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GUIDANCE FOR LICENSING ASSURANCE REVIEW OF THE BWIP SITE CHARACTERIZATION PLAN

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Prepared for:

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1. INTRODUCTION

The Nuclear Waste Policy Act of 1982 (NWPA) requires preparation of a Site Characterization Plan (SCP) for each candidate location for a geologic repository for disposal of high-level radioactive wastes (HLW). As indicated by its title, the SCP will describe plans for determining the physical characteristics of the site. Equally important, it will describe the basis for those plans.

The basis for plans has three parts: (1) the existing data base for the site; (2) regulatory standards which define the required safety performance of a HLW repository; and (3) assessment of the additions to the data base needed to evaluate compliance with the regulatory standards. The plans are the product of the assessment function.

The SCP is a licensing document; i.e., it is a step in the process leading to issuance, by the Nuclear Regulatory Commission (NRC), of a license to construct and operate a HLW repository at a given location. In issuing a license, the NRC certifies that repository safety performance will conform to regulatory standards.

The significance of the SCP as a licensing document is its role as the foundation for future assurance, through NRC licensing, of public health and safety for HLW disposal. It must demonstrate, to the NRC and to all other interested parties, that the technical issues bearing on repository safety performance are thoroughly understood, and that planned characterization work is expected to produce the in-

formation needed to resolve open technical issues for the site.

Review of the SCP by the NRC and others will produce comments concerning the soundness, completeness, and effectiveness of the technical approach and plans. Substantive comments will be directed at closing any perceived gaps between the information base the proposed plans are expected ultimately to produce and the information expected to be required in the license application. Such comments can be directed either at the plans themselves or the basis for them.

As an aid to producing a high-quality SCP for review by the NRC and others, the USDOE Basalt Waste Isolation Division (USDOE-BWID) is conducting a Licensing Assurance Review (LAR) for which this memorandum serves as guidance. As implied by the name, the LAR is directed at simulating the focus and content of the NRC review of the BWIP SCP. The review therefore emphasizes some SCP features and ignores others. This memo outlines "what to look for" in the LAR.

2. SCOPE AND FOCUS OF THE LAR

There are several possible measures of SCP quality and, therefore, targets for review. To help define the LAR, and to identify other review functions, the LAR can be stated not to be:

- an editorial review;
- a peer technical review of past work; or
- an assessment of the QA pedigree for existing data.

The above reviews will be performed by others. The principal implication for the LAR of this division of review labor is that the LAR will assume that the description of the existing characterization data base, which is contained in the first seven chapters of the SCP, is accurate.

The LAR is an assessment of the SCP as a statement of means to produce the information needed for regulatory compliance evaluations. To make this assessment, the review will evaluate the SCP as a recipe for resolution of technical issues. The review will look for:

- Clear statement of issues arising from regulatory requirements and from the existing data base*

*Lack of data is not an issue; available data may conflict, thereby creating an issue.

- Recognition and statement of issues arising from interactions (e.g., thermo-mechanical or design-geology coupling)
- Clear statement of the strategic approach and rationale used to deal with the issues and thereby to select the planned characterization activities
- Clear statement of planned characterization activities and their role in issue resolution
- Clear, evidence of continuity and integration, with respect to issue management, in the current-data, strategy, and plans sections of the SCP.

In short, the LAR will help assure that the SCP presents to the NRC and the public a complete and defensible map for getting to the objective: the technical base needed for reliable evaluation of disposal safety at the site.

Reviewers should note that the SCP will be mapping largely-uncharted territory. The present BWIP data base is perhaps 20% of that which will be required, and state-of-the-art technologies and issues will be involved in getting to completion. In the long run, present plans are therefore unlikely to be correct in detail. However, they should make sense for current knowledge. Perhaps most important, the strategic approach for embarking into the unknown territory should be clear and make sense; it will be the basis for course corrections as the information base expands.

Course corrections and results from execution of the plans will be described in periodic (six-month intervals) supplements to the SCP. The SCP itself will not be updated. As the permanent foundation for future technical activities

at BWIP, the SCP must therefore "get it right" and promote confidence in the soundness of the BWIP program.

3. ISSUES

As suggested above, the SCP can be viewed as the plan for management of issues to resolution as necessary for NRC licensing. This viewpoint is especially appropriate for the LAR. But the issues can be elusive critters, and they come in a variety of flavors. This section attempts to aid the effectiveness of the LAR by characterizing the issues aspects of the SCP.

Some issues are obvious and will be explicitly stated. For example, paragraph 60.113 of the NRC's 10 CFR Part 60 Regulations for HLW disposal requires that:

> "(A) Containment of HLW within the waste package will be substantially complete for a period...not less than 300 years nor more than 1000 years after permanent closure..."

The DOE has re-cast this requirement as an issue, which will be stated in the SCP as:

> "1.4 Will the waste package meet the performance objective for containment as required by 10 CFR 60.113?"

Each of the HLW repository safety performance requirements specified in the EPA and NRC regulations is treated as an issue in this manner in the SCP. This approach to issue statement and identification is, however, only the tip of the iceberg. The substantive issues are those concerned with generating the technical basis for an-

swering these questions. To be endorsed by NRC review, the SCP must deal effectively with the substantive technical issues that underlie the regulation-imposed issues.

Each regulation-imposed issue sits at the top of a hierarchy of technical factors relevant to resolution of that issue. The technical factors are of two basic types: analytical models (Darcy's Law is a simple example) and the parameters incorporated by the models.

The DOE objective in repository licensing will be to produce, from the models, reliable results (numbers) which demonstrate compliance with the regulatory requirements (again numbers, such as 300-1000 years of containment time). Such results are known in the trade as "performance assessment results".

The generic technical requirement for the SCP is therefore to provide a road map for obtaining reliable, defensible performance assessment results. This basically involves providing a plan for producing reliable models and reliable parameter values. The generic technical issues for the SCP are therefore the reliability of (a) performance assessment results, (b) results-producing models; and (c) parameter values.

This relatively simple concept is greatly complicated by the complexity of technical factors bearing on resolution of the regulation-imposed issues, and by the role of uncertainty in issue closure. These two factors introduce "strategic technical approach" as an issue and as a key subject of the LAR.

It is axiomatic that site characterization activities cannot address the detailed, complete hierarchies of technical factors bearing on resolution of the regulation-imposed issues. The hierarchies will have to be simplified, complex processes will be approximated in the analytical models, and assumptions and judgments will have to be made. Such actions are the essence of strategic technical approach; they will have strong impact on the plans for characterization activities and on the reliability of the performance assessment results.

Choice of strategic technical approach also affects, and is affected by, uncertainty in performance assessment results. Such uncertainty can be viewed as the driver for the entire site characterization program. Preliminary assessment of the safety performance of a HLW repository at BWIP -- based on available data, and reported in the Environmental Assessment -- indicated that the regulatory standards would be satisfied by wide margins. From one viewpoint, therefore, the only reason for the site characterization program is to reduce the uncertainty in these estimates to acceptable levels; i.e., to levels acceptable to the licensing process. The strategy must be aimed at this objective, because reduction of uncertainty is necessary. But choice of strategy can affect the magnitude and "quality" (e.g., source and judgment content) of residual uncertainty. "Residual uncertainty" is the uncertainty remaining in performance assessment results after data have been obtained and the strategy has been applied. The SCP rationale for choice of strategy should reflect this consideration.

The types of issues perhaps most difficult to identify and deal with are interaction issues, i.e., those that arise from interactions of processes and phenomena that are

usually handled technically as independent factors. Some interaction issues are obvious. For example, thermo-hydraulic-mechanical-chemical coupling as a result of heat emission from emplaced waste has been a subject of investigation in the HLW program for several years. Similarly, it is obvious that rock mass strength affects repository design.

The SCP should deal explicitly and specifically with these issues as they apply at the site. Generic interaction issues should be identified and particularized in accord with site characteristics and issues management strategy. Interaction issues that are unique to the site should also be addressed. Strategic approaches to resolution of these issues include experimental demonstration of insignificant coupling and accommodation through engineering design practice.

Another issue for the SCP and the LAR is continuity of issues management throughout the document. Traceability should be evident throughout the following steps:

- Genesis of issues from (a) the existing data base, and (b) the hierarchies of technical factors underlying the regulation-imposed issues;
- Narrowing, prioritization, and detailed specification of the technical issues agenda through application of the strategic technical approaches;
- Description of the strategic approach, the rationale for its selection, and its consequences in terms of technical issues not addressed or modified; and
- Description of planned characterization activities and their role in resolving the issues in the agenda that emerged from application of strategy.

Note that the "working level" for issues management in the SCP should be the technical issues subsumed by the regulation-imposed issues as previously cited (e.g., Issue 1.4, on containment time). The characterization activities are directed at evaluating parameters and validating models. It might be accurate for the SCP to state that "This activity will help resolve Issue 1.4", but such an approach is superficial and insufficient. It bypasses the critical impact of strategy: on the issues agenda; on the scope and content of the characterization activities; and, ultimately, on the adequancy and defensibility of the information brought to the licensing arena. Failure to discuss the isssues at this working level would also diminish the credibility and defensibility of the SCP.

Another category of issues exists because of currently-incomplete guidance, from NRC, on methods to evaluate compliance with the regulatory criteria. The NRC is developing guidance of this type through use of documents known as Technical Positions. This guidance is currently incomplete and currently exists primarily as an agenda of identified but unresolved compliance methodology issues. The members of the USDOE-BWID Technical Review Group will assume lead responsibility for review of SCP consideration of these issues.

In summary, as asserted at the beginning of this section, issues in the SCP come in many flavors and may not be obvious. Six categories of issues have been identified here:

- Regulation-imposed issues
- Issues arising from the current data base

- Interaction issues
- Selection and application of strategic approach to issue resolution
- Issues arising from incomplete definition of compliance evaluation methodology
- Closing the "issues material balance" for the document (all issues that go in must come out - in the characterization plans or in the strategy discards).

The LAR will check the effectiveness of the SCP in dealing with all of these issue categories.

4. LAR CORRELATION WITH SCP STRUCTURE

The SCP can be described as having four basic parts: Current Information, Strategic Approach, Characterization Plans, and Program Operations. The SCP structure of content in each part is as follows, with the numbers 1 though 8 dsignating chapters:

Current Information

1. Geology
2. Geomechanics
3. Hydrology
4. Geochemistry
5. Climatology & Meterology
6. Conceptual Design of a Repository
7. Waste Package

Strategic Approach

8.0 Introduction

8.1 Rationale for Planned Site Characterization Program

8.2 Issues to be Resolved and Information Required During Site Characterization

Characterization Plans

8.3 Planned Tests, Analyses, and Studies

8.3.1 Site Program

8.3.1.1 Overview

8.3.1.2 Geology

8.3.1.3 Hydrology
8.3.1.4 Geochemistry
8.3.1.5 Climatology
8.3.1.6 Resource Potential
8.3.2 Repository Program
8.3.3 Seal System Program
8.3.4 Waste Package Program
8.3.5 Performance Assessment Program Plan

Program Operations

8.4 Planned Site Preparation Activities
8.5 Milestones, Decision Points, and Schedules
8.6 Quality Assurance Program
8.7 Decontamination and Decommissioning

As can be seen from this structure, there is approximately a one-for-one correspondence between the subjects of the current information base (Chapter 1-7), and the 8.3.x characterization plan sections, with the strategic approach Sections (8.0 through 8.2) serving as the link between current information and plans. This structure reflects the overall logic of the document: plans are deduced by application of requirements (regulations) and strategy to available information.

The SCP structure also suggests the interactions of information and issues that will be significant to the LAR. For example, site geology (Chapter 1 and section 8.3.1.2) and hydrology (Chapter 3 and Section 8.3.1.3) are intimately related. Similarly, geomechanics (Chapter 2) is intimately related to repository design (Chapter 6, Section 8.3.2) and geology.

To fulfill the objectives of the LAR as previously described, the reviews will therefore have to deal with a matrix of text packages. One element of the matrix is the topical "vertical linking" in the document (i.e., current information-plus-strategy-plus-plans). The other matrix element is the topical cross-linking, which addresses interaction issues.

Text packages for the LAR have been defined as shown in Table 4.1. The SCP elements enclosed in parentheses are the cross-link elements for the principal topic.

Table 4.1 lists Section 8.2.x as a review item for each principal topic. This represents the relevant element of strategy. The review for each principal topic will focus

TABLE 4.1
SCP TEXT PACKAGES FOR THE LAR

PRINCIPAL TOPIC	TEXT PACKAGE
Strategic Approach	8.0 + 8.1 + 8.2 + 8.3.5
Geology	1 + 8.2.x + 8.3.1.2 + 8.3.1.6 + (3 + 8.3.1.3)
Geomechanics/Design	2 + 6 + 8.2.x + 8.3.2 + 8.3.3
Hydrology	3 + 8.2.x + 8.3.1.3 + (1 + 8.3.1.2 + 8.3.1.6)
Geochemistry	4 + 8.2.x + 8.3.1.4 + (7 + 8.3.4)
Climatology and Meterology	5 + 8.2.x + 8.3.1.5 + (8.3.5)
Waste Package	7 + 8.2.x + 8.3.4 + (4 + 8.3.1.4 + 3 + 8.3.1.3)
Program Operations	8.3.1 + 8.3.1.1 + 8.4 + 8.5 + 8.7
Quality Assurance	8.6

on its part of the overall strategy, but reviewers should also develop an overview familiarity with all of Sections 8.1 and 8.2 because of interfaces between strategy elements.

To fulfill its mission, the LAR must deal with the SCP text packages as defined in Table 4.1. This approach -- rather than piecemeal review of individual chapters or sections -- is essential because the "working-level technical issues material balance" is distributed throughout the SCP. A stand-alone review of Section 8.3.x cannot, for example, determine if there is continuity with the current information base and the selected strategy.

Also to fulfill its mission, the LAR team has been staffed with persons whose experience and expertise will meet the requirements of this important and complex effort. The challenge for the SCP is to present clear exposition of a sound program for dealing with state-of-the-art technical issues and state-of-the-art issues management problems. The challenge for the LAR is to constructively assist and confirm the success of the SCP mission.