

2/18

**REVIEW OF  
DEPARTMENT OF ENERGY  
REGULATORY COMPLIANCE REVIEW REPORT**

*Prepared for*

**Nuclear Regulatory Commission  
Contract NRC-02-93-005**

*Prepared by*

**Mysore S. Nataraja  
Banad N. Jagannath**

**U. S. Nuclear Regulatory Commission  
Washington, DC**

**Simon (Sui-Min) Hsiung  
Amitava Ghosh**

**Center for Nuclear Waste Regulatory Analyses  
San Antonio, Texas**

**November 1995**

## ACKNOWLEDGMENTS

This report was prepared to document work performed jointly by staffs of Nuclear Regulatory Commission (NRC) and the Center for Nuclear Waste Regulatory Analyses (CNWRA) for the NRC under Contract No. NRC-02-93-005. The activities reported here were performed on behalf of the NRC Office of Nuclear Material Safety and Safeguards (NMSS), Division of Waste Management (DWM). The report is a joint product of the CNWRA and NRC staff and may not reflect the regulatory position of the NRC.

**BACKGROUND**

On March 14, 1995, the Department of Energy (DOE) submitted a Regulatory Compliance Review Report (U.S. Department of Energy, 1995a) to the Nuclear Regulatory Commission (NRC). The report attempts to provide the NRC staff a description of the steps taken by the DOE, and the criteria used by the Civilian Radioactive Waste Management System Management and Operating Contractor, to identify, evaluate, and minimize any potential impacts to the site as a result of the ongoing site characterization program. Also included in the report is the description of how 10 CFR Part 60 requirements applicable to the Exploratory Studies Facility (ESF) Design Package 2C have been incorporated into the current design. Design Package 2C contains the design of a segment of the ESF consisting of the North Ramp from approximately Station 00+60 m [the west end of the Tunnel Boring Machine (TBM) Starter Tunnel] to 28+20 m (the lower end of the curve at the bottom of the North Ramp). Design Package 2C also contains design information for 11 configuration items (CI) categorized as permanent and temporary. The permanent CIs include the North Ramp Excavation, Test Alcoves, Operations Alcoves, and Lining and Ground Support. The temporary CIs are Furnishings, Subsurface Lighting, Subsurface Ventilation, Subsurface Water, Subsurface Waste Water, and Subsurface Compressed Air. There are no seal design activities associated with Design Package 2C (U.S. Department of Energy, 1995a).

The Regulatory Compliance Review Report contains an evaluation of 15 selected requirements for their allocation and traceability into the design solutions for the 11 CIs included in the ESF Design Package 2C. Evaluation of the results of 27 additional requirements was subsequently appended to the report on August 3, 1995 (U.S. Department of Energy, 1995b). On October 25, 1995, the DOE submitted a letter to the NRC further elaborating the steps taken to improve this design control process (U.S. Department of Energy, 1995c).

**OBJECTIVES**

The Regulatory Compliance Review Report is evaluated as a part of the NRC staff's Phase 3 In-Field Verification activities. The objectives of this review are to: (i) verify that DOE has identified applicable 10 CFR Part 60 requirements to be addressed in the ESF Design Package 2C, and (ii) assess if 10 CFR Part 60 design requirements included are appropriate, and (iii) assess if the flowdown to the design specifications is objective and traceable.

**REVIEW CRITERIA AND STAFF ASSESSMENTS**

NUREG-1439—Staff Technical Position on Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility (Gupta et. al, 1991) lists the key regulations in 10 CFR Part 60 that should be considered in the design and construction of the ESF. This review has been conducted using NUREG-1439 as the basis to determine whether the DOE has considered and included the requirements listed. It is recognized that the requirements listed in NUREG-1439 are intended for the entire ESF and some of the requirements may not be directly applicable to the ESF Design Package 2C. The DOE has also recognized this. For some of the regulatory requirements that were considered not applicable to the ESF Design Package 2C, the DOE did not include any discussion in the report. For those requirements considered applicable, the DOE provided discussion at varying levels of detail. The rationale provided by the DOE regarding the applicability for each requirement was evaluated. Table 1 gives the summary of this assessment.

The first column in the table lists all the regulatory requirements given in NUREG-1439. The second and third columns provide the DOE assessment regarding the applicability of each requirement to the ESF Design Package 2C. The column marked as "APPLICABLE" in the table is checked whether the requirement is considered applicable to at least one of the 11 CIs by the DOE. It is recognized that a large number of the requirements may or may not apply to all the configuration items. The last column of the table provides the staff's assessment of the DOE conclusions.

As a result of this review, the staff finds that the applicability or lack of it for most of the regulatory requirements has been reasonably discussed in the report. In general, the DOE has identified applicable 10 CFR Part 60 requirements and shown that these requirements have been included in the ESF Design Package 2C. Therefore, it is concluded that objectives (i) and (ii) mentioned before have been verified. However, for objective (iii) the staff has identified a few cases where DOE has not made appropriate interpretations. For example, 10 CFR 60.131(a) and 60.131(b)(8) are judged by the DOE not applicable to the Design Package 2C. The reviewers disagree with this assessment. Since 10 CFR 60.111(a) was judged to be applicable, there is no justification to judge 10 CFR 60.131(a) differently. As for 10 CFR 60.131(b)(8), since the North Ramp Excavation and Layout, and Linings and Support CIs are classified as structures, systems, and components important to safety, the provisions for instrumentations and control systems to monitor and control their behavior should be important. Consequently, 10 CFR 60.131(b)(8) should be considered applicable. Some of the regulatory requirements have been judged to be applicable to only certain CIs. In some cases, the reviewers do not agree with the assessment and are of the opinion that the requirement should also be applicable to some other CIs. For example, 10 CFR 60.72 has been judged by DOE to be not applicable to the lining and support systems CI. According to 10 CFR 60.72(b)(9), records for location and description of structural support systems are also required. In some cases, the rationale for applicability of a particular requirement is either insufficient or occasionally irrelevant. In spite of the above observations, the staff do not believe that the ESF Package 2C designs, analyses, and the subsequent construction have been adversely impacted by these minor omissions.

**SUMMARY**

The Regulatory Compliance Review Report has been evaluated as a part of the Phase 3 In-Field Verification activities. It is concluded that the DOE, in general, has identified 10 CFR Part 60 requirements applicable to the ESF Design Package 2C. The assessment of 10 CFR Part 60 design requirements included in the report is acceptable.

The NRC report on Phase 2 In-Field Verification (Nuclear Regulatory Commission, 1995) made three recommendations related to (i) modeling of rock bolts, (ii) a procedure for reporting geological conditions, and (iii) QA classification of precast concrete inverts. All these recommendations need to be pursued. However, parts of the checklist open items, related to verifying that appropriate regulatory requirements are being applied to ESF Design Package 2C, may be closed as a result of this review.

**FUTURE ACTIVITIES**

The following activities are recommended to complete Phase 3 of In-Field Verification: (i) observing the scheduled DOE surveillance on flowdown during the week of November 13, 1995, at Las Vegas; and (ii) following up on DOE's October 25, 1995, letter (U.S. Department of Energy, 1995c) and its implementation in the ESF design packages.

6/18

**REFERENCES**

U.S. Department of Energy. 1995a. *Regulatory Compliance Review Report, March 1995. Yucca Mountain Site Characterization Project*. Las Vegas, NV: U.S. Department of Energy.

U.S. Department of Energy. 1995b. *Regulatory Compliance Review Report, July 1995. Yucca Mountain Site Characterization Project*. Las Vegas, NV: U.S. Department of Energy.

U.S. Department of Energy. 1995c. Letter dated October 25, 1995 from Stephan J. Brocoum of U.S. Department of Energy to Joseph J. Holonich of Nuclear Regulatory Commission. Las Vegas, NV: U.S. Department of Energy.

Gupta, D., J. Peshel, and J. Bunting. 1991. *Staff Technical Position on Regulatory Considerations in the Design and Construction of the Exploratory Shaft Facility*. NUREG-1439. Washington, DC: Nuclear Regulatory Commission.

U.S. Nuclear Regulatory Commission. 1995. Letter dated June 16, 1995 from Joseph J. Holonich of Nuclear Regulatory Commission to Ronald A. Milner of U.S. Department of Energy. Washington, DC: Nuclear Regulatory Commission.

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.2 Definitions	✓		Agree
60.15(b) Site Characterization	✓		Agree
60.15(c)(1) Site Characterization	✓		Agree
60.15(c)(2) Site Characterization	✓		Agree
60.15(c)(3) Site Characterization	✓		Agree
60.15(c)(4) Site Characterization	✓		Agree
60.16 Site Characterization Plan Required		✓	Agree
60.17(a) Contents of Site Characterization Plan		✓	Agree
60.17(b) Contents of Site Characterization Plan		✓	Agree

4

7/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.17(c) Contents of Site Characterization Plan		✓	Agree
60.21(c)(1)(ii)(D) Content of Application	✓		Agree
60.21(c)(1)(ii)(E) Content of Application	✓		Agree
60.21(c)(11) Content of Application		✓	Agree
60.24(a) Updating of Application and Environmental Impact Statement		✓	Agree
60.72 Construction Records	✓		This requirement has not been specifically allocated to the linings and ground support configuration item. According to 60.72(b)(9), records for location and description of structural support systems are required.
60.74(a) Tests		✓	Agree

5

8/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.74(b) Tests		✓	Agree. Design of excavation, support systems, etc. will not be affected but we believe that, by considering this requirement, the design of the tests will be improved. It is essential to consider that testing requirements for the performance confirmation program would likely be long-term as opposed to the tests for site characterization that are intended for short-term duration. Design requirements for long-term test equipment may be more stringent.
60.111(a) Protection Against Radiation Exposure and Releases of Radioactive Material	✓		Agree (Discussion provided in this section is irrelevant)
60.111(b)(1) Retrievability of Waste	✓		Agree
60.111(b)(3) Retrievability of Waste		✓	Agree
60.112 Overall System Performance Objective for the Geologic Repository After Permanent Closure	✓		Partially agree. However, the DOE says that this requirement has been "inappropriately applied" to subsurface water, subsurface waste water, and material handling configuration items. We do not agree with this statement.

9

8/18



**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.113(a)(1)(i) Performance of Particular Barriers After Permanent Closure—Engineered Barrier System		✓	Agree
60.113(a)(1)(ii) Performance of Particular Barriers After Permanent Closure—Engineered Barrier System		✓	Agree
60.113(a)(2) Performance of Particular Barriers After Permanent Closure—Geologic Setting		✓	Agree
60.113(b)(2) Performance of Particular Barriers After Permanent Closure		✓	Agree

7

10/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.113(b)(3) Performance of Particular Barriers After Permanent Closure		✓	Agree
60.113(b)(4) Performance of Particular Barriers After Permanent Closure		✓	Agree
60.122(a)(1) Siting Criteria		✓	Agree
60.122(a)(2) Siting Criteria		✓	Agree
60.122(b) Siting Criteria—Favorable Conditions		✓	Agree
60.122(c) Site Criteria—Potential Adverse Conditions		✓	Agree
60.130 Scope of Design Criteria for the Geologic Repository Operations Area		✓	Agree

∞

11/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.131(a) General Design Criteria for the Geologic Repository Operations Area—Radiological Protection		✓	Disagree. If 60.111(a) is applicable, this requirement should also be applicable.
60.131(b)(1) Protection Against Natural Phenomena and Environmental Conditions	✓		Agree
60.131(b)(2) Protection Against Dynamic Effects of Equipment Failure and Similar Events	✓		Agree. Relevant discussion related to missile impact is not provided.
60.131(b)(3) Protection Against Fires and Explosions	✓		Agree. However, relevant discussion related to the alarm system in the design has not been provided.
60.131(b)(4)(i) Emergency Capacity	✓		Agree
60.131(b)(4)(ii) Emergency Capacity		✓	Agree

6

8/18  
13/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.131(b)(6) Inspection, Testing, and Maintenance	✓		Agree
60.131(b)(8) Instrumentation and Control Systems		✓	Disagree. Excavation and ground supports are permanent items, and classified as items important to safety.
60.131(b)(9) Compliance with Mining Regulations	✓		Agree
60.131(b)(10) Shaft Conveyances Used in Radioactive Waste Handling		✓	Agree
60.133(a) General Criteria for the Underground Facility	✓		Agree
60.133(b) Flexibility of Design	✓		Agree
60.133(c) Retrieval of Waste	✓		Agree
60.133(d) Control of Waste and Gas	✓		Agree

10

13/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.133(e)(1) Underground Openings	✓		Agree
60.133(e)(2) Underground Openings	✓		Agree. However, followup is needed on DOE Internal QA Review results.
60.133(f) Rock Excavation	✓		Agree
60.133(g) Underground Facility Ventilation		✓	Agree
60.133(h) Engineered Barriers		✓	Agree
60.133(i) Thermal Loads	✓		Agree. Verify consistency among CI BABEAD000, BABEAE000, and BABEAF000 for the applicability of 60.133(i).
60.134(a) Design of Seals for Shafts and Boreholes—General Design Criteria	?		In reviewing the discussion provided, it was considered that the regulatory requirement was applicable. However, the discussion is ambiguous.
60.134(b) Design of Seals for Shafts and Boreholes—Selection of Materials and Placement Methods	?		In reviewing the discussion provided, it was considered that the regulatory requirement was applicable. However, the discussion is ambiguous.

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.137 General Requirements for Performance Confirmation	✓		Agree
60.140(b) Performance Confirmation Program—General Requirements	✓		Agree
60.140(c) Performance Confirmation Program—General Requirements	✓		Agree
60.140(d)(1) Performance Confirmation Program—General Requirements		✓	Agree
60.141(a) Confirmation of Geotechnical and Design Parameters	?		See 60.141(e) for applicability.
60.141(b) Confirmation of Geotechnical and Design Parameters	?		See 60.141(e) for applicability.

12

15/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.141(c) Confirmation of Geotechnical and Design Parameters	?		See 60.141(e) for applicability.
60.141(d) Confirmation of Geotechnical and Design Parameters	?		See 60.141(e) for applicability.
60.141(e) Confirmation of Geotechnical and Design Parameters	✓		Agree
60.142(a) Performance Confirmation Program—Design Testing	✓		Agree
60.142(b) Performance Confirmation Program—Design Testing	✓		Agree. However, discussion regarding Lining and Ground Support does not address this particular requirement.
60.142(c) Performance Confirmation Program—Design Testing		✓	Agree

11/18

**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.142(d) Performance Confirmation Program—Design Testing		✓	Agree
60.143(a) Performance Confirmation Program—Monitoring and Testing Waste Packages		✓	Agree
60.143(b) Performance Confirmation Program—Monitoring and Testing Waste Packages		✓	Agree
60.143(c) Performance Confirmation Program—Monitoring and Testing Waste Packages		✓	Agree

14

17/18



**Table 1. Summary of staff assessment of the DOE Regulatory Compliance Review Report (cont'd)**

Applicable Requirements for ESF in NUREG-1439	DOE Regulatory Compliance Report (Examples for Package 2C)		Review Comments/Remarks
	Applicable	Not Applicable	
60.143(d) Performance Confirmation Program—Monitoring and Testing Waste Packages		✓	Agree
? Indicates that reviewers cannot determine from the report if the DOE considers this regulatory requirement applicable to ESF Package 2C.			