Humboldt Bay Power Plant

NRC presentation

July 29, 2010

Agenda

- Introductions and purpose of this meeting
- HBPP Site Orientation
- Alternate Disposal Method Request(s)
- Reactor Vessel Transportation and Disposal
- DCGL's and LTP

HBPP Site

- 2 Operating Steam Generation Fossil Units
- 2 backup Gas Turbines
- Operating ISFSI
- Construction of New Generation Facility
- Unit 3 Nuclear Plant decommissioning
- Preparation for Units 1 and 2 decommissioning

Alternate Disposal Request

- Purpose of the Alternate Disposal Request (submitted April 1, 2010)
- Schedule of Units 1/2 decommissioning
- Proposed answers to questions on submittal
- Travel Route from Eureka CA to Grand View Idaho (HBPP to USEI)
- Weather or road re-routing of trucks
- Potential future alternative disposal request(s)

Potential Alternate Disposal Requests

- Open air demo limits established at HBPP Unit 3 will require concrete shaving
- Resulting concrete structures will be very low concentration limits, consistent with current request
- Soils concentrations of SNM very localized
- Potential that an additional 1000 shipments will meet current alternate disposal concentration criteria

Potential Alternate Disposal Requests

- State of Calif Department of Toxic Substances Control (DTSC) clean up standards are based on combined cancer risk model, rather than a dose based model
- Increase total shipments

DCGL Development at Humboldt Bay

NRC Presentation, July 29, 2010
Washington, D.C.

Humboldt Bay Site Overview

- Located in Eureka, CA, Humboldt County;
- Humboldt County population, based on the 2000 census, is 126,118 persons;
- 143 acre owner-controlled area including a 13 acre Industrial Area; and
- PG&E will retain site ownership following termination of Part 50 license

Eureka, CA and Surrounding Area

HBPP Site Layout

Steps In HBPP DCGL Development

- Perform a source term abstraction,
- Develop an exposure scenario,
- Derive a mathematical model based on hydrogeological knowledge,
- Derive single nuclide soil $DCGL_W$s,
- Derive single nuclide structural surface $DCGL_W$s, and
- Derive soil and surface area factors.

Steps to Source Term Abstraction

- Derivation of a site-specific potential radionuclide suite:
  - Theoretical BWR radionuclides were identified based on NUREG/CR–3474 and NUREG/CR–4289 guidance,
  - Incorporated past 10 CFR 61 characterization results, and
  - Theoretical radionuclides narrowed to 22 HBPP site-specific potential radionuclides:
    - Radionuclides with half-lives <5.4 years (7 half-lives) were excluded, except for Co-60
    - Low relative abundance radionuclides discounted, and
    - Naturally occurring radionuclides indistinguishable from background were excluded.

Source Term Abstraction, Cont.

- Characterization samples were collected for analysis of potential radionuclides:
  - Impacted area soil samples,
  - Concrete cores to identify depth of penetration and volume activation products, and
  - Concrete scabble samples to identify surface contamination.
- Only 2 radionuclides were identified in soil.

Radionuclides of Interest At HBPP

Radionuclide	Half Life (Years)	Decay Mode	Radionuclide	Half Life (Years)	Decay Mode
Am-241	4.32E+02	α, γ	I-129	1.57E+07	β-, γ
C-14	5.73E+03	β-	Nb-94	2.03E+04	β-, γ
Cm-243	2.91E+01	α, γ	Ni-59	7.50E+04	Γ
Cm-244	1.81E+01	α, γ	Ni-63	1.00E+02	β-
Cm-245	8.50E+03	α, γ	Np-237	2.14E+06	α, γ
Cm-246	4.75E+03	α, γ	Pu-238	8.78E+01	α, γ
Co-60	5.27E+00	β-, γ	Pu-239	2.41E+04	α, γ
Cs-137	3.02E+01	β-	Pu-240	6.60E+03	α, γ
Eu-152	1.36E+01	β-, γ	Pu-241	1.44E+01	β-
Eu-154	8.80E+00	β-, γ	Sr-90	2. 86E+01	β-
H-3	1.23E+01	β-	Tc-99	2.13E+05	β-, γ

Source Term Abstraction, Cont.

- Dose modeling objective:
  - Derive single nuclide DCGLs only for detected radionuclides, and
  - Account for non-detected site-specific potential radionuclides when comparing to annual dose limit.

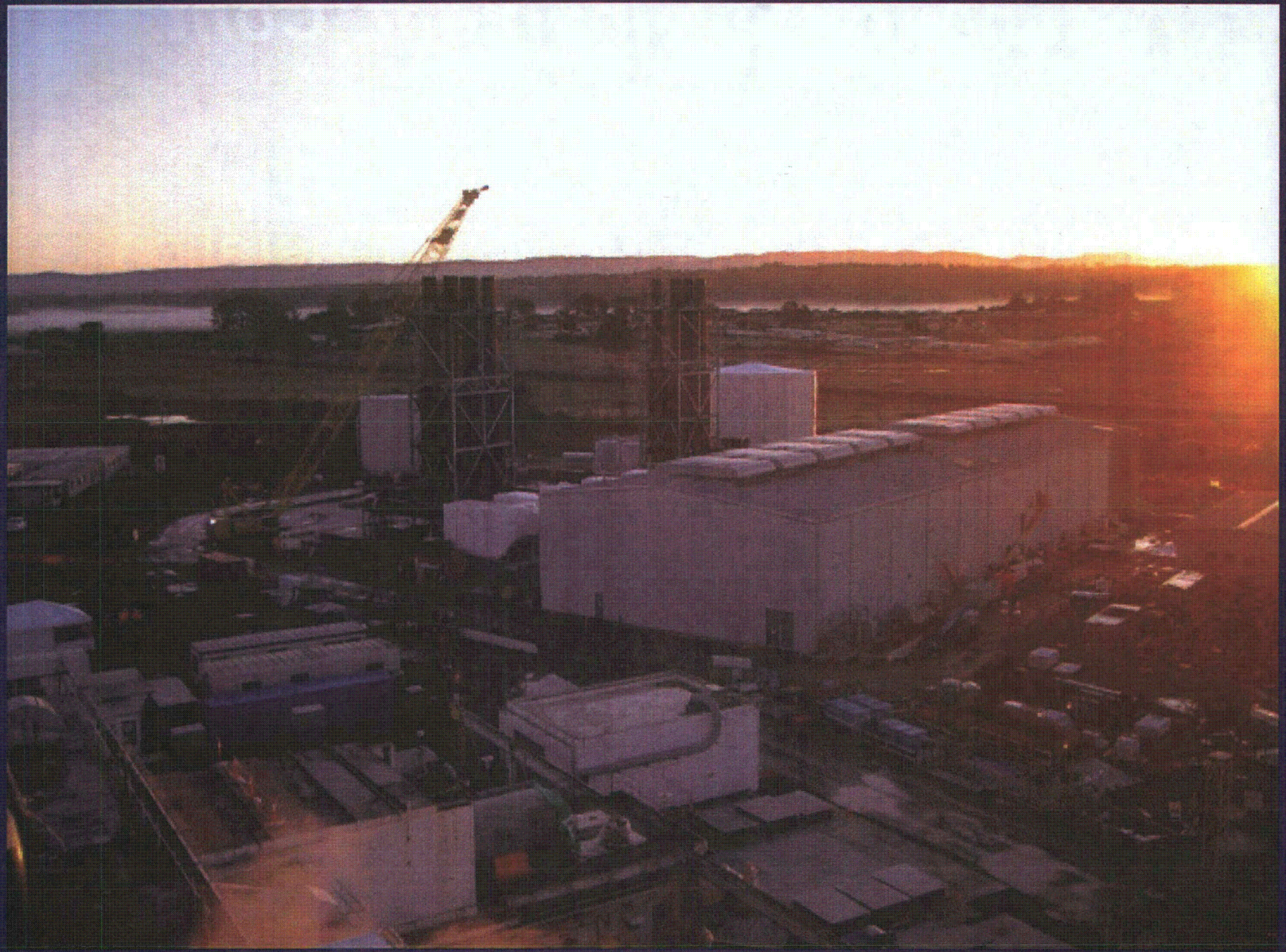
Exposure Scenario Development

- Small site – 143 acres:
  - All 143 acres are Impacted including:
    - A 13-acre fence-enclosed Industrial Area,
    - Plant liquid effluent pathway, and
    - Industrial Area storm drain outfall.
  - 10 CFR Part 72 licensed ISFSI,
  - Two natural gas/oil fired plants in full-time operation (105 MWe),
  - Two gas turbine peakers (30MWe), and
  - New natural gas-fired plant under construction (165 MWe)

HBPP ISFSI

HBPP Units 1 & 2

New Natural Gas-Fired Plant Under Construction



Scenario Development, Cont.

- Long-term PG&E expectation to maintain site for electrical generation and transmission, and
- PG&E intends to retain site ownership through the foreseeable future.

Scenario Development, Cont.

- Industrial worker scenario chosen for use with RESRAD for soil DCGL derivation:
  - RESRAD chosen because of subsurface soil contamination,
  - Industrial worker is most appropriate scenario for foreseeable future, and
  - Dose contribution due to detected soil radionuclides indistinguishable from background after 100 years.

Scenario Development, Cont.

- Alternative critical groups and exposure scenarios have been considered:
  - A resident farmer establishes occupancy after release of site from Industrial Area use, and
  - If the site license is terminated at uniform industrial worker scenario DCGLs, the site is in compliance with the regulatory limit 32 years later using a resident farmer scenario.

Scenario Development, Cont.

- Industrial worker building occupancy scenario chosen for use with RESRAD-BUILD:
  - Follows building occupancy scenario introduced in NUREG/CR-6755,
  - 2,000 hour work-year for industrial workers, and
  - Time onsite equally divided between indoors and outdoors.

Derivation of Soil DCGLs

- RESRAD v6.4 was chosen to derive soil $DCGL_W$s due to the presence of subsurface soil contamination:
  - RESRAD calculations were performed in the probabilistic mode,
  - Nuclide specific $DCGL_W$s were derived using the industrial worker scenario and a simplified hydrogeological mathematical site model, and
  - Single nuclide $DCGL_W$s values were calculated for all 22 radionuclides.

Derivation of Soil DCGLs, Cont.

- A RESRAD simplified mathematical hydrogeological model was derived based on existing knowledge:
  - Site studies define soil and aquifer profiles from surface to potable water aquifer,
  - Approximately 400 ft from surface to potable water aquifer,
  - Several clay layers exist between surface and potable water aquifer, and
  - Brackish water aquifers exist above the clay layers.

Single Nuclide DCGL Values for Site-Specific Suite of Radionuclides in Thin Soils

Nuclide	Peak Dose at 1 pCi/g (mrem/yr)	DCGL (pCi/g)
Am-241	1.76E-02	1.42E+03
C-14	4.98E-06	5.02E+06
Cm-243	7.78E-02	3.21E+02
Cm-244	6.82E-03	3.67E+03
Cm-245	5.44E-02	4.60E+02
Cm-246	1.26E-02	1.98E+03
Co-60	1.64E+00	1.52E+01
Cs-137	3.79E-01	6.60E+01
Eu-152	7.40E-01	3.38E+01
Eu-154	7.97E-01	3.14E+01
H-3	8.66E-06	2.89E+06
I-129	1.95E-03	1.28E+04
Nb-94	1.09E+00	2.29E+01
Ni-59	6.05E-07	4.13E+07
Ni-63	1.65E-06	1.52E+07
Np-237	1.31E-01	1.91E+02
Pu-238	1.09E-02	2.29E+03
Pu-239	1.21E-02	2.07E+03
Pu-240	1.21E-02	2.07E+03
Pu-241	4.11E-04	6.08E+04
Sr-90	3.10E-03	8.06E+03
Tc-99	1.15E-05	2.17E+06

Derivation of Structural Surface $DCGL_w$s for Building Occupancy

- RESRAD-BUILD v3.3 used in probabilistic mode, and
- $DCGL_w$ values based on an industrial worker building occupancy scenario introduced in NUREG/CR-6755.

Calculated Single Nuclide $DCGL_w$ Values for Structural Surfaces

Radionuclide	Dose Conversion Factor (mrem/yr per dpm/100 cm²)	DCGL (dpm/100 cm²)
H-3	6.07E-07	4.12E+07
C-14	2.05E-05	1.22E+06
Ni-59	3.09E-07	8.09E+07
Co-60	1.54E-03	1.62E+04
Ni-63	8.08E-07	3.09E+07
Sr-90	2.01E-04	1.25E+05
Nb-94	1.06E-03	2.36E+04
Tc-99	2.08E-06	1.20E+07
I-129	2.74E-03	9.12E+03
Cs-137	4.44E-04	5.63E+04
Eu-152	7.57E-04	3.30E+04
Eu-154	8.26E-04	3.03E+04
Np-237	5.28E-02	4.73E+02
Pu-238	7.01E-03	3.57E+03
Pu-239	8.17E-03	3.06E+03
Pu-240	7.26E-03	3.44E+03
Pu-241	1.38E-04	1.81E+05
Am-241	8.34E-03	3.00E+03
Cm-243	5.20E-03	4.81E+03
Cm-244	3.97E-03	6.30E+03
Cm-245	8.68E-03	2.88E+03
Cm-246	2.08E-02	1.20E+03

Derivation of Additional $DCGL_W$s

- In addition to thin soil and surface areas, $DCGL_W$s were also developed for:
  - Thick soils,
  - Volumetric materials,
  - Embedded piping, and
  - Buried piping.

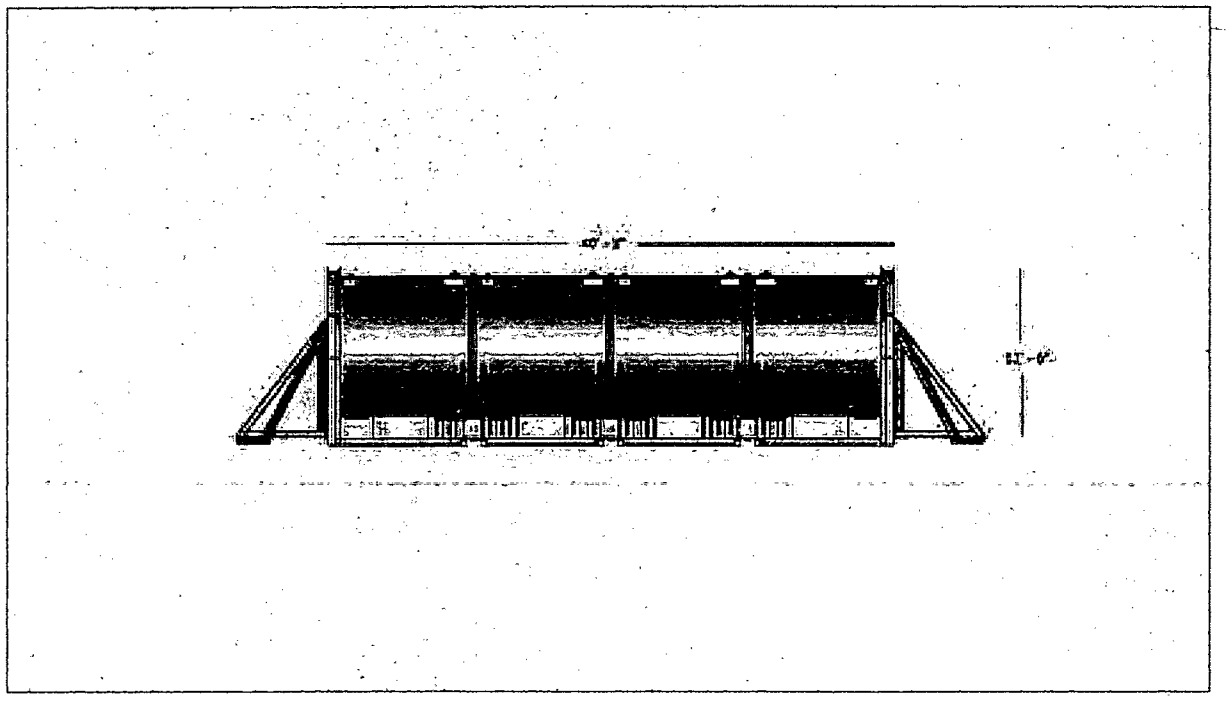
Derivation of Area Factors for $DCGL_{EMC}$

- Area factor used for elevated measurement comparison during final status surveys:

$$Area\ Factor = \frac{DCGL_{EMC}}{DCGL_{W}}$$

  - Based on methodology of NUREG-1505, Chapter 8, and
  - Calculated using dose pathway models and assumptions consistent with those used to calculate the $DCGL_W$s.

Humboldt Bay RPV Project
NRC Update
7/29/2010



Reactor Pressure Vessel Project Goal

- Package and Transport HBPP Reactor vessel as an single component package as an LSA shipment in a DOT IP2 package

Plant History

- 65 MW GE Boiling Water Reactor
- Approx 5.5 years effective run life
- Reactor last run in 1976 with approx 35 years of radioactive decay

Initial Characterization

- Performed in mid 1990s by TLG to support cost estimate for decommissioning
- Activation analysis for characterization was performed on internals and vessel
- This results in conservative estimates of the part 61 classification of activated internals

Current Approach

- Normalize the prior activation analysis by dose rate
- Determine final classification of vessel based on total activity averaged over metal volume in accordance with the BTP
- Perform partial segmentation of internals to remove items to meet the 1R at 3 meter unshielded dose limit

Regulatory Basis of Approach

- 10 CFR 71.14 concerning transport of LSA materials
- NRC Branch Technical Position (BTP) on Concentration Averaging 1995

Segmentation discussion – Classification

- Remove internal components to meet 10CFR61 classification as a Class A package
- Remove additional internal components to meet the 1R at 3 meter limit of 10CFR71.14

ALARA Basis for Approach

- Segment GTCC waste and place in ISFSI
- Segment B/C waste and store on-site until disposal option becomes available
- Reduce dose consequence to workers by minimizing segmentation of internals
- Reduce Radiological risk in transportation by minimizing truck quantities of less stable packaging alternatives

Project Schedule

- Selected RPV removal contractor June 2010
- Complete RPV characterization Oct 2010
- Mobilize for site work March 2011
- Ship reactor vessel February 2012

Summary

- Minimum segmentation is the ALARA thing to do.
- Making a single disposal package is the ALARA thing to do.
- The single package results in safety to the public.