ASSESSMENT OF APPROPRIATENESS OF LEVEL OF DESIGN DETAILS FOR HEATING, VENTILATION, AND AIR-CONDITIONING SYSTEM FOR DRY TRANSFER FACILITY 1 OF THE PROPOSED REPOSITORY AT YUCCA MOUNTAIN

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QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: No CNWRA generated original data are contained in this report.

ANALYSES AND CODES: No computer code was used in this report.

1 INTRODUCTION

Preclosure safety analysis, conducted at the appropriate level of rigor, will identify structures, systems, and components important to safety. Based on the provisions of 10 CFR 63.142(c), U.S. Department of Energy (DOE) will establish a quality assurance program, which will control all activities affecting quality of the structures, systems, and components identified as items important to safety. In the license application, DOE proposes to provide design information for all structures, systems, and components at a level of detail commensurate with their safety classification.

To obtain U.S. Nuclear Regulatory Commission (NRC) feedback, DOE agreed to provide the NRC staff with three preliminary sections of the safety analysis report as examples of the level of design detail that DOE proposes to provide in the actual license application. These example sections include (1) Dry Transfer Facility 1 Heating, Ventilation, and Air-Conditioning (HVAC) System; (2) Dry Transfer Facility; and (3) Underground Support System.

The first example submitted by DOE deals with the HVAC system that would serve the Dry Transfer Facility 1 at the proposed repository. Staff reviewed the information, and the review results are presented in this report.

2 OBJECTIVE

DOE conducted a preclosure safety analysis of the Dry Transfer Facility 1 HVAC system and concluded the HVAC system is not an item important to safety. Therefore, DOE intends the HVAC system to serve as an example of the level of design details for structures, systems, and components not important to safety. DOE has not, however, provided the analysis used to conclude that the HVAC system at the Dry Transfer Facility 1 is not an item important to safety.

Although DOE has classified the HVAC system as an item not important to safety, staff made no attempt to determine whether or not such conclusion is acceptable to NRC. Staff reviewed this document from two perspectives: (i) HVAC is not an item important to safety, and (ii) HVAC is an item important to safety. The contrast identified will provide staff a better understanding on the appropriate level of design detail needed to support the preclosure safety analysis and design review. This exercise pertains to the level of design details only. Staff assessed whether it would be appropriate to conduct a safety review based on the submitted information; however, conducting a safety review was beyond the scope of this exercise.

3 DRY TRANSFER FACILITY 1 HEATING, VENTILATION, AND AIR-CONDITIONING EVALUATION

Review of the Dry Transfer Facility 1 HVAC system was based on the information provided in a letter to NRC.[1] Staff reviewed the information on the Dry Transfer Facility 1 HVAC system design details with respect to the guidance provided in Section 2.1.1.7, Design of Structures, Systems, and Components Important to Safety and Safety Controls, of the Yucca Mountain Review Plan (NRC, 2003) and the following regulatory requirements (the Yucca Mountain

[1]Ziegler, J. D., "Transmittal of an Example of the Level of Detail to be found in Sections of the Yucca Mountain Repository License Application." Letter (September 19) to NRC. North Las Vegas, Nevada. 2003.

Review Plan does not provide any guidance to review structures, systems, and components not important to safety):

- According to 10 CFR 63.21(c), the Safety Analysis Report must include

  "(2) Information relative to materials of construction of the geologic repository operations area (including geologic media, general arrangement, and approximate dimensions), and codes and standards that DOE proposes to apply to the design and construction of the geologic repository operations area.

  (3) A description and discussion of the design of the various components of the geologic repository operations area and the engineered barrier system including:

  (i) Dimensions, material properties, specifications, analytical and design methods used along with any applicable codes and standards;

  (ii) The design criteria used and their relationships to the preclosure and postclosure performance objectives specified at §63.111(b), §63.113(b), and §63.113(c); and

  (iii) The design bases and their relation to the design criteria."

3.1 Conduct of Review

According to Section 1.1, System Description, of the submitted document, the Dry Transfer Facility 1 HVAC system has been classified as a not important to safety item. In an actual license application review, staff would review information provided by DOE to assess if the safety classification of the HVAC system was appropriate; however, that review is outside the scope of this exercise. Staff review of the presented information will focus on adequacy of the level of design details provided for an item classified as not important to safety. This review is presented in Section 3.2. Furthermore, staff will determine what additional information or design details would be necessary if the HVAC had been classified as important to safety. The review is given in Section 3.3.

3.2 Level of Design Detail if HVAC is Not an Item Important to Safety

Assuming the not important to safety classification of the Dry Transfer Facility 1 HVAC system can be substantiated, the level of design detail provided in the Example of Level of Design Detail document is satisfactory. However, staff has identified two minor concerns about the details that were presented in that document.

- Outdoor temperature and relative humidity, including anticipated fluctuations, were not provided.

- Codes and standards used in the design and referenced in Section 1.6, Design Methodologies, should be grouped according to the material in question (e.g., concrete, steel, etc.), the intended function of the system to be designed (e.g., fire suppression system, fire detection system, High Efficiency Particulate Air (HEPA) filter construction, etc.), or both.

3.3 Level of Design Detail If HVAC Is an Item Important to Safety

If the not important to safety classification of the Dry Transfer Facility 1 HVAC system cannot be substantiated, the following information will be required.

- Information on structural design bases and criteria. This information is needed to verify whether the bases and criteria are consistent with relevant NRC regulations and guidance and whether the HVAC system can withstand the site-specific design basis natural (e.g., tornado, earthquake, explosion, flood, etc.) and human-induced events and continue to perform its intended safety functions. In addition, the structural design bases and criteria including maximum loads, static and/or dynamic stress/pressure loads, and displacements will be checked to ensure safety margins for structures, systems, and components important to safety, identified by the preclosure safety analysis, are adequate.

- Information on thermal design bases and criteria. This information is necessary to verify that the structures, systems, and components important to safety are

  — Consistent with applicable NRC and American National Standards Institute/American Nuclear Society guidance and National Fire Protection Association standards on fire protection and whether the HVAC system will be able to continue to perform its intended safety functions in case of a fire.

    Normal indoor design temperatures and relative humidity were provided; however, no information on outdoor temperatures and relative humidity, including expected fluctuations, was provided to assess whether the system has adequate capacity to perform its intended safety functions.

  — Adequate for fire protection (e.g., fire ratings and fire barriers) taking into consideration the maximum credible fire duration and temperature.

    No information was provided about the fire ratings of the HVAC system and its components. Although automatic and manual water deluge systems would be installed to suppress fire in places where moderator exclusion is not necessary, a description of the design and an assessment would be necessary to show adequacy of the fire suppression system(s).

    Temperature and humidity are not controlled during any Category 1 or Category 2 event sequences. However, if this HVAC system is an item important to safety, design criteria and bases would be necessary that would maintain the temperatures of different structures, systems, and components important to safety below allowable limits for the duration of the event sequences.

- Information on shielding and confinement design bases and criteria. This information is required to

— Verify whether the design bases and criteria are appropriately based on relevant guidance or standards.

— Check the maximum and annual dose rates to workers and the public.

The Control Logic Diagram for the Dry Transfer Facility 1 HVAC system interlocks, and sensors are necessary to assess whether confinement functions of the three zones of the facility (Primary, Secondary, and Tertiary) can be maintained in failure of the HVAC system.

- Information on design methodologies will be required to verify if the methodologies are consistent with established industry practice. Any site data that will be used in analytical or numerical models to support the design methodologies will be reviewed elsewhere for appropriateness.

  Because DOE has classified the HVAC system as an item not important to safety, the discussion on design methodology points to a list of applicable standards. If the HVAC system is classified as an item important to safety, however, more details would be necessary of the design methodologies with appropriate references to relevant standard(s).

- Information on any concrete structures that will house any component of the HVAC system will be required to verify that the structures are designed in accordance with American Concrete Institute and American Society of Civil Engineers or other appropriate standards.

- Information will be necessary on the facility power system(s) including back ups, instrumentation, control, and operating systems.

- A list will be necessary of HVAC related technical specifications, if any.

- A description will be necessary of management controls that will be imposed on the structures, systems, and components associated with the HVAC system to verify the assumptions used in the preclosure safety analysis.

  A short description was provided of routine maintenance, in addition to different proposed tests and inspections for the HVAC system, which is adequate for an item classified as not important to safety. If the HVAC system is classified as an item important to safety, however, a discussion would be necessary to show the relationship between design criteria and bases and the preclosure safety analysis. For example, if unexpected downtime, time for routine maintenance, or both are included in the preclosure safety analysis, a discussion should be provided to demonstrate that the HVAC system, identified as an item important to safety for this exercise, can be maintained or repaired and resume its intended safety functions within the time assumed.

4 REFERENCES

NRC. NUREG–1804, "Yucca Mountain Review Plan." Final Report. Washington, DC: NRC. 2003.