 Office Annex
075BS3 MEPPs 2 and 3 Buildings
076BS3 MEPPs Control Bldg
077BS3 Security Building
078BS3 FFD Trailer
079BS3 Effluent Ponds
080BS3 Caustic Storage Area
081BS3 Hazardous waste Storage
082BS3 Fuel Oil Storage Tanks
083BS3 Diesel Fuel Tanks
084BS2 Distilled Water Tanks
085BS3 Lube Oil Fuel Tanks
086SD1 Discharge Canal
088SB1 Radwaste Piping Below Grade
089SB1 North Yard Drain System
090SB1 South Yard Drain System
095BS1 Unit 3 Roof

098BS2 Unit 1 Roofs
098SBW Well Installation Samples
099BS2 Unit 2 Roof
101BS2 Unit 1 & 2 1st and 2nd Floor Exterior
102BS2 Unit 1& 2 Pre-heaters Area and Outside
104BS3 Metal Storage Building
105BS3 Miscellaneous Class 3 Buildings

4.1.1 Class 1 Areas

4.1.1.1 Soils and Sediments

The Class 1 surface and shallow subsurface soils around Unit 3 were adequately characterized by IT/Duratek in 1997, however, some additional data was necessary at depths greater than 4 feet in subsurface soils that had a high potential for being impacted by leakage from the Spent Fuel Pool, spills, and/or operations. Several boring were advance around radiologically impacted pipes as described in section 2.6. The pipes, sample results, and sample depths are shown in Appendix A, Figures A-2, A-3, and A-4. Subsurface soil data was vital to the development of DECON-POS-H010, Excavation and removal of Subsurface Soil for Humboldt Bay Power Plant Decommissioning, which estimated the potential remediation costs of class A low level radiological waste during decommissioning of the Unit 3 NRC License. The laboratory results are attached in Appendix D and are summarized in Table 4-2 below.

In addition, the sediments in the Discharge Canal were sampled as described in section 2.5. This data was also used in the development of DECON-POS-H010. The results of the samples indicate an increase in sediment contamination in the first half of the canal over the last decade. Samples were also collected at greater depths than the IT/Duratek samples and indicate that contamination most likely has not leached into the deep subsurface soils, but remains in the top 2 feet of sediment and soils.

The laboratory results are attached in Appendix D and are summarized in Table 4-2 below.

TABLE 4-2
Results Summary – Subsurface Soil Samples

Area (Sample Pre-Fix)	Cesium -137 (pCi/g)			Cobalt-60		
	Max	Mean	Std Dev.	Max	Mean	Std Dev.
Radwaste Discharge Line (RWL)	0.03	0.00	0.01	0.04	-0.01	0.03
Discharge Canal (RDC)	40.50	3.70	7.94	0.80	0.11	0.16
N. Yard Drain System(RNY)	21.70	1.28	4.36	0.18	0.01	0.04
Misc Hand Auger (RCS)	0.55	0.07	0.14	0.04	0.00	0.02
Liquid Radwaste Tankage Drain (RWT)	0.08	0.00	0.02	0.05	-0.01	0.02
Deep Vertical Borings (RDVB)	21.00	1.98	5.69	0.04	0.00	0.02
Tritium Wells (RCW-SFP and RCW-CS)	0.26	0.00	0.04	0.06	0.00	0.02

4.1.1.2 Buildings and Structures

Due to spent fuel movement operations and due to the availability of data collected by the HBPP Radiation Protection (RP) Department, Class 1 areas were generally not surveyed. The HBPP RP data was collected in several areas of Unit 3. The data consisted of smears inside contaminated systems and concrete dust samples. The concrete dust samples were collected using a drill bit and a HEPA vacuum. The process used to collect these samples, as well as the data, was collected from various data archive locations at HBPP and placed together in Appendix E.

The data collected by the HBPP RP Department shows that concrete exposed to water contaminated with reactor generated radioactive materials has been volumetrically contaminated. In general, volumetric contamination is within the top ½ inch of the exposed concrete surface. Cracks and crevices were not investigated and may show increased depth of contamination when investigated and/or remediated.

Table 4-3 on the next page summarizes the available data for the concrete dust samples collected.

Table 4-3
Radionuclide data for HBPP Concrete Dust Samples

Hot Machine Shop

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor in front of Lathe	153	6.69E-06	N/A	N/A	215	<6.22E-7
2	Floor by rollup door drain	154	1.94E-05	181	1.79E-06	214	3.33E-07
3	Floor in front of sink	155	2.89E-04	182	4.20E-05	216	9.78E-06
4	Wall behind the sink	156	8.45E-06	183	1.46E-06	217	4.93E-07
5	Floor by south-west drain	157	8.29E-06	184	2.02E-06	219	7.60E-07

Air Ejector Room

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor at plant east end	261	1.06E-04	477	3.19E-05	504	7.82E-06
2	Adjacent to A/E Condenser	264	1.55E-02	N/A	N/A	N/A	N/A
	Outer outer ring	309	4.51E-03	N/A	N/A	N/A	N/A
	Outer Ring	283	6.01E-03	N/A	N/A	308	8.77E-04
	Middle Ring	N/A	N/A	N/A	N/A	N/A	N/A
	Inner Ring	N/A	N/A	N/A	N/A	N/A	N/A
3	Crack in floor at plant NWt End	265	1.35E-04	475	4.72E-05	505	1.65E-05
4	Plant West Wall	266	5.10E-05	N/A	N/A	310	2.76E-06
5	Plant SW floor by Grate	267	1.73E-04	476	5.08E-05	506	1.05E-05
6	Plant East Wall	311	6.03E-06	N/A	N/A	N/A	N/A
7	Plant North Wall	312	6.71E-06	N/A	N/A	N/A	N/A

Low Level Rad waste

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor near #1 Waste Holdup Tank	510	4.91E-04	521	1.69E-04	552	4.25E-05
2	Floor by drip pan	512	1.30E-03	523	8.88E-04	554	2.44E-04
3	Floor next to #3 WRT	511	6.81E-04	522	3.48E-04	553	3.58E-04
4	Floor next to LRW Sump	513	1.22E-03	524	6.83E-05	555	3.93E-05
5	Floor between LRW pumps	514	3.79E-03	525	7.81E-04	556	3.42E-04
6	Wall on plant north of trough	515	2.73E-03	526	9.32E-04	557	3.48E-04
7	Roof lower plant so. Floor	534	1.08E-05	781	6.48E-06	784	1.06E-05
8	Roof floor plant NE corner	535	4.33E-05	780	9.51E-06	783	4.72E-06
9	Roof near compactor	536	2.35E-03	779	3.16E-04	782	2.20E-04

Cal Facility

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor	979	3.75E-06	981	1.20E-06	984	1.03E-06
2	Wall	980	5.76E-07	983	2.10E-07	985	<3.2E-7

Turbine Enclosure

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor	1186	1.13E-05	1187	2.51E-06	1188	8.93E-07
2	Wall	1190	1.85E-06	1191	4.12E-07	1192	1.74E-07

Reactor Feed Pump Room

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor (Plant North)	1196	1.12E-06	1197	3.92E-07	1198	<3.55E-7
2	Floor (Plant South)	1200	3.21E-07	1201	2.37E-07	1202	<4.75E-7

Pipe Tunnel, Condenser, & Valve Gallery

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor East Side of Reheater	1206	4.92E-04	1207	4.73E-05	1208	1.82E-05
2	Floor N End of Condenser Box	1210	5.54E-04	1211	7.21E-06	1212	9.16E-06
3	North Pipe Tunnel Floor	1216	1.12E-04	1217	3.03E-05	1218	2.15E-05
4	North Pipe Tunnel Wall	1220	6.40E-06	1221	1.10E-06	1222	5.51E-07
5	Valve Gallery (wall to Rx)	N/A	N/A	N/A	N/A	N/A	N/A
6	Valve Gallery(floor by SFP Pipe)	N/A	N/A	N/A	N/A	N/A	N/A
7	Valve Gallery (Wall to SFP)	N/A	N/A	N/A	N/A	N/A	N/A

Refuel Building

Sample #	Location	1/8" Sample		1/4" Sample		3/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Clean Up Hx Room Floor	1358	5.57E-04	1359	4.08E-05	1360	1.14E-05
2	Floor by SFP Pumps (+12')	1366	1.33E-05	1367	5.13E-07	N/A	N/A
3	Cask Wash Down Area Floor	1362	7.34E-05	1363	3.10E-06	1364	5.67E-06
4	Shutdown Hx Room Floor	1347	9.57E-05	1348	3.77E-06	1349	2.30E-06
5	Access Shaft -14' Wall	1343	2.78E-06	1344	7.40E-07	1345	7.15E-07
6	Access Shaft -14' Floor	1339	1.45E-05	1340	9.96E-07	1341	4.51E-07
7	Access Shaft -24' Floor	N/A	N/A	N/A	N/A	N/A	N/A

8	Access Shaft -34' Floor	N/A	N/A	N/A	N/A	N/A	N/A
9	Wall -66' Near Man-Lift	1302	3.95E-05	1303	8.32E-06	1304	3.43E-06
10	Floor -66' under Reactor	1294	4.81E-04	N/A	N/A	1296	5.97E-06
11	Wall -66' under Reactor	1298	2.71E-05	N/A	N/A	N/A	N/A
12	Floor -66 near REDT	N/A	N/A	N/A	N/A	N/A	N/A

Hot Machine Shop

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor in front of Lathe	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Floor by rollup door drain	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Floor in front of sink	259	1.02E-06	N/A	N/A	N/A	N/A	N/A	N/A
4	Wall behind the sink	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Floor by south-west drain	N/A	N/A	307	1.27E-03	N/A	N/A	N/A	N/A

Air Ejector Room

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor at plant east end	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Adjacent to	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	A/E Condenser								
	Outer outer ring	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Outer Ring	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Middle Ring	282	1.15E-02	N/A	N/A	307	1.27E-03	N/A	N/A
	Inner Ring	N/A	N/A	281	1.15E-03	N/A	N/A	306	2.49E-04
3	Crack in floor at plant NWt End	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	Plant West Wall	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Plant SW floor by Grate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Plant East Wall	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	Plant North Wall	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Low Level Rad waste

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor near #1 Waste Holdup Tank	617	8.65E-06	N/A	N/A	N/A	N/A	N/A	N/A
2	Floor by drip pan	619	2.04E-04	N/A	N/A	N/A	N/A	N/A	N/A
3	Floor next to #3 WRT	618	3.65E-04	N/A	N/A	N/A	N/A	N/A	N/A
4	Floor next to	620	2.13E-05	N/A	N/A	N/A	N/A	N/A	N/A

	LRW Sump								
5	Floor between LRW pumps	621	4.80E-04	N/A	N/A	N/A	N/A	N/A	N/A
6	Wall on plant north of trough	622	1.27E-04	N/A	N/A	N/A	N/A	N/A	N/A
7	Roof lower plant so. Floor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Roof floor plant NE corner	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Roof near compactor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Cal Facility

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Wall	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Turbine Enclosure

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Cs-137 uCi/gm	Sample #	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor	1189	4.35E-07	N/A	N/A	N/A	N/A	N/A	N/A
2	Wall	1193	1.75E-07	N/A	N/A	N/A	N/A	N/A	N/A

Reactor Feed Pump Room

Sample	Location	1/2" Sample	5/8" Sample	3/4" Sample	7/8" Sample

#		Cs-137 uCi/gm	Sample #	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor (Plant North)	1199	3.33E-07	N/A	N/A	N/A	N/A	N/A	N/A
2	Floor (Plant South)	1203	<4.88E-7	N/A	N/A	N/A	N/A	N/A	N/A

Pipe Tunnel, Condenser, & Valve Gallery

Sample #	Location	1/2" Sample		5/8" Sample		3/4" Sample		7/8" Sample	
		Cs-137 uCi/gm	Sample #	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Floor East Side of Reheater	1209	5.25E-06	N/A	N/A	N/A	N/A	N/A	N/A
2	Floor North End of Condenser Box	1213	3.29E-06	N/A	N/A	N/A	N/A	N/A	N/A
3	North Pipe Tunnel Floor	1219	1.50E-05	N/A	N/A	N/A	N/A	N/A	N/A
4	North Pipe Tunnel Wall	1223	8.13E-07	N/A	N/A	N/A	N/A	N/A	N/A
5	Valve Gallery (wall to Rx)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	Valve Gallery(floor near SFP Pipe)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	Valve Gallery (Wall to SFP)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Refueling Building

Sample	Location	1/2" Sample	5/8" Sample	3/4" Sample	7/8" Sample

#		Cs-137 uCi/gm	Sample #	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm	Sample #	Cs-137 uCi/gm
1	Clean Up Hx Room Floor	1361	1.16E-05	N/A	N/A	N/A	N/A	N/A	N/A
2	Floor by SFP Pumps (+12')	1369	6.44E-07	N/A	N/A	N/A	N/A	N/A	N/A
3	Cask Wash Down Area Floor	1365	5.89E-07 (Co-60 & Am241)	N/A	N/A	N/A	N/A	N/A	N/A
4	Shutdown Hx Room Floor	1350	2.39E-06	N/A	N/A	N/A	N/A	N/A	N/A
5	Access Shaft -14' Wall	1346	<3.91E-7	N/A	N/A	N/A	N/A	N/A	N/A
6	Access Shaft -14' Floor	1342	<4.81E-7	N/A	N/A	N/A	N/A	N/A	N/A
7	Access Shaft -24' Floor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	Access Shaft -34' Floor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Wall -66' Near Man-Lift	1305	9.57E-07	N/A	N/A	N/A	N/A	N/A	N/A
10	Floor -66' under Reactor	1297	1.55E-05	N/A	N/A	N/A	N/A	N/A	N/A
11	Wall -66' under Reactor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	Floor -66 near REDT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Several Drain and trench samples were collected in Unit 3 Class 1 areas. Specifically, two drains on Unit 3 roof had positive detections for Plutonium 239/240, Co-60, and Cs-137. One drain sample from the Unit 3 Generator Exciter area had detectable Cs-137 and Co-60.

Table 4-4, below, summarizes the results for samples with detectable radioactive materials present.

Table 4-4
Results Summary – Class 1 Drain and Trench Samples

Sample Number/Location	Result (pCi/g) (GEL Report #217584)			
	Cesium-137	Cobalt-60	Plutonium-239/240	Americium-241
U3 Gen/Exciter 046BS1	25.20	2.05	ND	ND
Unit 3 Roof (Survey Unit 095BS1)	4.27	0.32	ND	ND
	5.40	0.45	0.12	ND
	2.11	ND	ND	ND
	17.10	1.30	0.17	ND

Notes:
1. Result in bold print indicates concentration is greater than background levels.
2. ND = Non-Detectable. Result less than laboratory established MDC.
3. N/A = Analysis not requested for sample.

4.1.2 Class 2 Areas

4.1.2.1 Soils

The primary Class 2 Soils, per the HBPP HSA Initial MARSSIM Classifications, are the soils surrounding the Unit 3 RCA. In August and September 2007, the surface soils in this area were investigated in an effort to provide enough data to revise the MARSSIM classifications to a Class 3 area. With the data collected (i.e., soil samples and 100% gamma walkover survey), prior characterization data, and the use of an industrial release scenario, the areas may be changed to a MARSSIM Class 3 in the next revision of the HSA and also be listed as a Class 3 area in the LTP.

The characterization survey consisted of 29 soil samples and a gamma radiation walkover survey. The design of the survey was based on criteria from NUREG-1757, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Soil samples were collected at locations that were determined by using a random start point systematic grid. The sample locations were selected using the current version of Visual Sample Plan. Physical collection of the soil samples was delineated in the Survey Instructions which included the sampling process, field decontamination of tools, sample labeling requirements, and sample location. The procedure HPP-OP-002, *Chain of Custody*, was used to delineate the required chain

of custody process and requirements to ensure the integrity of the samples collected. Soil samples were submitted to General Engineering Laboratories (GEL) for gamma spectroscopy for Cs-137 and Co-60 and for analysis of Am-241, Pu-239/240, Cm-242/244, and Sr-90.

The Survey Instructions also described the procedures to be followed for the gamma radiation walkover survey which covered 100% of accessible surface soil areas using a 2x2 Sodium Iodide (NaI) detector with a scanning speed of less than 0.5 m/s. The Gamma Walkover survey was performed using a Ludlum Model 44-10 (2" x 2") NaI detector coupled to a Ludlum Model 2221 meter. A Trimble® Pathfinder ProXR Global Positioning System (GPS) was used to log the position and radiation measurements collected during the gamma walkover survey. The GPS was also used to located and log the surface soil samples collected in the area.

As shown in Table 4-5 below, the three survey units where soil samples were collected have little to no contamination present. Detectable levels of Cs-137, however all of these levels are below 0.5 pCi/g which is the site established background for Cs-137 from atmospheric testing of nuclear weapons. Survey Unit 002SS2 had the only Co.

Table 4-5
Results Summary – Class 2 Surface Soils

	Cesium -137 (pCi/g)				Cobalt-60			
Area	No of samples >MDA	Maximum	Mean	Std Deviation	No of samples >MDA	Maximum	Mean	Std Deviation
001SS2	19	0.92	0.17	0.21	0	0.05	0.01	0.01
002SS2	22	1.00	0.21	0.25	1	0.07	0.01	0.02
003SS2	Samples not collected through asphalt.							
004SS2	14	2.69	0.58	0.70	0	0.06	0.01	0.02

NOTE: All Cs-137 analyses were below site established background.

4.1.2.2 Buildings and Structures

The Class 2 buildings and structures were surveyed as described in Section 1.3.1. All surveys are attached to the survey package and controlling work package in Appendix B. All laboratory analytical data of drain and trench samples is contained in Appendix D.

Table 4-6 below shows the various HBPP buildings and areas with a monitoring result greater than MDA. Characterization results will be evaluated by the licensee to determine waste volumes for Low Level Radioactive Waste (LLRW), materials for recovery/recycle, waste materials for clean disposal, and materials to be interned on site.

A review of the data in Table 4-6 shows most areas surveyed to be below the applicable survey criteria especially when construction material backgrounds are considered and subtracted for fixed alpha and beta levels. However low level fixed alpha and/or beta activity was detected particularly on the HBPP site roofs, the unit 1 and unit 2 exterior building structure including ventilation systems at all levels, and the onsite storage tanks.

Table 4-6 also shows a number of locations where fixed alpha activity levels were obtained that exceeded the fixed alpha survey criteria of 100 dpm/100 cm^2. Unit 2 exterior building structures including ventilation systems showed some fixed alpha activity results that exceeded the MDA ranging from 58-508 dpm/100 cm^2. Unit 2 roofs showed some fixed alpha activity results that exceeded the MDA ranging from 42-302 dpm/100 cm^2. Unit 1 exterior building structures including ventilation systems showed fixed alpha activity that exceeded the MDA ranging from 45-384 dpm/100 cm^2. Unit 1 roofs showed some fixed alpha activity results that exceeded the MDA ranging from 47-348 dpm/100 cm^2.

Several tanks showed some fixed alpha activity results that exceeded the MDA above the fixed alpha survey criteria. These tanks included the Fuel Oil Storage Tank #1 (40-188 dpm/100 cm^2), Fuel Oil Storage Tank #2 (45-180 dpm/100 cm^2), the Diesel Fuel Tanks (58-130 dpm/100 cm^2), the Distilled Water Tank (58-570 dpm/100 cm^2) and the Lube Oil Storage Tank (65-317 dpm/100 cm^2) Unit 1 and Unit 2 preheater areas showed some fixed alpha activity results that exceeded the MDA above the fixed alpha survey criteria ranging from 42-513 dpm/100 cm^2.

Further general review of the data in Table 4-6 shows several locations where some removable alpha activity results exceeded the removable survey criteria of 20 dpm/100 cm^2. The Unit 3 Generator Exciter Enclosure had some removable alpha activity results ranging from 7-43 dpm/100 cm^2. Four tanks had some removable alpha activity results ranging from 20-40 dpm/100 cm^2. These tanks included the Distilled Water tank, the Diesel Fuel tank, the Lube Oil Storage tank and the Freshwater tank. Four areas had some elevated removable alpha activity results (21 dpm/100 cm^2) just at the survey criteria. These

results may have just exceeded the survey criteria due to statistical variation (Haz Mat Building, Riggers shed, Main Office and Cold Shop Roof and the Unit 3 roof).

General review of Table 4-6 also shows locations where some beta activity results exceeded the survey criteria of 1000 dpm/100 cm^2 for fixed contamination. These locations included spot contamination on the Unit 2 exhaust support structure (5855 dpm/100 cm^2), the Unit 1 Ground Floor (1011 dpm/100 cm^2), the Unit 2 Seal Oil Room Roof (2556 dpm/100 cm^2), the Office and Cold shop roof(1126 dpm/100 cm^2), three tanks including the Fuel Oil Storage Tank #1(1043 dpm/100 cm^2), the Freshwater tank (1436 dpm/100 cm^2) and the Distilled tank walls and roof (2256 and 1005 dpm/100 cm^2 respectively), the Unit 1 and Unit 2 preheater pads (maximum value of 4769 dpm fixed beta/100 cm^2). The elevated beta result from the riggers shed was remediated by PG&E RP.

Three locations showed some removable beta activity results that exceeded the survey criteria of 200 dpm/100 cm^2. These areas included the Unit 1 Building Structure 80' Level (95-275 dpm/100 cm^2), the Unit 3 Generator Excitor (200 dpm/100 cm^2) and the Unit 2 Penthouse Roof (220 dpm/100 cm^2).

Table 4-6
Survey Areas with Measurements Greater than MDA[1]

Location	Alpha (DPM/100 cm^2)		Beta (DPM/100 cm^2)	
	Fixed	Removable	Fixed	Removable
009BS2 Unit 1 Exhaust Stack and Structure	25-130	7	166-678	39-60
009BS2 Unit 1 Intake Ducting, Fan and Motor Exterior	45-144	7-11	397	< MDA
010BS2 Unit 2 Exhaust Stack Exterior	50-89	6-21	278-815	< MDA
010BS2 Unit 2 Exhaust Support Structure	< MDA	7-11	217-545, 1 pt @ 5855	< MDA
010BS2 Ventilation, Steam Drum	2 pts @ 21	< MDA	< MDA	< MDA
010BS2 Ventilation, U2 Air Inlet Exterior	< MDA	7	234-310	40-56
010BS2 Ventilation, U2 Air Intake Fan Housing	55-214	< MDA	221-714	< MDA
010BS2 Ventilation, U2 Air Intake Interior	< MDA	< MDA	206-291	117
011BS2 Unit 1 Ground Floor Floors	< MDA	1-2	210-1011	< MDA
011BS2 Unit 1 Ground Floor Walls	< MDA	< MDA	130-240	< MDA
011BS2 Unit 1 Ground Floor Ceiling	< MDA	< MDA	170-315	< MDA

012BS2 Unit 1 2nd Floor Ceiling	30-90	< MDA	< MDA	< MDA
012BS2 Unit 1 2nd Floor Walls	< MDA	< MDA	140-240	18
012BS2 Unit 1 2nd Floor Floors	< MDA	< MDA	180-350	28
013BS2 Unit 2 Ground Floor Floors	< MDA	< MDA	200-400	< MDA
013BS2 Unit 2 Ground Floor Ceiling	< MDA	1	300-420	< MDA
013BS2 Unit 2 Ground Floor Walls	< MDA	1	1 pt @ 200	< MDA
014BS2 Unit 2 2nd Floor Floors	8-12	1	200-400	< MDA
014BS2 Unit 2 2nd Floor Ceiling	< MDA	< MDA	< MDA	< MDA
014BS2 Unit 2 2nd Floor Walls	< MDA	< MDA	260-330	< MDA
015BS2 Unit 2 Seal Oil Room Exterior	< MDA	< MDA	275-341	< MDA
015BS2 Unit 2 Seal Oil Room Roof	42-656	< MDA	480-2556	< MDA
015BS2 Unit 2 Seal Oil Room Interior	< MDA	< MDA	200-400	< MDA
016BS2 Unit 2 Condenser	< MDA	< MDA	204-317	< MDA
017BS2 Unit 2 Firebox, Interior	42-79	7-14	385-556	< MDA
017BS2 Unit 2 Firebox, Exterior	< MDA	< MDA	276-408	< MDA
017BS2 Unit 2 Lower Exhaust to Stack	2 pts @ 23	< MDA	< MDA	< MDA
018BS2 Unit 2 2.4 kv room	42-106	< MDA	246-514	< MDA
019BS2 Unit 2 56' structures	1 pt @ 53	7	159-430	< MDA
019BS2 Unit 2 73' structures	65-72	7	1 pt @ 542	< MDA
019BS2 Unit 2 80' Structures	60-508	< MDA	198-282	< MDA
019BS2 Unit 2 46' Structures	< MDA	< MDA	170-520	< MDA
019BS2 Unit 2 47.5' Structures	58-108	7-10	1 pt @ 234	< MDA
019BS2 Unit 2 27' Structures	< MDA	< MDA	189-377	< MDA
019BS2 Unit 2 97.5' Structures	55-60	7	< MDA	< MDA
019BS2 Unit 2 64' Structures	16-90	< MDA	< MDA	< MDA
020BS2 Unit 1 Seal Oil Room, Interior	< MDA	1	163-681	< MDA
020BS2 Unit 1 Seal Oil Room, Exterior	1 pt @ 111	7	195-722	< MDA
020BS2 Unit 1 Seal Oil Room, Roof	37-107	1	< MDA	< MDA
021BS2 Unit 1 Condenser	29-43	7	1 pt @ 190	< MDA
023BS2 Unit 1 Building Structures, U1 27' Structures	1 pt @ 69	< MDA	201-317	< MDA
023BS2 Unit 1 Building Structures, U1 47.5' Structures	45-142	< MDA	188-304	< MDA
023BS2 Unit 1 Building Structures, U1 56' Structures	64-176	< MDA	248-944	< MDA
023BS2 Unit 1 Building Structures, U1 64' Structures	71-221	< MDA	253-464	< MDA
023BS2 Unit 1 Building Structures, U1 73' Structures	45-172	< MDA	194-642	< MDA

023BS2 Unit 1 Building Structures, U1 80' Structures	73-384	< MDA	287-559	95-275
023BS2 Unit 1 Building Structures, U1 97.5' Structures	60-271	7	208-231	< MDA
025BS2 Cold Machine Shop Walls	< MDA	< MDA	195-202	< MDA
025BS2 Cold Machine Shop Floors	< MDA	< MDA	180-340	< MDA
025BS2 Cold Machine Shop Upper Walls & Ceiling	< MDA	< MDA	168-260	< MDA
026BS2 Weld Shop Walls & ceiling	< MDA	7	< MDA	< MDA
026BS2 Weld Shop Floor	< MDA	< MDA	184-311	< MDA
027BS2 Warehouse Floor	16-37	< MDA	208-280	< MDA
027BS2 Warehouse Interior	< MDA	< MDA	124-692	< MDA
028BS2 Office & Shop Interior Floors	18-24	< MDA	221-347	< MDA
028BS2 Office & Shop Interior Walls & Ceiling	< MDA	< MDA	225-331	< MDA
028BS2 Office and Shop Spaces Roof	25-536	7-21	224-1126	< MDA
028BS2 Office and Shop Spaces Exterior	18-110	7	197-382	< MDA
029BS2 Oily Water Sump	< MDA	< MDA	< MDA	< MDA
032BS1 Unit 3 Seal Oil Room Walls	< MDA	< MDA	216-511	< MDA
032BS1 Unit 3 Seal Oil Room Floor	< MDA	7	1 pt @ 328	< MDA
032BS1 Unit 3 Seal Oil Room Ceiling	< MDA	7	< MDA	< MDA
044BS1 Propane Engine Generator Interior Floor	< MDA	< MDA	234-487	< MDA
044BS1 Propane Engine Generator Interior Walls	< MDA	7	227-476	< MDA
044BS1 Propane Engine Generator Ceiling	< MDA	7	231-426	< MDA
044BS1 Propane Engine Generator Exterior Walls	1 pt @ 58	< MDA	247-626	< MDA
046BS1 Unit 3 Generator Excitor Walls	63-151	7-11	167-339	< MDA
046BS1 Unit 3 Generator Excitor Floor	63-302	7	177-505	< MDA
046BS1 Unit 3 Generator Excitor Drains	< MDA	7-14	242-663	< MDA
046BS1 Unit 3 Generator Excitor Enclosure Exterior Walls and Ceiling	79-143	7-43	1 pt @ 170	200
046BS1 Unit 3 Generator Excitor Interior Surfaces	< MDA	7	< MDA	< MDA
060BS3 Relay building exterior and interior	< MDA	< MDA	< MDA	< MDA
061BS3 Steam Cleaning Station	< MDA	< MDA	223-385	< MDA
062BS3 Oily Water Sepators Pits	< MDA	< MDA	227-354	104-157
062BS3 Oily Water Sepators Pad and Walkways	79	< MDA	220-278	104-126
063BS3 Assembly Building Roof	< MDA	< MDA	260-300	< MDA
063BS3 Assembly Building Interior	< MDA	< MDA	219	< MDA

063BS3 Assembly Building Exterior Wall	58	< MDA	< MDA	< MDA
064BS3 Training Building Exterior	< MDA	< MDA	234-340	< MDA
064BS3 Training Building Roof	50-75	7	250-400	< MDA
064BS3 Training Building Interior	< MDA	< MDA	249-733	< MDA
065BS3 Out of Stock Warehouse Exterior Walls	< MDA	< MDA	191-354	< MDA
065BS3 Out of Stock Warehouse Interior Floor	18-49	7	191-285	< MDA
065BS3 Out of Stock Warehouse Interior Walls and Ceiling	< MDA	< MDA	191-285	< MDA
066BS3 Feedwater Intake Structure Ground	55-89	< MDA	370-789	< MDA
066BS3 Feedwater Intake Structure Pits	15-60	7	566	< MDA
067BS3 Unit 3 Transfer Yard Structures	40	7	280	< MDA
068BS3 Riggers Shed Exterior	< MDA	7-21	90-160	< MDA
068BS3 Riggers Shed Interior	< MDA	< MDA	8178	120
069BS3 Fuel Oil Service Tanks, Tank #1 Walls	72-94	7-10	176-473	< MDA
069BS3 Fuel Oil Service Tanks, Tank #1 Roof	65-87	7-10	166-393	< MDA
069BS3 Fuel Oil Service Tanks, Tank #2 Walls	< MDA	7-10	212-370	< MDA
069BS3 Fuel Oil Service Tanks, Tank #2 Roof	1 pt @ 45	7-10	197-249	< MDA
070BS3 Hydrogen Storage Building Interior of Enclosed Room	< MDA	< MDA	309-353	< MDA
070BS3 Hydrogen Storage Building Interior of Open Air Section	< MDA	< MDA	322-573	< MDA
070BS3 Hydrogen Storage Building Exterior	72-108	7	1 pt @ 256	< MDA
071BS3 Propane Tank	< MDA	< MDA	249-257	< MDA
072BS3 Freshwater Tank, Roof	58-462	7-20	185-828	< MDA
072BS3 Freshwater Tank, Walls	57-260	17-33	212-1436	< MDA
073BS3 Fire Water Pump House Exterior	< MDA	< MDA	90-450	< MDA
073BS3 Fire Water Pump House Ceiling	< MDA	< MDA	367	< MDA
073BS3 Fire Water Pump House Interior	< MDA	< MDA	170-195	< MDA
073BS3 Fire Water Pump House Roof	50-98	< MDA	193-465	< MDA
073BS3 Fire Water Pump House Floor	< MDA	< MDA	150-359	< MDA
074BS3 Office Annex Floors	1 pt @ 16	< MDA	220-630	< MDA
074BS3 Office Annex Interior Walls	1 pt @ 16	< MDA	<MDA	< MDA
074BS3 Aux Admin Roof	55-105	< MDA	310-560	< MDA
074BS3 Office Annex Exterior Walls	< MDA	7	< MDA	< MDA
075BS3 MEPPS 2 & 3 Control Trailer Roof	25-100	7	170-530	< MDA
075BS3 MEPPS 3 Enclosure & Horizontal	55-130	< MDA	200-250	< MDA

Surfaces				
075BS3 MEPPS 2 Enclosure & Horizontal Surfaces	55-110	< MDA	184-303	< MDA
075BS3 MEPPS 2 Interior	< MDA	< MDA	1 pt @ 200	< MDA
075BS3 MEPPS 2 & 3 Control Trailer Ext. Walls	58-87	< MDA	< MDA	< MDA
075BS3 MEPPS 2 Enclosure Building Ext. Walls	1 pt @ 58	< MDA	1 pt @ 234	< MDA
075BS3 MEPPS 3 Enclosure Building Ext. Walls	< MDA	< MDA	< MDA	< MDA
075BS3 MEPPS Interior	< MDA	< MDA	< MDA	< MDA
076BS3 MEPP Control Building Ext. Wall	< MDA	< MDA	< MDA	< MDA
076BS3 MEPPS Control Building Roof	< MDA	7	1 pt @ 219	< MDA
077BS3 Security Building Interior	< MDA	< MDA	250-500	< MDA
077BS3 Security Building Roof	80	7	200-500	< MDA
077BS3 Security Building Exterior	< MDA	< MDA	< MDA	< MDA
078BS3 FFD Trailer Exterior	70-100	7	250-400	< MDA
078BS3 FFD Trailer Interior	< MDA	< MDA	< MDA	< MDA
081BS3 Haz-Mat Storage Building Exterior	< MDA	7-21	190-300	< MDA
081BS3 Haz-Mat Storage Building Interior	< MDA	< MDA	100-200	< MDA
081BS3 Haz-Mat Storage Building Roof	55-200	7-10	260-400	< MDA
082BS3 Fuel Oil Storage Tanks, Tank #1 Walls	58-188	< MDA	204-469	< MDA
082BS3 Fuel Oil Storage Tanks, Tank #1 Roof	40-129	< MDA	238-1043	< MDA
082BS3 Fuel Oil Storage Tanks, Tank #2 Walls	60-180	< MDA	224-304	< MDA
082BS3 Fuel Oil Storage Tanks, Tank #2 Roof	45-153	< MDA	179-605	< MDA
083BS3 Diesel Fuel Tanks, Walls	58-130	7-40	169-355	108-164
083BS3 Diesel Fuel Tanks, Roofs	58-108	7-13	< MDA	< MDA
084BS2 Distilled Water Tanks, Walls	< MDA	7-20	317-2256	< MDA
084BS2 Distilled Water Tanks, Roof	58-570	7-40	212-1005	117-146
085BS3 Lube Oil Storage Tanks, Roofs	65-317	20	214-504	< MDA
085BS3 Lube Oil Storage Tanks, Walls	< MDA	< MDA	1 pt @ 186	< MDA
085BS3 Lube Oil Storage Tanks, Basin	2 pts @ 58	< MDA	190-473	< MDA
095BS1 Unit 3 Roof	79-317	7-21	190-952	< MDA
098BS2 Unit 1 Roofs, U1 42' South Roof	65-348	7-10	317-586	< MDA
098BS2 Unit 1 Roofs, U1 42' Northwest Roof	< MDA	7-10	234-268	< MDA
098BS2 Unit 1 Roofs, U1 42' Northeast Roof	60-99	< MDA	1 pt @ 212	< MDA
098BS2 Unit 1 Roofs, U1 50' Roof	47-177	< MDA	261-548	98-107

098BS2 Unit 1 Roofs, Penthouse Roof	49-293	7-10	189-363	< MDA
099BS2 Unit 2 50' Roof	37-180	7	263-685	< MDA
099BS2 Unit 2 42' NE & NW Roof	45-68	7	214-603	< MDA
099BS2 Unit 2 Penthouse Roof	42-143	7	363-981	220
099BS2 Unit 2 42' South Roof	48-302	10	462-760	< MDA
101BS2 Unit 1 Penthouse Exterior Walls	15-134	7-11	198-556	< MDA
101BS2 Unit 2 Penthouse Exterior Walls	55-99	7-11	231-624	< MDA
102BS2 Unit 2 Preheater Pad 2nd Level	42-513	< MDA	242-4769	< MDA
102BS2 Unit 2 Preheater Pad 1st Level	45-164	7	223-590	< MDA
102BS2 Unit 1 Preheater	42-513	< MDA	146-839, 1 pt @ 2423	< MDA
102BS2 Unit 2 Preheater	22-208	< MDA	219-722	< MDA
104BS3 Metal Storage Building Floor	< MDA	7	< MDA	< MDA
104BS3 Metal Storage Building Roof	1 pt @ 61	7	< MDA	< MDA
104BS3 Metal Storage Building Exterior Walls	< MDA	10	< MDA	104
104BS3 Metal Storage Building Interior Walls	< MDA	< MDA	< MDA	< MDA
105BS3 Paint Shop Exterior Walls	49-104	< MDA	412-480	< MDA
105BS3 Paint Shop Exterior Roof	79-238	17	231-729	< MDA

NOTE: (1) Material specific natural background radiation has not been subtracted from results shown

In general, Units 1 and 2 are primarily free of radioactive materials, however, some detectable contamination was detected on the roofs, in drains, and in trenches. Primarily, the measured radioactivity was Cs-137, with a couple detections of Co-60 and Plutonium 239/240 (Unit 3 Roof Drains). Table 4-7, shown below, provides a summary of sample results from laboratory data for drains and trenches for Class 2 Areas is attached.

Table 4-7
Results Summary – Drain and Trench Samples

Sample Number/Location	Result (pCi/g) (GEL Report #217584)			
	Cesium-137	Cobalt-60	Plutonium-239/240	Americium-241
Unit 2 Ventilation Intake (Survey Unit 010BS2)	0.66	ND	N/A	ND
	0.11	ND	N/A	ND
Unit 1 Second Floor (Survey Unit 012BS2)	0.86	ND	N/A	ND
	0.82	0.08	N/A	ND
	2.58	ND	N/A	ND
	0.59	ND	N/A	ND
	1.18	ND	N/A	ND

Unit 1 Second Floor (Survey Unit 012BS2) (cont.)	4.44	ND	N/A	ND
	7.79	0.42	N/A	ND
	4.66	ND	N/A	ND
	1.72	ND	N/A	ND
	2.82	ND	N/A	ND
	1.02	ND	N/A	ND
	0.72	ND	N/A	ND
	2.29	ND	N/A	ND
	1.12	ND	N/A	ND
	1.37	ND	N/A	ND
	1.07	ND	N/A	ND
	0.70	ND	N/A	ND
Unit 2 Ground Floor (Survey Unit 13BS2)	1.55	ND	N/A	ND
	0.97	ND	N/A	ND
	4.77	ND	N/A	ND
	7.53	0.30	N/A	ND
	1.03	ND	N/A	ND
	0.68	ND	N/A	ND
	1.40	ND	N/A	ND
	15.20	0.52	N/A	ND
Unit 2 Second Floor (Survey Unit 014BS2)	2.12	0.14	N/A	ND
	9.09	ND	N/A	ND
	3.79	0.27	N/A	ND
	2.57	ND	N/A	ND
	3.06	ND	N/A	ND
Unit 2 Condenser (Survey Unit 016BS2)	0.16	ND	N/A	ND
	0.19	ND	N/A	ND
	0.16	ND	N/A	ND
	0.72	ND	N/A	ND
	0.16	ND	N/A	ND
Unit 1 Seal Oil Rm 020BS2	1.27	ND	N/A	ND
Unit 1 Condenser (Survey Unit 021BS2)	0.28	ND	N/A	ND
	0.14	ND	N/A	ND
	0.50	ND	N/A	ND
	0.29	ND	N/A	ND
	0.22	ND	N/A	ND
U2 Oil/Water Sump 029BS2	0.23	ND	N/A	ND
U3 Gen/Exciter 046BS1	25.20	2.05	ND	ND
Switchyard Structures (Survey Unit 067BS3)	1.07	ND	N/A	ND
	0.35	ND	N/A	ND
	0.40	ND	N/A	ND
	0.17	ND	N/A	ND
	0.20	ND	N/A	ND
Fire Water P-House 073BS3	0.60	ND	N/A	ND
MEPPS Ctl Bldg 075/076BS3	0.53	ND	ND	ND

Security Bldg 077BS3	0.42	ND	N/A	ND
Unit 3 Roof (Survey Unit 095BS1)	4.27	**0.32**	ND	ND
	5.40	**0.45**	**0.12**	ND
	2.11	ND	ND	ND
	17.10	**1.30**	**0.17**	ND
Unit 1 Roofs (Survey Unit 098BS2)	0.81	ND	N/A	ND
	3.86	ND	N/A	ND
	0.81	ND	N/A	ND
Unit 2 Roofs (Survey Unit 099BS2)	8.72	ND	N/A	ND
	7.94	ND	N/A	ND
	4.81	ND	N/A	ND
	4.43	ND	N/A	ND
	1.97	ND	N/A	ND
	0.56	ND	N/A	ND
	7.38	ND	N/A	ND
	1.76	**0.52**	N/A	ND
	3.37	ND	N/A	ND
	2.94	ND	N/A	ND
	7.24	ND	N/A	ND
	2.55	ND	N/A	ND
Unit 1 and Unit 2 Feed Water Heater Ground Area and 2nd Floor Platform (Pre-Heaters) (Survey Unit102BS2)	0.29	ND	N/A	ND
	1.03	ND	N/A	ND
	2.28	ND	N/A	ND
	6.01	ND	N/A	ND
	1.62	ND	N/A	ND
	2.32	ND	N/A	ND
	12.60	**0.35**	N/A	ND
	0.75	ND	N/A	ND
	22.50	**0.58**	N/A	ND
	5.47	**0.30**	N/A	ND
	1.65	ND	N/A	ND
	0.64	ND	N/A	ND
	0.59	ND	N/A	ND
	0.52	ND	N/A	ND

Notes:
1. Result in bold print indicates concentration is greater than background levels.
2. ND = Non-Detectable. Result less than laboratory established MDC.
3. N/A = Analysis not requested for sample.

4.1.3 Class 3 Areas

4.1.3.1 Soils

Two Class 3 survey areas were surveyed in 2007. The purpose of the sampling effort was to characterize the soils in the area designated for the Humboldt Bay Repowering Project (HBRP); also known as the New Gen area. The following is a summary of the sampling effort in the HBRP Area. The information was extracted from a letter dated September 2, 2008, *DGM08-004*, that was sent to Mr. David Sokolsky, HBPP Licensing Manager, in regards to the "Radiological Status of the Humboldt Bay Repowering Project Soils." The letter also summarized previous sampling efforts in the HBRP/New Gen area.

<u>Survey Package 005SS3, Humboldt Bay Repowering Project Area</u>

<u>Operational History of Survey Unit</u>

The HBRP area was not involved in typical plant work activities during operation of the HBPP Unit 3 Nuclear Reactor. The Northern portion of this area is downwind of the Unit 3 stack, for the typical Winter South to Southeast winds. A large portion of this area has been covered by fill material with about one third of the fill material placed prior to Unit 3 operation and about half of the fill material placed since the beginning of Unit 3 operation. The historical activities in filled portions of this survey area are related to landscaping, operation of the Mobile Electric Power Plants (MEPPs), diesel oil storage, material/equipment storage, painting (and sandblasting to prepare for painting), office space and employee parking. The area has underground piping and electrical conduits. Items of interest in the survey area include the original sanitary sewer leach field for Unit 3 (South of the Oily Water Separator), and the filled drainage ditch/drainpipe that was constructed parallel to the rail spur roadbed.

<u>Detailed Physical Description of the HBRP</u>

This survey unit contains the land area where the HBRP will occur. Some of the survey unit, approximately 50%, is covered by asphalt and/or rock. The remaining surface soil is covered with grass and other natural vegetation. This area has been initially classified as a MARSSIM Class 3 area due to the very low potential for radiological contamination to be present based off of soil sample data from the IT/Duratek 1997 Characterization effort.

<u>Characterization Survey Instructions Summary</u>

The characterization survey consisted of 14 soil samples and a gamma radiation walkover survey. The design of the Characterization Survey was based on criteria from NUREG-1757, Multi-Agency Radiation

Survey and Site Investigation Manual (MARSSIM). Soil samples were collected at locations that were determined by random selection using the current version of Visual Sample Plan. Physical collection of the soil samples was delineated in the Survey Instructions which included the sampling process, field decontamination of tools, sample labeling requirements, and sample location. The procedure HPP-OP-002, *Chain of Custody*, was used to delineate the required chain of custody process and requirements to ensure the integrity of the samples collected. Soil samples were submitted to General Engineering Laboratories (GEL) for gamma spectroscopy for Cs-137 and Co-60 and for analysis of Am-241, Pu-239/240, Cm-242/244, Sr-90, and Tritium.

The Survey Instructions also described the procedures to be followed for the gamma radiation walkover survey which covered 100% of accessible surface soil areas using a 2x2 Sodium Iodide (NaI) detector with a scanning speed of less than 0.5 m/s. The Gamma Walkover survey was performed using a Ludlum Model 44-10 (2" x 2") NaI detector coupled to a Ludlum Model 2221 meter. A Trimble® Pathfinder ProXR Global Positioning System (GPS) was used to log the position and radiation measurements collected during the gamma walkover survey. The GPS was also used to located and log the surface soil samples collected in the area.

Characterization Data Results

The survey of the area indicated no significant detectable contamination from HBPP Unit 3 nuclear reactor operations. One surface soil sample result indicated a Cs-137 concentration of 0.653 pCi/g with a two-sigma uncertainty of ± 0.084pCi/g. All other Cs-137 sample results were less than the HBPP site established background of 0.5 pCi/g Cs-137. The Cs-137 and Co-60 results are summarized in Table 4-5 below. All results for Co-60, Am-241, Pu-239/240, Cm-242/244, Sr-90, and Tritium were not detected. The result of the soil sample Gamma radiation surveys indicated no levels of gamma radiation greater than twice background. Laboratory analysis reports from General Engineering Laboratories are attached as well as drawings of the surface soil sample locations and the gamma walkover measurement locations.

Table 4-8, below, summarizes the sample results for the HBRP area.

Table 4-8
Results Summary – HBRP Surface Soil Samples

Area	Cesium -137 (pCi/g)				Cobalt-60			
	No of samples >MDA	Max	Mean	Std Dev.	No of samples >MDA	Max	Mean	Std Dev.
005SS3 HBRP Area	8	0.65	0.13	0.17	0	0.02	0.00	0.02
006SS3 HBRP Access Rd	13	0.44	0.17	0.11	0	0.02	0.01	0.01

4.1.2.2 Buildings and Structures

For Class three areas, trenches and drains were sampled for radioactive material. The samples were collected and sent to GEL for analysis. Only a few drains in Class three areas had detectable levels of radioactive materials; of which, only Cs-137 was detected. No alpha emitting radionuclides were detected and Co-60 was not detected. Table 4-8 below provides a summary of the analysis data for samples with detectable levels of radioactive materials. The GEL laboratory reports are contained in Appendix D.

Table 4-9
Results Summary – Class 3 Drain and Trench Samples

Sample Number/Location	Result (pCi/g) (GEL Report #217584)			
	Cesium-137	Cobalt-60	Plutonium-239/240	Americium-241
Office and Shop Structures (Survey Unit 028BS3)	0.26	ND	ND	ND
	0.34	ND	ND	ND
	0.36	ND	ND	ND
	0.48	ND	ND	ND
	0.44	ND	ND	ND
	0.40	ND	ND	ND
	0.51	ND	ND	ND
	0.41	ND	ND	ND
Switchyard Structures (Survey Unit 067BS3)	1.07	ND	N/A	ND
	0.35	ND	N/A	ND
	0.40	ND	N/A	ND
	0.17	ND	N/A	ND
	0.20	ND	N/A	ND
Fire Water P-House 073BS3	0.60	ND	N/A	ND
MEPPS Ctl Bldg 075/076BS3	0.53	ND	ND	ND
Security Bldg 077BS3	0.42	ND	N/A	ND

Notes:
1. Result in bold print indicates concentration is greater than background levels.
2. ND = Non-Detectable. Result less than laboratory established MDC.
3. N/A = Analysis not requested for sample.

5.0 Conclusions

Characterization surveys were conducted at HBPP following a MARSSIM process described in HBPP-PP-003, *Site Characterization Plan.* After performing an area walkdown and an analysis of prior characterization data, each survey was planned using an HBPP Work Control Package and a Characterization Survey Package. The Characterization Survey Package was used to document the survey instructions, the history of each area, a detailed description of each area, pictures, and data results. The work control package was used to notify area supervisors of pending work and to establish the required safety protocols.

The radiological characterization surveys showed that surveyed areas of HBPP that were impacted by the operation of the Unit 3 nuclear reactor. However, not all measurements and samples exhibited detectable contamination. Where detected, the levels of contamination are low and are typically limited to building roofs, drains and/or trenches. For soils, the levels of contamination, when detected in a sample, were significantly less than the potential site specific Derived Concentration Guideline Levels (DCGL) that are being developed for the HBPP LTP industrial release scenario. All sample results for Class 2 and Class 3 soils were less than the NRC Radionuclide Screening values, which are less that the industrial release scenario DCGLs by a factor of approximately 5. Nearly all radiological measurements for Class 2 and Class 3 buildings and surfaces were less than the HBPP release values that are based on Reg Guide 1.86.

The HBPP Characterization data will be used, in conjunction with previous data, to support the Humboldt Bay Power Plant License Termination Plan. In addition, revision of the HBPP HSA to include the new characterization data should be completed.

6.0 References

NUREG-1757, Revision 1, August 2000, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

HBPP-PP-003 Rev. 0 Site Characterization Plan

HBPP-OP-002 Rev. 0 Chain of Custody

HBPP-OP-005 Rev. 0 Radiological Surveys

HBPP-OP-006 Rev. 1 Instrument Source and Response Check

HBPP-OP-008 Rev. 0 Field Decontamination of Sampling Equipment

HBPP-OP 009 Rev. 0 Sampling Materials for Radiological Characterization

HBPP-OP-010 Rev. 0 Sample Handling

HBPP-OP-011 Rev. 0 Radiological Characterization Scans and Measurements

HBPP-OP-012 Rev. 0 Technician Training, Qualifications and Authorization

Battelle, 1983, Residual Radionuclide and Inventory at the Humboldt Bay Nuclear Power Plant.

GTS Duratek, 1998a, Background Study for the Humboldt Bay Power Plant.

GTS Duratek, 1998b, Structural Characterization Report for the Humboldt Bay Power Plant.

GTS Duratek, 1997a, HBPP Site Radiological Characterization Quality Assurance Project Plan.

GTS Duratek, 1997b, Sample Analysis and Data Management Plan.

GTS Duratek, 1997c, Illness and Injury Prevention Plan.

IT Corporation, 1997a, Environmental Radiological Survey Plan.

IT Corporation, 1997b, Calculation of Soil Cleanup Guidelines for Residual Radionuclides at the PG&E Humboldt Bay Power Plant.

HBPP Work Package SAPN Listings and Survey Packages

- **Work Package SAP# 1246478 – First Work Order**
  - **Survey Package 073BS3 – Fire Water Pump House**
    - 08-001, 29/05/2008, Ceiling Fire Water Pump House
    - 08-002, 29/05/2008, Fire Water Pump House Interior
    - 08-003, 29/05/2008, Fire Water Pump House Exterior
    - 08-004, 29/05/2008, Fire Water Pump House Roof
    - 08-005, 29/05/2008, Fire Water Pump House Floor
    - 08-179, 20/09/2008, QC2 of Fire Water Pump House
    - 08-180, 21/09/2008, QA of Fire Water Pump House
- **Work Package SAP# 1246478 – Second Work Order**
    - 08-008, 30/05/2008, Unit 1 & Unit 2 Asbestos Containing Material
    - 08-016, 09/06/2008, Unit 1 & Unit 2 Trenches & Drains
  - **Survey Package 011BS2 – Unit 1 Ground Floor (+12 Elev.)**
    - 08-009, 30/05/2008, Unit 1 Ground Floor
    - 08-010, 03/06/2008, Unit 1 Ground Floor Walls
    - 08-020, 20/06/2008, Unit 1 +12 Ceiling
  - **Survey Package 012BS2 – Unit 1 Second Floor (+27 Elev.)**
    - 08-013, 09/06/2008, Unit 1 2nd Floor, Floor
    - 08-023, 23/06/2008, Unit 1 +27 Walls
    - 08-027, 23/06/2008, Unit 1 +27 Ceiling (1 of 2)
    - 08-028, 23/06/2008, Unit 1 +27 Ceiling (2 of 2)
  - **Survey Package 013BS2 – Unit 2 Ground Floor (+12 Elev.)**
    - 08-011, 03/06/2008, Unit 2 Ground Floor
    - 08-021, 20/06/2008, Unit 2 +12 Ceiling
    - 08-024, 23/06/2008, Unit 2 +12 Walls
    - 08-053, 16/07/2008, Unit 2 12' Walls 2
    - 08-111, 27/08/2008, Unit 2 +12 Walls 3
  - **Survey Package 014BS2 – Unit 2 Ground Floor (+27 Elev.)**
    - 08-012, 09/06/2008, Unit 2 27' Floor
    - 08-015, 09/06/2008, Unit 2 27' Walls
    - 08-025, 23/06/2008, Unit 2 +27 Ceiling (1 of 2)
    - 08-026, 23/06/2008, Unit 2 +27 Ceiling (2 of 2)
  - **Survey Package 060BS3 – Relay Building**
    - 08-006, 30/05/2008, Relay Building Interior
    - 08-007, 30/05/2008, Relay Building Exterior
- **Work Package SAP# – Work Order U1-1**
  - **Survey Package 009BS2 – Unit 1 Ventilation Intake**
    - 08-206, 29/09/2008, Unit 1 Stack and Exhaust Structures
    - 08-268, 15/10/2008, Unit 1 Intake Ducting, Fan, & Fan Motor Exterior
  - **Survey Package 021BS2 – Unit 1 Condenser**
    - 08-104, 23/08/2008, Unit 1 Condenser
  - **Survey Package 022BS2 – Unit 1 Boiler/Firebox**
    - Surveyed within 023BS2-Unit 1 Building Structures

- **Work Package SAP# 1246478 – Work Order U1-2**
  - **Survey Package 020BS2 – Unit 1 Seal Oil Room**
    - 08-017, 16/06/2008, Unit 1 Seal Oil Room Roof
    - 08-018, 17/06/2008, Unit 1 Seal Oil Room Exterior
    - 08-019, 17/06/2008, Unit 1 Seal Oil Room Interior
  - **Survey Package 023BS2 – Unit 1 Building Structures**
    - 08-047, 11/07/2008, Unit 1 97.5' Structures
    - 08-048, 11/07/2008, Unit 1 73' Structures Additional Points
    - 08-049, 11/07/2008, Unit 1 64' Structures Additional Points
    - 08-055, 17/07/2008, Unit 1 56' Structures Additional Points
    - 08-056, 17/07/2008, Unit 1 47.5' Structures Additional Points
    - 08-057, 17/07/2008, Unit 1 80' Structures Additional Points
    - 08-059, 18/07/2008, Unit 1 27' Structures Additional Points
    - 08-060, 23/07/2008, Unit 1 27' Structures
    - 08-061, 23/07/2008, Unit 1 47.5' Structures
    - 08-062, 23/07/2008, Unit 1 56' Structures
    - 08-063, 23/07/2008, Unit 1 64' Structures
    - 08-064, 23/07/2008, Unit 1 73' Structures
    - 08-065, 23/07/2008, Unit 1 80' Structures
  - **Survey Package 098BS2 – Unit 1 Roofs**
    - 08-022, 20/06/2008, Unit 1 50' Roof
    - 08-029, 23/06/2008, Unit 1 42' Roof South
    - 08-030, 24/06/2008, Unit 1 42' Roof Northwest
    - 08-031, 24/06/2008, Unit 1 42' Roof (resurvey)
    - 08-032, 25/06/2008, Unit 1 Penthouse Roof
    - 08-033, 25/06/2008, Unit 1 Penthouse Roof (resurvey)
    - 08-038, 26/06/2008, Unit 1 42' Roof Northeast
- **Work Package SAP# 1246729-01 – Work Order U2-1**
  - **Survey Package 015BS2 – Unit 2 Seal Oil Room**
    - 08-041, 01/07/2008, Unit 2 Seal Oil Room Interior
    - 08-044, 02/07/2008, Unit 2 Seal Oil Room Roof
    - 08-045, 07/07/2008, Unit 2 Seal Oil Exterior Walls
  - **Survey Package 018BS2 – 2.4 kV Room**
    - 08-046, 09/07/2008, Unit 2 2.4 kV Room
  - **Survey Package 019BS2 – Unit 2 Building Structures**
    - 08-066, 25/07/2008, Unit 2 46 Foot Structures
    - 08-067, 25/07/2008, Unit 2 80' Structures
    - 08-068, 25/07/2008, Unit 2 73' Structures
    - 08-071, 05/08/2008, Unit 2 56' Structures (1 of 3)
    - 08-072, 05/08/2008, Unit 2 56' Structures (2 of 3)
    - 08-073, 05/08/2008, Unit 2 56' Structures (3 of 3)
    - 08-074, 05/08/2008, Unit 2 64' Structures (1 of 4)
    - 08-075, 05/08/2008, Unit 2 64' Structures (2 of 4)
    - 08-076, 05/08/2008, Unit 2 64' Structures (3 of 4)
    - 08-077, 05/08/2008, Unit 2 64' Structures (4 of 4)
    - 08-079, 05/08/2008, Unit 2 97.5' Structures

        - 08-080, 05/08/2008, Unit 2 27' Structures
        - 08-101, 20/08/2008, Unit 2 47.5' Structures
    - **Survey Package 029BS2 – Unit 2 Oily Water Sump**
        - 08-203, 25/09/2008, Unit 2 Oily Water Sump
    - **Survey Package 099BS2 – Unit 2 Roofs**
        - 08-039, 27/06/2008, Unit 2 Penthouse Roof
        - 08-040, 30/06/2008, Unit 2 42' NE and NW Roof
        - 08-042, 01/07/2008, Unit 2 50' Roof
        - 08-043, 01/07/2008, Unit 2 42' Roof South
- **Work Package SAP# 1246832 – Work Order U2-2**
    - **Survey Package 025BS2 – Cold Machine Shop**
        - 08-146, 13/09/2008, Cold Machine Shop Floor
        - 08-164, 16/09/2008, Cold Machine Shop Walls
        - 08-202, 25/09/2008, Cold Machine Shop Ceiling and Upper Walls
    - **Survey Package 026BS2 – Welding Shop**
        - 08-177, 20/09/2008, Weld Shop Floor and Brick
        - 08-185, 23/09/2008, Weld Shop Walls & Ceiling
    - **Survey Package 027BS2 – Warehouse**
        - 08-147, 13/09/2008, Warehouse Floor
        - 08-176, 20/09/2008, Warehouse Interior
        - 08-194, 24/09/2008, Warehouse Interior Pt. 1
    - **Survey Package 028BS2 – Office and Shop Structures**
        - 08-181, 21/09/2008, Office & Shop Interior Walls and Ceiling
        - 08-182, 21/09/2008, Office & Shop Interior Floors
        - 08-212, 01/10/2008, Office & Shop Roofs
        - 08-215, 01/10/2008, Office & Shop Exterior
    - **Survey Package 101BS2 – Unit 1 & 2 1st and 2nd Floor Exteriors**
        - 08-226, 03/10/2008, Penthouse #2 Exterior Walls
        - 08-227, 03/10/2008, Penthouse #1 Exterior Walls
        - Survey Package Completed within other Survey Packages
    - **Survey Package 102BS2 – Unit 1 & 2 Pre-Heater Areas and Outside**
        - 08-183, 23/09/2008, Pre-heater Pad Second Level (Part 1 of 2)
        - 08-184, 23/09/2008, Pre-heater Pad Second Level (Part 2 of 2)
        - 08-190, 23/90/2008, Pre-heater Pad
        - 08-197, 24/09/2008, Unit 2 Pre-heaters
        - 08-210, 30/09/2008, Unit 1 Pre-heaters
- **Work Package SAP# 1247496**
    - **Survey Package 010BS2 – Unit 2 Ventilation Intake**
        - 08-144, 12/09/2008, Unit 2 Steam Drum
        - 08-145, 12/09/2008, Unit 2 Air Inlet Exterior
        - 08-165, 16/09/2008, Unit 2 Intake Fan Housing (1 of 3)
        - 08-175, 19/09/2008, Unit 2 Intake Fan Housing (2 of 3)
        - 08-178, 20/09/2008, Unit 2 Intake Fan Housing (3 of 3)
        - 08-187, 23/09/2008, Unit 2 Characterization of Air Intake Pt. 1
        - 08-188, 23/09/2008, Unit 2 Characterization of Air Intake Pt. 2
        - 08-189, 23/09/2008, Unit 2 Characterization of Air Intake Pt. 3

        - 08-207, 29/09/2008, Unit 2 Exhaust Support Structure
        - 08-208, 29/09/2008, Unit 2 Exhaust Stack
    - **Survey Package 016BS2 – Unit 2 Condenser**
        - 08-186, 23/09/2008, Unit 2 Condenser
    - **Survey Package 017BS2 – Unit 2 Boiler/Firebox**
        - 08-132, 09/09/2008, Unit 2 Firebox Interior
        - 08-133, 09/09/2008, Unit 2 Firebox Exterior
        - 08-195, 24/09/2008, Unit 2 Lower Exhaust to Stack Building
- **Work Package SAP# 1247474 – Work Order U3-2**
    - **Survey 032BS1 – Unit 3 Seal Oil Room**
        - 08-246, 11/10/2008, Unit 3 Seal Oil Room Floor
        - 08-247, 11/10/2008, Unit 3 Seal Oil Room Ceiling
        - 08-248, 11/10/2008, Unit 3 Seal Oil Room Walls
- **Work Package SAP# 1247474 – Work Order U3-3**
    - **Survey Package 044BS1 – Unit 3 Propane Engine Generator**
        - 08-220, 02/10/2008, Propane Generator Interior Floor
        - 08-221, 02/10/2008, Propane Generator Interior Walls
        - 08-231, 03/10/2008, Propane Generator Room Interior Ceiling
        - 08-232, 07/10/2008, Propane Generator Room Exterior Walls
    - **Survey Package 046BS1 – Unit 3 Generator/Exciter**
        - 08-243, 10/10/2008,Generator/Exciter Exterior Surfaces
        - 08-257, 13/10/2008, Unit 3 Exciter Interior & Exterior Floor
        - 08-258, 13/10/2008, Unit 3 Generator/Exciter Drains
        - 08-259, 13/10/2008, Unit 3 Generator/Exciter Interior Walls & Ceiling
        - 08-270, 17/10/2008, Unit 3 Generator/Exciter Building Walls
- **Work Package SAP# 1247474 – Work Order U3-6**
    - **Survey Package 095BS1 – Unit 3 Roof**
        - 08-261, 14/10/2008, Unit 3 Roof
- **Work Package SAP# 1246914 – Work Order BS-1**
    - **Survey Package 082BS3 – Fuel Oil Storage Tanks**
        - 08-069, 30/07/2008, Fuel Tank 2 Roof
        - 08-070, 04/08/2008, Fuel Tank 2 Outer Walls
        - 08-081, 06/08/2008, Fuel Oil Storage Tank #1 Walls
        - 08-083, 08/08/2008, Fuel Oil Storage Tank #1 Roof
    - **Survey Package 083BS3 – Diesel Fuel Tanks**
        - 08-094, 15/08/2008, Light (Diesel) Tank Walls
        - 08-095, 15/08/2008, Light (Diesel) Tank Roof
    - **Survey Package 084BS2 – Distilled Water Tanks**
        - 08-105, 26/08/2008, Distilled Water Tank Walls
        - 08-106, 26/08/2008, Distilled Water Tank Roof
    - **Survey Package 069BS3 – Fuel Oil Service Tanks**
        - 08-091, 14/08/2008, Service Tank 2 Walls
        - 08-092, 14/08/2008, Service Tank 1 Walls
        - 08-096, 18/08/2008, Service Tank 1 Roof
        - 08-100, 20/08/2008, Fuel Oil Service Tank 2 Roof
    - **Survey Package 072BS3 – Freshwater Tank**

        - 08-098, 19/08/2008, Fresh Water Tank Roof
        - 08-103, 22/08/2008, Fresh Water Tank Walls
    - **Survey Package 085BS3 – Lube Oil Tanks**
        - 08-107, 26/08/2008, Lube Oil Storage Tank Roofs
        - 08-108, 26/08/2008, Lube Oil Storage Tank Walls
        - 08-109, 26/08/2008, Lube Oil Storage Tank Basin
- **Work Package SAP# 1247167 – Work Order BS-2 A1**
    - **Survey Package 063BS3 – Assembly Building**
        - 08-116, 29/08/2008, Assembly Building Interior
        - 08-148, 15/09/2008, Assembly Building Roof
        - 08-149, 15/09/2008, Assembly Building Exterior Walls
    - **Survey Package 064BS3 – Training Building**
        - 08-129, 05/09/2008, Training Building Roof
        - 08-150, 15/09/2008, Training Building Interior
        - 08-166, 17/09/2008, Training Building Exterior and Overhang
    - **Survey Package 065BS3 – Out-of-Stock Warehouse**
        - 08-138, 11/09/2008, Out-of-Stock Interior Walls
        - 08-154, 15/09/2008, Out of Stock Warehouse Floor
        - 08-159, 15/09/2008, Out of Stock Exterior Walls
        - 08-161, 16/09/2008, Out of Stock Warehouse Floor Pt. 2
    - **Survey Package 068BS3 – Rigger's Shed**
        - 08-158, 15/09/2008, Rigger's Shed Interior
        - 08-171, 17/09/2008, Rigger's Shed Exterior Surfaces
    - **Survey Package 074BS3 – Office Annex**
        - 08-124, 03/09/2008, Aux. Admin Building Roof
        - 08-151, 15/09/2008, Office Annex Interior Walls
        - 08-152, 15/09/2008, Office Annex Floors
        - 08-201, 25/09/2008, Office Annex Exterior Walls
    - **Survey Package 075BS3 – MEPPS 2 & 3 Control Building**
        - 08-173, 17/09/2008, MEPPS 2 Interior
        - 08-174, 17/09/2008, MEPPS 3 Interior
        - 08-191, 24/09/2008, MEPPS 2 Enclosure & Horizontal Structures
        - 08-192, 24/09/2008, MEPPS 3 Enclosure & Horizontal Structures
        - 08-196, 24/09/2008, MEPPS 2 & 3 Control Trailer Roofs
        - 08-222, 01/10/2008, MEPPS 2 & 3 Control Trailer Walls
        - 08-223, 03/10/2008, MEPPS 2 Enclosure Building Exterior
        - 08-224, 03/10/2008, MEPPS 3 Enclosure Building Exterior
    - **Survey Package 077BS3 – Security Building**
        - 08-123, 03/09/2008, Security Building Roof
        - 08-213, 01/10/2008, Security Building Interior
        - 08-214, 01/10/2008, Security Building Exterior
    - **Survey Package 078BS3 – FFD Trailer**
        - 08-153, 15/09/2008, FFD Trailer Interior
        - 08-172, 17/09/2008, FFD Exterior Surfaces
    - **Survey Package 081BS3 – Hazardous Waste Storage**
        - 08-130, 05/09/2008, HazMat Building Roof

        - 08-160, 15/09/2008, HazMat Storage Interior
        - 08-170, 17/09/2008, HazMat Building Exterior Surfaces
    - **Survey Package 104BS3 – Metal Storage Building**
        - 08-139, 11/09/2008, Metal Storage Building Floor
        - 08-155, 15/09/2008, Metal Storage Roof
        - 08-156, 15/09/2008, Metal Storage Exterior Walls
        - 08-157, 15/09/2008, Metal Storage Building Interior
    - **Survey Package 105BS3 – Paintshop**
        - 08-118, 02/09/2008, Paintshop North Exterior Wall
        - 08-119, 02/09/2008, Paintshop Exterior Roof
        - 08-131, 05/09/2008, Paintshop Office Building Roof
        - 08-140, 11/09/2008, Paintshop Building Exterior South Wall
        - 08-142, 11/09/2008, Paintshop Exterior West Wall
- **Work Package SAP# 1247761 – Work Order BS-2 A2**
    - **Survey Package 061BS3 – Steam Cleaning Station**
        - 08-230, 07/10/2008, Steam Cleaning Station
    - **Survey Package 062BS3 – Oil/Water Separators**
        - 08-266, 14/10/2008, Oily Water Separators, Concrete & Pits
        - 08-267, 14/10/2008, Oily Water Separators, Separators & Walkways
    - **Survey Package 066BS3 – Intake Structures**
        - 08-233, 08/10/2008, Feed Water Intake (Ground)
        - 08-269, 15/10/2008, Intake Structure Pits & Pump Wells
    - **Survey Package 067BS3 – Unit 3 Transfer Yard Structures**
        - 08-265, 14/10/2008, Unit 3 Transfer Yard Structures
    - **Survey Package 070BS3 – Hydrogen Bottle Storage**
        - 08-262, 14/10/2008, Hydrogen Storage Building Open Air-Interior
        - 08-263, 14/10/2008, Hydrogen Storage Building Enclosed Room Interior
        - 08-264, 14/10/2008, Hydrogen Storage Building Exterior
    - **Survey Package 071BS3 – Propane Tank**
        - 08-228, 06/10/2008, Propane Tank
    - **Survey Package 076BS3 – MEPP Control Building**
        - 08-167, 17/09/2008, MEPP Control Bldg. Interior Office Space Wall and Ceiling
        - 08-168, 17/09/2008, MEPP Control Bldg. Interior Office and Equipment Space Floors
        - 08-169, 17/09/2008, MEPP Control Bldg. Interior Equipment Space Wall and Ceiling
        - 08-193, 24/09/2008, MEPP Control Building Roof
        - 08-225, 03/10/2008, MEPP Control Building Enclosure
- **Work Package SAP# – Work Order BS-3**
    - **Survey Package 086SD1 – Discharge Canal**
        - 08-229 Discharge Canal Samples
    - **Survey Package 088SB1 – Radwaste Piping Below Grade**
        - 08-050, 14/07/2008, Soil Bores
        - 08-051, 15/07/2008, Soil Bores
        - 08-054, 16/07/2008, Soil Bores

- 08-058, 14/07/2008, Soil Bores
- 08-112, 27/08/2008, Hand Bore RNY-35 and RNY-41
- 08-113, 28/08/2008, Hand Bore RNY-31+33
- 08-114, 28/08/2008, Hand Bore RNY-38, 39, & 40
- 08-115, 29/08/2008, Deer Bore RDVB-74
- 08-117, 29/08/2008, Hand Bore 34, 35
- 08-120, 02/09/2008, Hand Bore 4, 5, 6, 7, 8, & 9
- 08-121, 03/09/2008, Hand Bores (6) and 10 Samples
- 08-122, 03/09/2008, Hand Bores RCS 46-49
- 08-125, 04/09/2008, Hand Bores RWT 16 & 18
- 08-126, 04/09/2008, Hand Bores (3 Holes & 6 Samples)
- 08-127, 04/09/2008, Boring RDVB-76 11 Samples
- 08-128, 05/09/2008, 5 Hand Bores 12 Samples
- 08-134, 09/09/2008, Hand Bore RCS 42-45 & 50
- 08-136, 10/09/2008, Hand Bore RCS 51, 52, 53, & 77
- 08-137, 10/09/2008, Hand Bore RDVB-75
- 08-141, 11/09/2008, RDVB-75
- 08-143, 11/09/2008, Hand Bore RNY-37

- **Survey Package 098SB2 – Well Installation Samples**
  - 08-078, 05/08/2008, Tritium Well Installation
  - 08-082, 07/08/2008, Tritium Well Installation
  - 08-084, 11/08/2008, Tritium Well Installation
  - 08-090, 13/08/2008, Tritium Well Installation C-1
  - 08-099, 19/08/2008, Tritium Well 098BSW-RCW-CS-02
  - 08-102, 21/08/2008, Tritium Well 098BSW-SFP-1
  - 08-110, 26/08/2008, Tritium Well 098BSW-RCW-CS-3