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under Contract DE-AC05-76RL01830

Review of Natural Phenomena Hazard (NPH) Assessments for the Hanford 200 Areas (Non-Seismic)

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SB Ross
RS Sullivan

September 2010

Pacific Northwest
NATIONAL LABORATORY

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Executive Summary

The purpose of this review is to assess the need for updating Natural Phenomena Hazard (NPH) assessments for the Hanford 200 Areas, as required by DOE Order 420.1B Chapter IV, *Natural Phenomena Hazards Mitigation*, based on significant changes in state-of-the-art NPH assessment methodology or site-specific information. The review includes all natural phenomena hazards with the exception of seismic/earthquake hazards, which are being addressed under a separate effort.

It was determined that existing non-seismic NPH assessments are consistent with, or bounded by, current design methodology as described in WHC-SD-GN-ER-501, *Natural Phenomena Hazards, Hanford Site, Washington* and site specific data.

Contents

1.0 Introduction

1.1 Purpose

The purpose of this review is to evaluate the need for updating Natural Phenomena Hazard (NPH) assessments, as required by U.S. Department of Energy (DOE) Order 420.1B, Chapter IV, *Natural Phenomena Hazards Mitigation*, based on any significant changes in state-of-the-art NPH assessment methodology or site-specific information. As identified in the Order, if no change is warranted from the earlier assessment, then this only needs to be documented.

1.2 Scope

The review scope includes all natural phenomena hazards with the major exception of seismic/earthquake hazards, which are being addressed under a separate effort. The geographical scope of the review is the Hanford 200 areas, for specific application with regard to the Tank Operations Contractor.

1.3 Methods

HNF-SD-GN-ER-501, *Natural Phenomena Hazards, Hanford Site, Washington* develops NPH design criteria for use in implementing DOE Order 420.1B and the associated design criteria standard DOE-STD-1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*. Assessment methodologies and site-specific data, as presented in the current revision of HNF-SD-GN-ER-501, were reviewed for continued relevance compared to current methodology and more recent site-specific data. DOE-STD-1023-95, *Natural Phenomena Hazards Assessment Criteria*, requires site-specific probabilistic hazard assessments for application to Performance Category 3 or 4 structures, systems, and components.

Site-specific general climatological data was taken from PNNL-15160, *Hanford Site Climatology Summary 2004 with Historical Data*. More recent data through August 2010 was taken from the Hanford Meteorological Station website at http://hms.pnl.gov (METDATA).

2.0 Wind Hazard

The current wind hazard assessment in HNF-SD-GN-ER-501 and resulting basic wind speed values were based on site data through 1997, as evaluated in HNF-3329, *Hanford Site Peak Gust Wind Speeds*. The wind hazard assessment methodology was undergoing change at that time, moving from wind speeds in fastest mile values to peak gust values. The peak gust speeds as assessed in HNF-3329 and reported in HNF-SD-GN-ER-501 Table 3 are consistent with the design methodology up through the 2005 edition of ASCE/SEI 7 (ASCE/SEI 7-05), which remains the current methodology as implemented in the *International Building Code,* 2009 edition. HNF-SD-GN-ER-501 reconciles the design wind speed values with those of DOE's 1998 Interim Advisory on Straight Winds, which was incorporated into DOE-STD-1020-2002.

Site-specific wind speed data since 1997 (PNNL-15160 and METDATA) show monthly peak gust values generally well below the record values evaluated in HNF-3329, with two exceptions: a new record for the month of December was set in 2006 with a peak gust of 74 mph (@ 50 m) compared to the

previous record of 71 mph in 1955, and in 1999 the record was tied for the month of February at 65 mph. This new data is consistent within the evaluations of HNF-3329, and revision to the wind hazard assessment on the basis of site data is not indicated at this time.

The wind hazard methodology is changing. The design approach recently published in the ASCE/SEI 7-10 presents changes to basic wind speeds and their associated recurrence probabilities. It is possible that the current wind hazard assessment at Hanford can be accepted under the provisions in ASCE/SEI 7-10 for estimation of basic wind speeds from regional climatic data, but reconciliation between DOE-STD 1020-2002 and ASCE/SEI 7-10 requirements will need to be made.

Tornado winds are considered to be of sufficiently low probability at the Hanford Site that DOE-STD 1020-2002 excludes them from design consideration.

3.0 Volcanic Ash Criteria

Unlike wind and flood hazard assessment and resulting design methodologies which are reasonably well developed in national codes and standards and specific DOE implementations (e.g. DOE-STD 1020-2002), volcanic ash fall hazard assessments are less well defined. HNF-SD-GN-ER-501 includes ash fall criteria developed in WHC-SD-GN-ER-30038, *Volcanic Ashfall Loads for the Hanford Site*, based on probabilistic volcanic hazard studies of the Cascade Range completed by the U.S. Geological Survey (USGS) dating from 1995. USGS has since produced a draft report entitled "Estimate of Tephra Accumulation Probabilities for U.S. Department of Energy's Hanford Site, Washington (Hoblitt and Scott, 2010)." The draft results suggest that the values used previously for design purposes at Hanford are reasonable. This report is planned for release after it has gone through a review process.

4.0 Flood Hazard

4.1 Local Storm Flood Hazard

Table 5 of HNF-SD-GN-ER-501 presents extreme precipitation estimates for Hanford based on the National Weather Service predictions in their 1994 Hydrometeorological Report No. 57, *Probable Maximum Precipitation – Pacific Northwest States*. No new information is available from the National Weather Service at this time. The most recent probabilistic analysis of Hanford site-specific precipitation data in PNNL-15160 gives precipitation amounts significantly below the extreme estimates of HNF-SD-GN-ER-501. There is no indication of a need for storm flood hazard assessment revision.

4.2 River Flood Hazard

Columbia River flood hazard, as documented in HNF-SD-GN-ER-501 for the Hanford site, in general, does not approach the central plateau region of the Hanford 200 areas. For applicability to the 200 areas, the Columbia River flood hazard assessment methodology discussed in HNF-SD-GN-ER-501 remains current to DOE-STD 1020-2002 requirements. The potential for Yakima River flooding is bounded by the Columbia River flood hazard.

HNF-SD-GN-ER-501 identifies a flood risk at the southwestern edge of the 200 West Area from the Cold Creek Watershed. PNNL-15534, *FY 1999 Progress Report on: Potential Groundwater Recharge From the Infiltration of Surface Runoff in Cold and Dry Creeks*, discusses this event in more detail,

presenting it in a storm flood context and relating it to (and being bounded by) the Probable Maximum Precipitation.

There is no indication of a need to revise the river flood hazard assessment for the 200 areas.

5.0 Snow Load

HNF-SD-GN-ER-501 gives a ground snow load for the Hanford site of 15 lb/ft^2, based on the 1995 edition of ASCE/SEI 7 (ASCE/SEI 7-95). Snow load design methodologies have evolved somewhat in recent years, with both ASCE/SEI 7-05 and ASCE/SEI 7-10 showing a ground snow load of 10 lb/ft^2 for over most of Hanford, and procedures for calculating roof snow loads that include small-scale effects such as drifts which may produce higher local loads. The current criterion is bounding over the newer refinements in methodology, and it is recommended that no specific update is warranted at this time. Snowfall data at Hanford brings no challenge to the validity of this approach.

6.0 Temperatures

6.1 Ambient Temperatures

HNF-SD-GN-ER-501 reports a simple range of 115 °F to -25 °F for design temperatures for all performance categories. The range was chosen to envelope historical recorded temperatures at Hanford. A review of recent temperature extremes shows the range is still bounding in this manner.

6.2 Subsurface Temperatures

Subsurface temperature design criteria are established in HNF-SD-GN-ER-501based on evaluation of historical hourly subsurface soil temperatures. A review of recent subsurface temperature data indicates one slightly higher maximum extreme temperature of 156.8 °F for a depth of 0.5 in, but this is still within the design range to 160 °F at this depth.

7.0 Solar Radiation

HNF-SD-GN-ER-501establishes a maximum solar radiation environment for design of 900 langleys, which is based on the highest recorded measurement of 838 langleys in May 1977. Review of recent data (PNNL-15160 and METDATA) indicates that this previous highest recorded level has not been exceeded.

8.0 Atmospheric Sand and Dust

HNF-SD-GN-ER-501 invokes MIL-STD-2I0C, *Climatic Information to Determine Design and Test Requirements for Military Systems and Equipment,* as design criteria for systems and components which may be exposed to blowing dust. Available site information gives no cause to doubt the sufficiency of this approach.

9.0 Relative Humidity

HNF-SD-GN-ER-501conservatively specifies design for relative humidity of near 0 to 100 percent, based on an historical data range of approximately 20 to near 100 percent. Recent data give no reason to change this assessment.

10.0 Summary

Existing non-seismic NPH assessments are consistent with or bound by current design methodology and site specific data. Potential forthcoming methodology changes are discussed below.

Changes to wind hazard assessment and wind design methodology have recently been published in the 2010 edition of ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures* (ASCE/SEI 7-10), which is in the process of being adopted into the next version of the International Building Code (IBC) in 2012. The basic wind speeds and especially the associated probabilities in DOE-STD 1020-2002, as well as HNF-SD-GN-ER-501, will require reconciliation with the new values in the ASCE/SEI 7-10 methodology. It is recommended that this reconciliation be made by the time ASCE/SEI 7-10 is mandated as effective.

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