Design Analysis Cover Sheet

Complete only applicable items.

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QA: L

Page: 1 Of: 15

2. DESIGN ANALYSIS TITLE			
QA Classification Analysis of Ground Support Systems (CI: BABEE0000) (SCPB: N/A)			
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11. Department Manager	Peter S. Hastings	<i>Peter S. Hastings</i>	30 Oct 96
12. REMARKS			
<p>This revision of the classification analysis for CI BABEE0000 (Ground Support Systems) supersedes the previous classification analysis in its entirety. As in the previous analysis, CI BABEE0000 is classified as QA-1 and QA-5.</p> <p>The minimum QA-1 and QA-5 design criterion for Ground Support Systems, as presented in this analysis, shall be used as appropriate for CI BABEE0000.</p> <p>This classification analysis will be distributed as a controlled document in accordance with QAP-6-1.</p>			

Design Analysis Revision Record

Complete only applicable items.

1.

Page: 2

Of: 15

2. DESIGN ANALYSIS TITLE

QA Classification Analysis of Ground Support Systems (CI: BABEE0000)

3. DOCUMENT IDENTIFIER (Including Rev. No.)

BABEE0000-01717-2200-00001 Rev 05

4. Revision No.	5. Description of Revision
00 - 05/09/95	Initial issue - Supersedes classification analysis for Lings & Ground Support (CI: BABEAB000) performed in Determination of Importance Evaluation for ESF Package 2C, BAB000000-01717-2200-00005 Rev 04.
01 - 06/06/95	Incorporated Starter Tunnel ground support; deleted criteria 4.2.2; added assumption 4.3.3; clarified discussion on QA-2 discussion on seals; clarified postclosure discussion on ground support.
02 - 07/05/95	Revised Section 7.1 to clarify the scope of BABEE0000 evaluation (does not include ground support in waste emplacement areas). As a result, assumption 4.3.3 is not necessary and was deleted. Revised Section 7.3 discussion of ground support. Editorial change also made in Section 7.1.
03 - 03/25/96	Editorial clarifications in Section 3, 4.1.1, and 7.3. Updated 4.4.3, 5.1, 5.6, & 5.7 to current revision. Revised requirement 1c (and associated text in 7.2). Deleted Attachment III.
04 - 04/19/96	Revised throughout to include South Portal headwall in scope. Editorial changes in 2.0, 3.0, 7.3, 7.7, and 7.8. Updated reference 5.8.
05 - 10/30/96	Revised Requirement 3 and associated text. Updated ESFDR reference and associated text. Eliminated Reference 5.5 since description of CI is now contained in Reference 5.1. Editorial change throughout to ensure consistent use of terms "permanent function", "temporary function", and "ground support system." Included Operation and Test Support Area classification analyses in reference section and added cites in section 7.

QA Classification Analysis of Ground Support Systems (CI: BABEE0000)

1.0 PURPOSE

The purpose and objective of this analysis is to determine if the permanent function Ground Support Systems (CI: BABEE0000) are quality-affecting items and if so, to establish the appropriate Quality Assurance (QA) classification.

2.0 QUALITY ASSURANCE

In accordance with QAP-2-0 and NLP-3-18, the QA program applies to this analysis since it determines whether the permanent function Ground Support Systems (CI: BABEE0000) are quality-affecting items that should be subject to QA controls. This analysis will establish the appropriate QA classification in accordance with QAP-2-3.

3.0 METHOD

This evaluation was performed using the evaluation criteria checklists in QAP-2-3, "Classification of Permanent Items." QAP-3-9, "Design Analysis," is used for establishing format, content, and review requirements. The conclusions of QA classification analyses are used as input into recommended changes to the project Q-List (Reference 5.3).

4.0 DESIGN INPUTS

4.1 Design Parameters

- 4.1.1 Specific engineering parameters are not applicable. The MGDS classification checklists (Attachment II) represent the functional evaluation criteria from which QA classifications are developed.

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The results of this analysis will enable designers to establish design parameters for QA items within the boundaries of CI BABEE0000.

4.2 Criteria

- 4.2.1 ESFDR 3.7.3.1 (Reference 5.1) states that the ground support system in the main access openings and in the transition zones for the operations support and test support areas are permanent items, i.e., will provide a permanent function in a repository.

4.3 Assumptions

- 4.3.1 It is assumed throughout this evaluation that, unless otherwise stated in the body of the analysis, "failure of an item" is the deterministic failure of the item (i.e., independent of initiating event) to meet its intended function (based on establishment of a conservative design basis).
- 4.3.2 It is assumed that a postulated complete collapse of a portion of the tunnel will bound other postulated seismically-induced or deterministically assumed collapses. This collapse is conservatively assumed to result in a radiological release exceeding the 0.5 rem criterion in 10CFR60 in order to establish bounding conditions for potential radiological releases.

4.4 Codes and Standards

- 4.4.1 NUREG-1318, "Technical Position on Items and Activities in the High-Level Waste Geologic Repository Program Subject to Quality Assurance Requirements" (April 1988).
- 4.4.2 Code of Federal Regulations, 10 CFR 60, "Disposal of High Level Radioactive Waste in Geologic Repositories", January 1, 1994 Edition.
- 4.4.3 Quality Assurance Requirements and Description, DOE/RW/0333P, Rev. 5, October 31, 1995.

5.0 REFERENCES

- 5.1 Exploratory Studies Facility Design Requirements, YMP/CM-0019, Rev. 2, April 22, 1996.
- 5.2 Initial Summary Report for Repository/Waste Package Advanced Conceptual Design, B00000000-01717-5705-00015 Rev 00, August 29, 1994.
- 5.3 Yucca Mountain Site Characterization Project Q-List, YMP/90-55Q, Rev. 3, December, 1994.
- 5.4 Repository Design Requirements (RDR) Document, YMP/CM-0023, Rev. 0, ICN 1, September 22, 1994.
- 5.5 QA Classification Analysis of Test Support Areas (CI: BABEAF000), BABEAF000-01717-2200-00001 Rev 00, June 6, 1995.
- 5.6 Determination of Importance Evaluation for Subsurface Exploratory Studies Facility, BAB000000-01717-2200-00005 Rev 05, July 14, 1995.
- 5.7 QA Classification Analysis of Main Access Openings (CI: BABEAD000), BABEAD000-01717-2200-00002 Rev 02, March 20, 1996.
- 5.8 QA Classification Analysis of the Starter Tunnel and South Portal Headwall (CI: BABEAA000), BABEAA000-01717-2200-00098 Rev 01, April 19, 1996.
- 5.9 QA Classification Analysis of Operation Support Areas (CI: BABEAE000), BABEAE000-01717-2200-00001 Rev 00, June 6, 1995.

6.0 USE OF COMPUTER SOFTWARE

Not applicable; no analytical computer programs are applicable to the derivation of the contents or results of this document.

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7.0 DESIGN ANALYSIS

7.1 Ground Support Systems (CI: BABEE0000) Description

The Ground Support Systems are the structures installed within the excavated opening, or reinforcement made to the rock surrounding the opening, with the intention of controlling the configuration and stability of the opening, and to provide protection for personnel and equipment against potential falls of loose rock from the back and walls of the opening. This includes the ground support system installed throughout the main access openings and in the transition zones for the operations support and test support areas. The transition zone length is approximately 2.5 times the main access opening diameter measured perpendicular from the centerline of the main access opening. The ground support systems in the aforementioned areas are permanent items. (Reference 5.1)

In this analysis, permanent ground supports are referred to as permanent function ground support systems and are described as:

1. Permanent function ground support systems in Main Access Openings (CI: BABEAD000) and the Starter Tunnel (CI: BABEAA000) and transition zones (discussed in 7.2) of Operations Support Areas (CI: BABEAE000) and Test Support Areas (CI: BABEAF000);
2. Permanent function ground support systems for the South Portal headwall (CI: BABEAA000); and
3. All other permanent function ground support systems in Operations Support Areas and Test Support Areas that are not part of a support area transition zone.

(Refer to respective CI classification analysis for definitions of these areas. The evaluation of BABEE0000 only covers ground support installed in areas included in BABEAD000, BABEAA000 (Starter Tunnel and South Portal headwall only), BABEAE000, and BABEAF000 (References 5.5, 5.7, 5.8, and 5.9). As such, it does not include ground support in waste emplacement areas.)

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Temporary function ground support systems (i.e., not installed for repository use) does not require classification in accordance with QAP-2-3; any potential impacts or criteria, including that the temporary function ground support systems are designed so as not to preclude the installation of permanent function ground support systems, prevention of deleterious rock movement during ESF operation, etc., is considered in the appropriate Determination of Importance Evaluation.

7.2 Basis for MGDS QA Classification 1

Based on references 5.7 and 5.8, the Main Access Openings, Starter Tunnel, and South Portal headwall are not QA Classification 1; however, preserving their integrity of these openings is important-to-radiological-safety due to the fact that these areas may house important-to-radiological-safety equipment, and that function is allocated to Ground Support Systems (References 5.7 and 5.8). Therefore, the permanent function ground support systems in Main Access Openings (CI: BABEAD000), the Starter Tunnel (CI: BABEAA000), and the South Portal headwall are QA Classification 1 .

The magnitude and impact of consequences associated with a rockfall have not yet been determined. It is assumed, however, that a rockfall may damage important-to-radiological-safety equipment (including the waste package) which could result in a dose on or beyond the nearest unrestricted area boundary of ≥ 0.5 rem without considering mitigating features. (This assumption conservatively bounds a seismically-induced or deterministically assumed collapse.) It is judged that the use of permanent function ground support systems will act to reduce the probability of rockfall, although a quantitative assessment of this probability cannot be made at this time, since actual rock characteristics along the entire ramp are still unknown. The determination of such probability may result in a design input which would not require the waste package, transporter, or transport overpack (if any) to prevent radionuclide release in the event of a rockfall. The use of permanent function ground support systems in areas where a waste package might be transported or that contain a system required to mitigate an accident (i.e., QA-1) is therefore judged to be QA-1. These areas are defined in the classification analysis for Main Access Openings (CI BABEAD000, Ref 5.7), the Starter Tunnel (CI BABEAA000, Ref 5.8), and South Portal headwall (CI BABEAA000, Reference 5.8) .

A "transition zone" is defined by the A/E at a main access area/support area (operations or test) intersection, and extending into the support area. [Note that, for the purposes of this evaluation, main access area includes the Starter Tunnel (CI: BABEAA000) and Main Access Openings (CI: BABEAD000).] This zone is defined based on that area extending into the support area where permanent-function ground support systems are installed to supplement main access area permanent function ground support systems (i.e., to preserve main access area integrity). Permanent-function ground support systems in such a zone, since it is installed to preserve main access area integrity, are controlled in the same manner as main access area permanent function ground support systems (i.e., as QA-1). Further, any permanent function ground system support resulting from subsequent permanent function ground support inspections which supplements the main access area permanent function ground support system will be designed and installed as QA-1. The transition zone is defined in the ESFDR (Reference 5.1) as 2.5 times the main access opening diameter measured perpendicular from the centerline of the main access openings, or it may be conservatively defined as the entire length of the alcove, or specifically defined in the design basis (i.e., specifications, drawings, analyses) for the support area (alcove, refuge chambers, etc.). Any such supplemental support added beyond the extent of the transition zone would also require redefinition of the transition zone. Temporary function ground support systems may be installed in the support area transition zones or anywhere else underground prior to the installation of permanent function ground support system to support ESF construction/operation; a permanent function QA-1 ground support system will be established prior to licensed operation in a potential repository.

The operations and test support areas along the TS Loop (CIs BABEAE000 and BABEAF000) do not support any of the assumed TS Loop permanent functions (such as providing a path for ventilation or other systems required to mitigate the radiological consequences of emplacement accidents, or providing a path for waste emplacement), or any other functions which are important to radiological safety (except in transition zones discussed above). (Reference 5.5 and 5.9) Permanent function ground support systems installed in these support areas (except transition zones) is therefore judged not to be QA Classification 1.

For permanent function ground support systems classified as QA-1, commercial grade mining materials and conventional mining industry practices are judged to be acceptable for maintaining the integrity of the opening and reducing the

likelihood of a rockfall, due to the integral conservatism involved. Standard practices are those mining practices conforming with appropriate A/E drawings and specification sections. The acceptability of these conventional techniques is assured by the application the following QA controls which provide reasonable assurance that the QA-1 criteria for permanent function Ground Support Systems are maintained during ESF operations: use of qualified materials or dedication of commercial-grade materials; receipt inspection and verification of representative materials per A/E specifications; verification that placement (e.g., pattern, spacing, shotcrete thickness, etc.) of permanent function ground support system is in accordance with the minimum requirements of the selected ground category as described on the drawings and specifications; selected installation testing; and A/E approval of changes to ground support. Maintenance of the permanent function ground support system shall include periodic walkdowns of the system (at a frequency accepted by the A/E) and incorporating appropriate input from the Construction Monitoring program. Maintenance and/or the addition of appurtenances shall be controlled so as to not compromise the critical characteristics of the fully qualified or dedicated commercial grade items. Any post-qualification welding of or on (QA-1 or QA-5) hardware must consider the applicable requirements of QARD section 9.0 ("Control of Special Processes"). (Note that weld material is not considered to be a consumable item and is not QA-1 except in the fact that it becomes part of the QA-1/QA-5 component; any special requirements associated with the control of weld material is handled under "Control of Special Processes"). In conformance with 10CFR60.72, use and retention of construction and maintenance procedures (including walkdown documentation) and other records as quality records shall also be required in order to support potential license applications (Requirements 1, 2, 3).

Based on the above discussions, permanent function ground support systems in Main Access Openings (CI: BABEAD000), Starter Tunnel (CI: BABEAA000), South Portal headwall (CI: BABEAA000), and transition zones of Operations Support Areas (CI: BABEAE000) and Test Support Areas (CI: BABEAF000) are judged to be QA Classification 1. Other permanent function ground support systems in Operations Support Areas and Test Support Areas are judged not to be QA Classification 1.

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7.3 Basis for MGDS QA Classification 2

Permanent function Ground Support systems do not form a part of the natural or engineered barrier subject to the requirements of 10CFR60.112 or 10CFR60.113. They do not inhibit radionuclide transport within the extent of the natural barrier, prevent or discourage human intrusion into the engineered or natural barrier, or inhibit degradation of the natural barrier. Although some of the rock formations penetrated by these excavations are part of the natural barrier, the excavations do not function as part of the barrier. Since these excavations do not function as part of the natural barriers, their respective permanent function ground support systems are not required to inhibit their degradation.

Due to their location relative to the saturated zone and the fact that material selection is controlled through the DIE process, the failure of the permanent function Ground Support System is not expected to create significant ponding or the possibility of drainage into the underground facility, result in the introduction of fluids or other materials that might affect the geochemical characteristics of natural barriers (as indicated on the Q-List), or affect the geomechanical characteristics of the natural barrier. Additionally, requirements in the RDR (Ref 5.4) for repository seals include the following provisions from 10CFR60.134:

1. Seals [for accesses] ... shall be designed so that following permanent closure they do not become pathways that compromise the geologic repository's ability to meet the performance objectives for the period following permanent closure.
2. Materials and placement methods for seals shall be selected to reduce, to the extent practical, (a) the potential for creating a preferential pathway for groundwater to contact the waste packages; or (b) for radionuclide migration through existing pathways.

While the potential creation of preferential pathways by use of permanent function ground support is not considered significant (Ref 5.6), it is judged, based on the above RDR requirements, that the design of the seals will adequately address any potential impact of permanent function ground support that will be present in a post closure repository. When the seal design is formulated for underground accesses, further evaluation of potential impacts will be performed which incorporate site data on the geomechanical properties of the disturbed

zone, including any permanent function ground support that would be present in a post closure repository. The record-keeping requirements associated with QA-1 permanent function ground support systems (see Section 7.2), also provide confidence that sufficient records of the permanent function ground support system installation are maintained such that no additional QA requirements are necessary with regard to the future establishment of seals. Based on the above discussion, Ground Support Systems (CI BABEE0000) are judged not to be QA-2 with respect to repository seals; any potential waste isolation concerns due to the presence (or failure) of permanent function ground support systems is allocated to repository seals (CI is not defined at this time). It is judged that the existing RDR seal requirements adequately encompass this allocation.

Failure of the permanent function ground support systems is not expected to compromise the ability of natural or engineered barriers to isolate waste. (Note: As discussed in Section 7.1, the evaluation of BABEE0000 only covers permanent function ground support systems installed in areas included in BABEAD000, BABEAA000 (Starter Tunnel and South Portal headwall only), BABEAE000, and BABEAF000. As such, it does not include ground support in waste emplacement areas.)

Based on the current design of the conceptual repository, there are no other factors which would lead to the conclusion that permanent function Ground Support Systems are Important to Waste Isolation.

The permanent function Ground Support Systems are therefore judged not to be QA Classification 2.

7.4 Basis for MGDS QA Classification 3

Based on the current design of the conceptual repository, there are no functions identified where permanent function Ground Support Systems are designed to collect or contain site generated radioactive waste; they are not a portion of a radiological, meteorological, or environmental monitoring system required to assess radionuclide release or dispersion.

Permanent function Ground Support Systems are therefore judged not to be QA Classification 3.

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7.5 Basis for MGDS QA Classification 4

Based on the current design of the conceptual repository, the permanent function Ground Support Systems do not protect QA Classification 1 or 2 structures, systems, or components from the effects of fire.

Permanent function Ground Support Systems are therefore judged not to be QA Classification 4.

7.6 Basis for MGDS QA Classification 5

During a Design Basis Event (such as an earthquake), the consequential failure of TS Main Access Openings, Starter Tunnel, or South Portal headwall permanent function ground support systems could impair the ability of the waste package or other important to radiological safety (IRS) systems (e.g. ventilation or control systems) to perform their IRS functions (by damage incurred from a rockfall). Based on the definition of a transition zone discussed above, the failure of operations or test support area permanent functions ground support systems in the transition zone could also cause failure of TS Main Access Openings or Starter Tunnel ground support and similarly damage a waste package or other IRS systems. Therefore, the permanent function ground support systems for the Main Access Openings, Starter Tunnel, and South Portal headwall, as well as permanent function ground support systems in support areas transition zones are considered to be QA-5, Important to Potential Interaction.

As discussed above, permanent function ground support systems in the Main Access Openings, Starter Tunnel, South Portal headwall, and transition zones are also QA-1. It is judged that controls applied to ensure the QA-1 classification is maintained during ESF construction and operation are adequate for QA-5 considerations.

The permanent function Ground Support Systems for Main Access Openings, Starter Tunnel, South Portal headwall, and support area transition zones (as defined above) are judged to be QA Classification 5.

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7.7 Basis for MGDS QA Classification 6

Based on the current design of the conceptual repository, no functions have been identified where permanent function Ground Support Systems are required to detect and provide alarm of unauthorized intrusion into the protected area, entry of explosives, incendiary devices, or firearms into protected areas, control access to vital areas, or for special nuclear material accountability.

The permanent function Ground Support Systems are therefore judged not to be QA Classification 6.

7.8 Basis for MGDS QA Classification 7

Based on the current design of the conceptual repository, the permanent function Ground Support Systems are not items that will require personnel access into radiation areas for normal or post-accident operation or maintenance. They do not provide radiation shielding to an area requiring personnel access. They are not a permanently installed radiation monitor or a design feature installed for reducing dose rates in areas requiring personnel access.

The permanent function Ground Support Systems are therefore judged not to be QA Classification 7.

8.0 CONCLUSIONS

Based on the current design of the conceptual repository, permanent function ground support systems in Main Access Openings, Starter Tunnel, South Portal headwall, and transition zones of Operations Support Areas and Test Support Areas are classified as QA-1 and QA-5. It is judged that the applicable QA requirements listed below adequately address the minimum QA-1 and QA-5 design criteria for permanent function ground support systems.

Requirement 1: The standard mining practices (i.e., conventional industry techniques and commercial grade materials conforming to requirements of A/E drawings and specifications) employed for emplacement of permanent function

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ground support systems (e.g., rock bolts, steel sets, concrete, shotcrete, etc.) associated with the Topopah Spring Loop (including the Starter Tunnel), other Main Access Openings, South Portal headwall, and Support Area transition zones shall be controlled by requiring the following minimum QA controls:

- a. use of qualified material or dedication of commercial grade material;
- b. receipt inspection and verification of representative materials per A/E specifications;
- c. verification that placement (e.g., pattern, spacing, shotcrete thickness, etc.) of the permanent function ground support system is in accordance with the minimum requirements of the selected ground category as described on the drawings and specifications;
- d. selected installation testing;
- e. and A/E approval of changes.

Requirement 2: Permanent function ground support system work performed in the Topopah Spring Loop (including the Starter Tunnel), other Main Access Openings, South Portal headwall, and support area transition zones shall be documented in accordance with ground support specifications. These records shall document work processes in conformance with 10CFR60.72. Receipt verification and procedural documentation, including changes to bolt patterns, shall also be treated as QA records.

Requirement 3: Periodic walkdowns (at a frequency accepted by the A/E) of the permanent function ground support system in the Topopah Spring Loop (including the Starter Tunnel), other Main Access Openings, South Portal headwall, and in support area transition zones shall be performed to check acceptable system performance. Maintenance of the permanent function ground support system shall be made based on the walkdown results and the Construction Monitoring program. Maintenance or the addition of appurtenances shall not compromise the critical characteristics of the permanent function ground support system. Post-qualification welding on permanent function ground support system components must consider the applicable sections of QARD Section 9.0.

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Maintenance, walkdowns, and repair procedures shall document work processes in conformance with 10CFR60.72 and shall be maintained as QA records.

Permanent function ground support systems installed in support areas for Main Access Openings and the Starter Tunnel (CIs BABEAE000 and BABEAF000) beyond the transition zone does not meet any of the QA 1-7 classification criteria. Temporary function ground support systems do not require classification in accordance with QAP-2-3. Potential site impact of permanent and temporary ground support systems are addressed in the applicable DIE.

9.0 ATTACHMENTS

Attachment I	List of Acronyms
Attachment II	QAP-2-3 MGDS Checklists

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List of Acronyms

A/E	Architect/Engineer
BABEAA000	Portals Configuration Item
BABEE0000	Ground Support Systems Configuration Item
BABEAD000	Main Access Openings Configuration Item
BABEAE000	Operations Support Areas Configuration Item
BABEAF000	Test Support Areas Configuration Item
CI	Configuration Item
DIE	Determination of Importance Evaluation
ESF	Exploratory Studies Facility
ESFDR	Exploratory Studies Facility Design Requirements
MGDS	Mined Geologic Disposal System
QA	Quality Assurance
QAP	Quality Administrative Procedure
QARD	Quality Assurance Requirements Description
RDR	Repository Design Requirements
SSC	System, Structure, and Component
TBM	Tunnel Boring Machine
TS	Topopah Spring Geologic Unit
YMP	Yucca Mountain Project
10CFR60	Title 10 Code of Federal Regulations Chapter 60

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CRWMS/M&O

QA Classification 1
Important to Radiological Safety

WBS: 1.2.1.11

QA: L

Classification Checklists for MGDS Page 1 of 7

Configuration Item Identifier: BABEE0000 - Ground Support Systems

Yes No

1.1 Is the item required:☒ ☐

- a. To prevent or mitigate the effects of a credible ¹ accident which could directly or indirectly result in a release of radioactive materials which would result in a dose on or beyond the nearest unrestricted area boundary of ≥ 0.5 rem whole body or any organ until completion of permanent closure?

☐ ☒

- b. To monitor and/or control QA Classification 1 sections of structures, systems, and components important to radiological safety?

☒ ☐

- c. For functioning of any equipment required to mitigate the effects of a credible accident as defined by the methods described in the analysis?

1.2 Can failure of the item:☒ ☐

- a. Initiate a credible accident which would result in a dose on or beyond the nearest unrestricted area boundary of ≥ 0.5 rem whole body or any organ until permanent closure without considering mitigating features?

☐ ☒

- b. Directly cause a credible offsite release of radioactive materials which would result in a dose on or beyond the nearest unrestricted area boundary of ≥ 0.5 rem whole body or any organ until completion of permanent closure?

☐ ☒

- 1.3 Is the item a consumable/expendable item which is part of, or contained within, and affects the safety function of any component identified in Section 1.1 or 1.2 above?

☐ ☒

- 1.4 Are there other factors, such as previous analyses, a body of consensus, or direct inclusion, that lead to the conclusion that the item is Important to Radiological Safety?

If the answer to any question in 1.1, 1.2, 1.3 or 1.4 is Yes, then the item is QA Classification 1.

¹ Credibility is established in the analyses in support of this procedure. A nominal probability threshold of 10^{-6} design events per year has been established for MGDS. In cases where data are limited, however, engineering judgement and conservative bounding assumptions will be required as described in NUREG-1318.

QA Classification 2
Important to Waste Isolation

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Yes No

2.1 Does the item perform a waste isolation function by:

☐	☒	a. Forming part of the natural or engineered barrier subject to the requirements of 10 CFR Part 60.112 or Part 60.113.?
☐	☒	b. Inhibiting water or radionuclide transport within the extent of the natural barrier (as indicated on the Q-list)?
☐	☒	c. Preventing or discouraging human intrusion into the engineered or natural barrier?
☐	☒	d. Inhibiting degradation of the engineered barrier?

2.2 Can failure of the item:

☐	☒	a. Result in changes to the hydrological characteristics of natural barriers (as indicated on the Q-List) by creating significant ponding or the possibility for drainage into the underground facility?
☐	☒	b. Result in the introduction of fluids or other materials that might affect the geochemical characteristics of natural barriers (as indicated on the Q-List)?
☐	☒	c. Affect the geomechanical characteristics of natural barriers (as indicated on the Q-List)?

☐	☒	2.3 Can failure of the item otherwise compromise the ability of natural or engineered barriers to isolate waste?

☐	☒	2.4 Are there other factors, such as previous analyses, a body of consensus, or direct inclusion, that lead to the conclusion that the item is Important to Waste Isolation?

If the answer to any question in 2.1, 2.2, 2.3, or 2.4 is Yes, then the item is QA Classification 2.

QA Classification 3
Important to Radioactive Waste Control

Classification Checklists for MGDS Page 3 of 7

Yes No

3.1 *Is the item part of:*☐☒

- a. A system designed for the collection and containment of site-generated radioactive waste, which, if failed, could result in a dose on or beyond the nearest unrestricted area boundary in excess of 10CFR20 limits and less than 0.5 rem whole body or any organ?

☐☒

- b. A portion of the radiological, meteorological and environmental monitoring required to assess radionuclide release or dispersion?

If the answer to any question in 3.1 is Yes, then the item is QA Classification 3.

CRWMS/M&O

QA Classification 4
Important to Fire Protection

Classification Checklists for MGDS Page 4 of 7

Yes No

☐ ☒

4.1 Does the item protect QA Classification 1 or 2 structures, systems or components from the effects of fire?

NOTE: If the answer to question 4.1 is No, then the item is not QA Classification 4 and Sections 4.2 and 4.3 are not applicable.

4.2 Is the item part of the pressure boundary of:

☐ ☐

a. Interior fire protection, including hose stations and sprinkler systems?

☐ ☐

b. Exterior fire protection, including fire pumps and hydrants?

☐ ☐

c. A CO₂, Halon, or other chemical fire suppression system?

4.3 Is the item part of:

☐ ☐

a. Structures, barriers, doors, or dampers designed to prevent the spread of fire?

☐ ☐

b. Fire/smoke detectors or associated supporting equipment?

☐ ☐

c. Instrumentation that actuates or demonstrates operability of fire protection systems?

If the answer to any question in 4.2 or 4.3 is Yes, then the item is QA Classification 4.

Classification Checklists for MGDS Page 5 of 7

Yes No

- 5.1 During a Design Basis Event, could consequential failure of the item impair the capability of other items to perform their intended radiological safety or waste isolation function?

If the answer question 5.1 is Yes, then the item is QA Classification 5.

QA Classification 6
**Important to Physical Protection of
Facility and Materials**

Classification Checklists for MGDS Page 6 of 7

Yes	No	
☐	☒	6.1 <i>Is the item required to detect and provide alarm of:</i>
☐	☒	a. Unauthorized intrusion into the protected area?
☐	☒	b. Entry of explosives, incendiary devices, or firearms into the protected area?
☐	☒	6.2 Is the item required to control access to vital areas?
☐	☒	6.3 Is the item required for special nuclear material accountability?

If the answer to any question in 6.1, 6.2, or 6.3 is Yes, then the item is QA Classification 6.

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Yes No

☐☒

7.1 Does the item require personnel access into radiation areas for normal or post-accident operation or maintenance?

☐☒

7.2 Does the item provide radiation shielding to an area requiring personnel access?

☐☒

7.3 Is the item a permanently installed radiation monitor which monitors areas for personnel radiation protection?

☐☒

7.4 Is the item a design feature installed for reducing dose rates in areas requiring personnel access?

If the answer to any question in 7.1, 7.2, or 7.3, or 7.4 is Yes, then the item is QA Classification 7.