NRC Response to Public Comments

Appendices F-I to NUREG/BR-0058, Revision 5, "Regulatory Analysis Guidelines of the U.S. NRC"

ADAMS Accession No. ML21230A380
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Enclosure 5

I. INTRODUCTION

This document presents the U.S. Nuclear Regulatory Commission (NRC) staff response to written public comments received on four draft appendices to NUREG/BR-0058, Revision 5, "Regulatory Analysis Guidelines of the U.S. NRC." The NRC published the draft appendices for public comment in the *Federal Register* on April 16, 2021 (86 FR 20208). The staff considered this public input when developing the final appendices provided for Commission approval.

II. OVERVIEW OF COMMENTERS AND COMMENTS

The NRC staff received two comment submissions with a total of 20 individual comments. Table 1 presents information on the commenters who submitted comments on draft appendices F-I.

Table 1. Information on Commenters

Name	Affiliation	ADAMS Accession No.	Identifier
Maggie N. Staiger	Nuclear Energy Institute (NEI)	ML21204A100	NEI
Rod Baltzer	Deep Isolation (DI)	ML21245A339	DI

Staff has grouped similar comments to facilitate NRC response. Comments were binned into the following categories:

a. Comments Related to Appendix G, "Regulatory Analysis Methods and Data for Nuclear Facilities Other Than Power Reactors"
b. Comments Related to Appendix H, "Severe Accident Risk Analysis"
c. Comments Related to Cost-Benefit Analyses

Staff received no comments directed to the content of Appendix F, "Data Sources" or Appendix I, "NEPA Cost-Benefit Analysis Guidance".

a. Comments Related to Appendix G

Comment a1 (DI): The NRC should consider updating or replacing 10 CFR Part 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories," to more uniformly apply a risk-informed, performance-based approach to the governance of nuclear facilities. It is widely accepted that this regulation is outdated and needs to reflect the same total system performance objective methodology that was adopted in 10 CFR Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada." Over the past several years, we have seen significant technology-driven advancement in performance objectives – including radiological risk and performance assessment models – to safely manage backend fuel cycle waste streams. Accordingly, regulators have adapted rules to reflect these new standards in all disposal scenarios, except that of high-level radioactive waste and spent nuclear fuel.

NRC Response: The NRC staff acknowledges this comment, which is outside the scope of this appendix. No changes were made in response to this comment.

Comment a2 (DI): The first paragraph on page G-1, Section G.1 and page G-3, Section G.2, discusses regulatory analysis methods and approaches for high-level waste repositories, while the last paragraph identifies the disposal of spent nuclear fuel. These two descriptions are incomplete, as high-level waste and spent nuclear fuel are two different "waste" types per the U.S. Department of Energy policy and as addressed in the Nuclear Waste Policy Act. Appendix G should identify both with regard to disposal in a repository.

NRC Response: The NRC staff understands the basis for the comment regarding the meaning of high-level waste and spent nuclear fuel. However, consistent with the Nuclear Waste Policy Act, NRC has provided a definition of high-level waste at 10 CFR 63.2 that that includes irradiated reactor (i.e., spent nuclear fuel) as high-level waste. A footnote was added to Section G.2 to clarify the definition of high-level waste. No other changes were made in response to this comment.

Comment a3 (DI): Page G-14, Section G.2.7 is devoted strictly to spent nuclear fuel disposal. Both high-level waste and spent nuclear fuel go through similar activities. While commercial spent nuclear fuel will be shipped from numerous locations across the country, high-level waste, which is owned by the U.S. Department of Energy, will be shipped from four sites. To be complete, the opening paragraph could acknowledge that disposal of both high-level waste and spent nuclear fuel is to be done in one or more repositories and for the purposes of this document: (1) only spent nuclear fuel is analyzed in detail, and (2) only mined geologic repository is considered in this analysis.

NRC Response: The NRC staff agrees with this comment. The introductory paragraph of Section G.2.7 was revised to include this clarification.

Comment a4 (DI): Section G.2.7 includes a statement that, "the development time for a repository is long (on the order of 100 years or more)." On page G-20, a sentence reads, "The [Environmental Impact Statement] EIS specifies an operating period of 105 years, beginning with construction and ending with the permanent closure of the repository…" These two sentences are not congruent and the development time for a repository need not be on the order of 100 years. Whether re-invigorating Yucca Mountain, or starting anew, a mined repository development time could be substantially shorter than a century. This is, in-part,

dependent upon gaining more social and political support in a consent-based siting model and this applies to borehole repositories also. In a scenario of increased social and political acceptability, boreholes can be developed much more rapidly than 100 years, given the more limited capacity of an individual borehole and the implementation methods that would be employed.

NRC Response: The NRC staff disagrees with this comment. The reference to a long period (in the order of 100 years or more) is a generally applicable time frame, whereas the specific time frame of 105 years for development of a repository in DOE's EIS is consistent with the generic time frame and does not have to be the same value. Additionally, the commenter has misinterpreted the intent of the repository development time or operational period that is used in the appendix. The operational period does not include the time required for the siting process. The operational period does account for activities such as the time required for receipt and emplacement of 70,000 metric tons of high-level waste and a monitoring period of approximately 50 years after all the waste is emplaced. Although the commenter suggests that borehole repositories could be developed over a shorter time period, borehole disposal of high-level waste has not been considered and evaluated to the same extent as mined repositories. Section G.2.7 was revised to clarify the operational and developmental time periods.

Comment a5 (DI): In Section G.2.7, transporting the spent nuclear fuel from individual sites to a repository may not be required if a borehole facility is co-located with a nuclear power plant. This option shouldn't be foreclosed in the NUREG. Transportation may be needed for boreholes not co-located with sites where waste is generated or processed, so this aspect should be listed as a possible risk depending on the locations of the repository and the SNF.

NRC Response: The current national program supports disposal of high-level waste in a mined repository. Other options such as borehole disposal co-located with a nuclear power plant is currently not under consideration as part of the national program and therefore was not included in the NUREG. Section G.2.7.1 was revised to clarify that transportation impacts depend on the distance between where waste is generated or processed and the location of the repository.

Comment a6 (DI): Page G-15, Table G-1 - The borehole canisters will be smaller, so there will be additional handling compared to a mined repository. An evaluation of the dose limits for a disposal canister other than a transportation, aging, and disposal (TAD) should be developed or a general methodology provided to enable alternative disposal repository methods, such as boreholes. The 500 mrem annual limit as noted in the first paragraph under Table G-1 is a reasonable statement on dose that can provide for different canisters and dose rates per canister.

NRC Response: The current national program supports disposal of high-level waste in a mined repository. Other options such as borehole disposal co-located with a nuclear power plant is currently not under consideration as part of the national program and therefore was not included in the NUREG.

Comment a7 (DI): Page G-16, Table G-2, should not be specific to Yucca Mountain. Because this NUREG includes Part 60, it should include more general data about dose impacts.

NRC Response: Table G-2 reflects analysis that was performed for a geologic repository. No changes were made in response to this comment.

Comment a8 (DI): Page G-19, Section G.2.7.2, should note that an individual borehole is similar to a drift in that a repository of 100 boreholes may be licensed and designed, but emplacement and closure of the first boreholes may be completed prior to the construction of the final boreholes. The post-closure period may end for the first boreholes while the final boreholes are still in the pre-closure period. Flexibility for boreholes and drifts should be included in this section.

NRC Response: The NRC staff agrees with this comment. The current national program supports disposal of high-level waste in a mined repository. Other options for disposal of high-level waste, including spent nuclear fuel, such as borehole disposal co-located with a nuclear power plant is currently not part of the national program. NRC's regulations have been developed for a mined geologic repository. Requirements for borehole disposal of high-level waste would need to be developed through NRC's rulemaking process, which includes Commission review and approval. Although boreholes and repository drifts might hold a similar number of waste packages, it is unknown how borehole requirements may differ from those for a mined repository that might affect development and closure of borehole disposal of high-level waste. The introductory paragraph to Section G.2.7 was revised to clarify that only data from mined geologic repositories are included in the appendix, and discussion of borehole disposal was removed from G.2.7.2.

Comment a9 (DI): Page G-20, Section G.2.7.2 - Exposure to on-site workers and off-site individuals to natural sources of radiation (e.g., radon) during the pre-closure period for a deep borehole repository will be essentially zero, given how the borehole is drilled and made available for emplacement of waste. In particular, there will be no workers underground for construction and operation of a deep borehole repository – hence, no exposure to these natural sources of radiation. From a radiological safety perspective, this is a clear benefit of deep boreholes over mined geologic repositories. The importance of this point is punctuated by a statement on page G-34, where it is noted that public exposure to radon is 1,000 times greater than the dose from the SNF.

NRC Response: See response to comment a6.

Comment a10 (DI): Page G-25, Tables G-3 [G-9] and G-8, is specific to a mined repository. It would be helpful for this guidance to provide for other disposal approaches that may not have workers underground or take a shorter amount of time to implement, fill and close.

NRC Response: The titles to Tables G-8 and G-9 were revised to clarify that the data is specific to a mined repository. No other changes were made in response to this comment.

Comment a11 (DI): Page G-27, Section G.2.7.2, the radiation dose to subsurface workers in the case of a deep borehole repository would be essentially zero, which is another benefit of a borehole repository compared to a mined geologic repository.

NRC Response: See response to comment a6.

Comment a12 (DI): Page G-31 - A borehole disposal canister will hold less than a TAD, so the magnitude of impact of an individual canister accident will be less. We will handle more canisters, so the probability of an accident may be higher. It is unclear if a borehole canister will get the same result or not as a TAD, but flexibility in this analysis should be allowed.

NRC Response: The current national program supports disposal of high-level waste in a mined repository. Other options for disposal of high-level waste, including spent nuclear fuel, such as borehole disposal co-located with a nuclear power plant is currently not part of the national program. The introductory paragraph to Section G.2.7 was revised to clarify that only data from mined geologic repositories are included in the appendix.

Comment a13 (DI): Page G-33, Section G.2.7.3, the statement is made that a release from a repository in the distant future "is expected." To be consistent with total system performance assessments completed to date for the candidate repository site at Yucca Mountain, as well as modeling done on a deep horizontal borehole, a more accurate statement would be that a release from a repository in the distant future "could occur, but is highly unlikely or will have inconsequential health impacts".

NRC Response: The NRC staff agrees with the comment that the potential releases from a mined repository could be clarified. Section G.2.7.3 was revised to state that although a release in the distant future could occur, the multiple barriers of a mined repository are expected to ensure the repository will continue to function safely (i.e., within the post-closure dose limits).

Comment a14 (NEI): With regard to NRC rulemakings specific to fuel cycle facilities regulated under 10 CFR Parts 40 and 70, the industry encourages the NRC to reach out to potentially affected licensees earlier in the rulemaking process such that the industry is able to provide relevant and experience-based cost data to inform NRC's estimates. We acknowledge that this is a challenge since the final rule content is not always well understood in the early phases of rulemaking. We have several examples that are symptomatic of this challenge where NRC staff has significantly underestimated the costs associated with a potential new or revised regulation and, in our view, overestimated the rule's benefit. These examples include a proposed Material, Control and Accounting Rule (Part 74), proposed codification of security orders and cyber security requirements (Part 73), and early phases of a Part 21 rulemaking. Other non-rulemaking regulatory initiatives have also fallen victim to this challenge. As such, we continue to be committed to working closely with NRC staff on all future rulemaking initiatives to support the intended outcome of NRC's cost-benefit analyses being more realistic and truly informing the rulemaking.

NRC Response: This comment is outside the scope of this appendix. No changes were made in response to this comment.

b. Comments Related to Appendix H

Comment b1 (NEI): The Appendix H methodology does not reflect current best practices in all areas, because of new technologies that have been introduced, changed processes, or refined inputs.

NRC Response: The NRC staff agrees with the comment. Section H.1 was revised to clarify that to better set the context, i.e., current practices and information should be used at the time of any analysis, and the summaries of previous analyses are provided as examples.

Comment b2 (NEI): We recommend that the staff consider adapting some examples to note the changed assumptions and include additional references to provide the complete story.

NRC Response: The NRC staff disagrees with this comment. As noted in the response to comment b1, a discussion was added to Section H.1 recognizing that knowledge bases are

expected to evolve over time. Analysts are expected to use current practices and information to perform future analyses.

Comment b3 (NEI): For example, the information outlining the considerations involved in the regulatory analysis of hardened containment vents for boiling water reactors (BWRs) with Mark I and II containments after Fukushima Dai-Ichi provides an exceptionally valuable illustration of the information that impacts NRC decision-making. To provide the complete picture of the considerations taken regarding containment failure, we recommend inclusion of the risk-analyses for pressurized water reactors (PWRs).

NRC Response: The NRC staff agrees in part with this comment. Enclosures H-3 and H-4 were revised to reiterate that the scope of these analyses was limited to BWRs with Mark I and Mark II containments. Section H.2 was also revised to explain that Enclosures H-3 to H-6 provide useful examples, but are not meant to cover all reactor types, initiators, and systems. The NRC disagrees with including risk analyses for PWRs. Similar concerns for other containment types, including all PWRs, were dispositioned in a separate document, SECY-16-0041, which did not provide any additional modeling or analysis beyond that contained in the appendix.

Comment b4 (NEI): Additionally, under Enclosure H.1, "Early (Emergency) Phase Protective Actions and Exposure Pathways," we recommend a clarifying statement regarding evacuation to emphasize its occurrence on a site-specific basis since strategies vary and not all sites employ evacuation protocols at this level.

NRC Response: The NRC staff agrees with the comment. Enclosure H-1 was revised to provide clarifying text in response to this comment.

c. Comments Related to Cost-Benefit Analyses

Comment c1 (NEI): The industry encourages the NRC's cost-benefit analyses to consider a more representative scope of plants for modeling the range of industry conditions. While we understand the substantial data derived from Peach Bottom and Surry Power Stations greatly contributes to developing the baseline for many of these analyses, we believe that the NRC should consider a wider range of plants and designs than these two stations.

NRC Response: Future cost-benefit analyses would consider representative plants for modeling the regulatory action under consideration. No changes were made to the four appendices as a result of this comment.

Comment c2 (NEI): In the same vein, we believe the NRC should ensure that any models of other plants used in developing regulatory analyses reflect the actual condition of the plants in question. We know from the NRC's utilization of Standardized Plant Analysis Risk (SPAR) models in the Reactor Oversight Process, for example, that it is essential for the NRC to confirm that the SPAR model reflects the current as-built, as-operated plant before using that model to estimate risk significance of inspection findings. We believe the same accuracy checks should apply when using the SPAR model or other NRC models for event assessments conducted for the development of numeric data to support decision-making.

NRC Response: The NRC staff agrees that analysts are expected to use current and accurate inputs for use in modeling event assessments and performing analyses to support

regulatory decisionmaking. For example, Appendix H notes that the SPAR model quality assurance plan provides reasonable assurance that the SPAR models used by agency risk analysts represent the as-built, as-operated plants to the extent intended within the scope of the SPAR models. Comments regarding the Reactor Oversight Process are out of scope. No changes were made to these appendices as a result of this comment.