R10988206

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RPP-WTP PDC

Document title: **RPP-WTP Compliance with Uniform Building Code Seismic Design Requirements**

Contract number: DE-AC27-01RV14136

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Document number: 24590-WTP-RPT-ST-01-001, Rev 2

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Date of issue: 11/17/08

Issue status: Approved

Approved by: Mark Braccia

Approver's position: Civil, Structural and Architectural Design Production Engineering Manager

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NOTE: Contents of this document are Dangerous Waste Permit affecting.

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History Sheet

Rev	Date	Reason for revision	Revised by
A	03/06/00	Issue in Support of DWPA	
0	07/09/01	Supercedes RPT-W373-ST00001	S. Horn
1	10/31/01	Revised to Incorporate Comments	S. Horn
2	11/17/2008	Report rewritten in its entirety to reflect current RPP-WTP seismic design criteria, seismic category definitions, add reference to the 24590-WTP-SRD-ESH-01-001-02, 24590-WTP-PSAR-ESH-01-002-01, and 24590-WTP-DC-ST-04-001.	A. Sheridan

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1 Introduction

This report outlines how the seismic design requirements specified for the RPP-WTP facilities will meet, as a minimum, all the requirements of the 1997 Uniform Building Code (UBC).

2 Compliance with the Uniform Building Code

Design of structures, systems and components (SSCs) for the RPP-WTP facility will meet, as a minimum, the design requirements of the Uniform Building Code and thus satisfy the requirements of WAC 173-303-806(4)(a)(xi).
Two approaches are allowed per UBC, the design procedures prescribed in Chapter 16 and alternate procedures per Section 1629.10. The procedures to be utilized for each SSC is set after the SSC is categorized.
Each facility is evaluated to determine both the hazards associated with internal events caused by the process systems and hazards associated with the events external to the facility, including seismic events. The hazard assessment process will identify SSCs which have important to safety functions. Once these SSCs are identified, they are categorized based on the necessity for them to function during or following a seismic event.

3 Seismic Categorization

RPP-WTP Facility SSCs designated as important to safety are designed to withstand the effects of Natural Phenomena Hazards (NPH) without loss of capability to perform their safety function per 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*, Safety Criterion 4.1-3. The most significant NPH being seismic events. The seismic categories used for designing RPP-WTP facilities are defined by the requirements of the SSC to perform its safety function during a seismic event. The seismic categories are:

Table 3-1 RPP-WTP Seismic Categorization[a]

RPP-WTP Seismic Category (SC)[b]	Description	Population
I	Important to safety (safety class) SSCs with seismic safety function.	Includes both front line systems and supports systems (for example, power, controls, foundations, supports)
II	Important to safety SSCs with seismic safety function.	Includes only SSCs whose failure from an earthquake could prevent an SC-I SSC with seismic safety function from performing its specified safety function.

Table 3-1 RPP-WTP Seismic Categorization[a] (Continued)		
RPP-WTP Seismic Category (SC)[b]	**Description**	**Population**
III	Important to safety SSCs with and without seismic safety function.	Includes the following: • A Safety Significant SSC that has a seismic safety function • an SSC (Safety Class, Safety significant, or Additional Protection class[APC]) whose seismic safety function is that its failure could adversely affect the seismic safety function of a SC-III Safety Significant SSC • A Safety Class or Safety Significant SSC that has no seismic safety function
IV	Important to safety SSCs without seismic safety function and non-important to safety SSCs.	Includes the following: • an APC SSC that has no seismic safety function (i.e., not required for prevention of an SSC intervention) • SSCs that are not important to safety and require seismic protection per the UBC

[a] Seismic Category information from Table 1-8 of 24590-WTP-PSAR-ESH-01-002-01, Rev. 4.

[b] See Table 1-9 of 24590-WTP-PSAR-ESH-01-002-01, Rev. 4, for corresponding WTP Performance Categorization per DOE-STD-1024-94.

4 Seismic Design Criteria

The RPP-WTP Project has evaluated standards for seismic design, which meet the minimum requirements of UBC and selected Department of Energy standard DOE-STD-1020, for evaluation of natural phenomena hazards, including specifically for seismic design. Table 4-1 below provides the seismic design criteria developed for design of RPP-WTP Facilities as found in 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*, Safety Criterion 4.1-3.

Table 4-1 Seismic Design Loads Applicable to RPP-WTP SSCs

Hazard	Load	Source Document for Load
Seismic Category I	DBE with 0.30 g horizontal PGA and 0.21 g vertical PGA	DOE Letter 05-WTP-036[a, e] DOE-STD-1020-94[b]
Seismic Category II	DBE with 0.30 g horizontal PGA and 0.21 g vertical PGA[c]	DOE Letter 05-WTP-036[a, e] DOE-STD-1020-94[b]
Seismic Category III	DOE-STD-1020-94(Capacity from Uniform Building Code,[d] Static Force procedure)	DOE-STD-1020-94[b]
Seismic Category IV	DOE-STD-1020-94(Capacity from Uniform Building Code,[d] Static Force procedure)	DOE-STD-1020-94[b]

[a] DOE Letter 05-WTP-036, "Delivery of Revised Seismic Ground Motion Spectra to be Used as the Design Basis for the Design of the Waste Treatment and Immobilization Plant (WTP)," dated February 11, 2005. The revised seismic ground motion (RGM) with 2000-uear return period as provided by DOE Letter 05-WTO-036 shall be used on the WTP project as the approved DBE when discussing and analyzing the bounding earthquake.

[b] DOE-STD-1020-94 (Change 1, 1996), "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities," as tailored in Appendix C of the Safety Requirements Document, 24590-WTP-SRD-ESH-01-001-02.

[c] DOE-STD-1020-94, Section 2.3.2, allows reduction in the elastically computed seismic responses by the use of the inelastic energy absorption factor in the design of Performance Category 3 structures. Credit for inelastic energy absorption is considered only in the design of Seismic Category II structures, and evaluation of constructed SC-I structures designed for the original DBE loads as discussed in "Seismic Analysis and Design Criteria," 24590-WTP-DC-ST-04-001 Commentary, Section 10.5.b.

[d] 1997, Uniform Building code, International Conference of Building Officials, Whittier, California. DOE Developed site-specific spectra (CCN 139357, dated May 3, 2006). The site-specific spectra were compared to the UBC-97 earthquake spectra, which are based on a 500-year earthquake. The UBC-97 was found to envelope (be equal to or more conservative than) the site specific spectra 1000-year spectra. therefore, use of the site-spectra 1000-year spectra has been accomplished by the use of UBC-97.

[e] The WTP site specific ground motion with 2000-year return period as provided in DOE Letter 07-WTP-195 may be used on the WTP project on specific SSCs as approved by DOE.

5 Design Requirements

Seismic Categories I and II

The seismic design requirements for Seismic Categories I and II follow the alternate method permitted by UBC. The RPP-WTP project has selected alternative methods for evaluation of seismic loads and design of SSCs within the provisions of the UBC. These alternative evaluation procedures applied to SC-I and

ZASC-II SSCs are established in the "Seismic Analysis and Design Criteria," 24590-WTP-DC-ST-04-001. This document governs the performance of seismic analysis and design of the RPP-WTP Facility. The UBC permits the use of alternative lateral-force procedures, using rational analyses based on well-established principals used for design of facilities with more significant hazardous consequences.

Seismic Categories III and IV

The seismic design requirements for Seismic Category III and Seismic Category IV SSCs follow the requirements of the UBC. In accordance with UBC, Figure 16-2, the USGS seismic hazards survey map, the RPP-WTP site is designated as seismic zone 2B. SC-III SSCs contain radioactive and hazardous materials and will be designed with an Importance Factor of 1.25. Since SC-IV SSCs do not contain significant radioactive or hazardous materials, the Importance Factor (I) used in design is 1.0.

6 Conclusion

In conclusion, the seismic design requirements for the RPP-WTP facilities meet the provisions of methods permitted by the UBC. The requirements for seismic design of Seismic Category I and II structures, systems and components are achieved through well-established alternative methods. The requirements for seismic design of Seismic Category III and IV structures, systems and components are achieved by direct application of the UBC. Structures, systems and components designed in accordance with the requirements established for the RPP-WTP project will adequately resist the maximum horizontal and vertical acceleration ground motions associated with the seismic zone 2B or site-specific seismic response spectra, as permitted by the UBC.