



Department of Energy  
Washington, DC 20585

AUG 31 1987

Robert Browning, Director  
Division of High Level Waste Management  
Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Browning:

On March 3, 1987, the DOE presented the issues hierarchy and issue resolution strategy that will be included in the Site Characterization Plans (SCPs). At the request of NRC staff and others, we agreed to repeat the presentation because the strategy is a key to understanding the site characterization program. The repeat briefing will be enhanced using examples from Chapter 8 of the NNWSI SCP to show how the strategy is implemented. Although Chapter 8 has not yet been issued, we will show an assembled draft and identify selected portions which demonstrate the implementation concepts. We will also have available senior staff who are acquainted with the overall conceptual development of Chapter 8, but will not have the specialists/authors to cover details relating to each technical discipline. If interactions involving specific technical disciplines are needed, they will be arranged later.

As background for the briefing we recommend that participants review the enclosed pre-meeting materials; they include a revised description of the DOE Issues Hierarchy (DOE/RW-0101) and a draft of Section 8.1 of the NNWSI SCP. These two items generally describe the concepts of the issues hierarchy and issue resolution strategy. A draft agenda for the briefing is attached. The briefing will be held at DOE facilities, Room 6E069, Forrestal Building, 1000 Independence Avenue, S.W. Washington D.C., on September 29-30, 1987, beginning at 8:30 am. By copy of this letter we are inviting interested representatives from States and Indian Tribes to participate.

In order to facilitate access into the Forrestal Building, participants should provide us with their name, affiliation and nationality. Additionally, if the participating groups have any specific requests regarding the agenda, we will

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do our best to accommodate them provided requests are received by September 22, 1987. Please provide this information to Dr. Owen Thompson (202-586-5003/FTS 896-5003).

  
James P. Knight, Director  
Siting, Licensing and Quality Assurance  
Division, Office of Civilian Radioactive  
Waste Management

Attachments:

Draft Agenda  
DOE Issues Hierarchy (DOE/RW-0101)  
NNWSI SCP Chapter 8.1 (draft)

cc:

J. Anttonen  
C. Gertz  
J. Neff  
J. Leahy (20 Copies)

See packet 5  
for envelope

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## SCP ISSUES HIERARCHY/PERFORMANCE ALLOCATION

(Repeat of Briefing March 3-4, 1987)

### Purpose:

- a) To repeat and update for NRC, State and Indian Tribe staff the previous briefing on the SCP Issues Hierarchy, Issue Resolution Strategy and Performances Allocation process, using examples from the NNWSI SCP Part B (Chapter 8).
- b) To show and explain the organization of NNWSI Chapter 8.

### Objectives:

- a) To familiarize reviewers with the stated subject to facilitate their review of NNWSI Chapter 8 when it is released.
- b) To aid NRC staff in developing SCP review plans.

### Agenda

Tuesday September 29, 1987

<u>Time</u>	<u>Item</u>	<u>Responsibility</u>
8:30-8:45	Introduction, Statement of Purpose and Objectives, Agenda	DOE
8:45-9:00	Opening comments	NRC
9:00-9:20	Statements by other participants (10 min per speaker)	States, Indian Tribes
9:20-10:30	General description of Issues Hierarchy, Issue Resolution Strategy and Performance Allocation	DOE
10:30-10:45	Break	All

10:45-12:00	Implementation of Issues Hierarchy, Issue Resolution Strategy and Performance Allocation in NNWSI, Chapter 8.	All
12:00-1:00	Lunch	All
1:00-2:00	Questions and discussion of Issues Hierarchy, Issue Resolution Strategy and Performance Allocation	All
2:00-2:15	Break	All
2:15-5:00	Questions and discussions of implementation in NNWSI Chapter 8 (DOE will show assembled draft Chapter 8)	All

Wednesday September 30, 1987

8:30-12:00	Continued questions and discussions of implementation in NNWSI Chapter 8, as needed.	All
12:00-1:00	Lunch	All
1:00-2:30	Continued questions and discussions of implementation in NNWSI Chapter 8, as needed.	All
2:30-2:45	Break	All
2:45-3:30	Preparation of meeting report and closure	DOE

**OFFICE OF GEOLOGIC REPOSITORIES  
ISSUES HIERARCHY  
FOR A  
MINED GEOLOGIC DISPOSAL SYSTEM**

**Revision 1**

**June 1987**

**U.S. Department of Energy  
Office of Civilian Radioactive Waste Management**

## FOREWORD

The Nuclear Waste Policy Act of 1982 (NWPA) charges the Department of Energy (DOE) with responsibility for siting, constructing, operating, and permanently closing a mined geologic disposal system (MGDS) for high-level waste and spent nuclear fuel. The Nuclear Regulatory Commission (NRC) is charged with responsibility for promulgating the regulatory requirements and criteria (10 CFR Part 60) that will govern authorization for the construction, licensing, and approval for permanent closure of the MGDS. In the DOE's Office of Civilian Radioactive Waste Management (OCRWM), the Office of Geologic Repositories (OGR) has primary responsibility for the MGDS program.

The NWPA also requires that the DOE prepare, and the NRC adopt to the extent practicable, an environmental impact statement (EIS) to satisfy the requirements of the National Environmental Policy Act (NEPA) and the implementing regulations of 40 CFR Part 1500 et seq. These implementing regulations require that the DOE undertake a scoping process to identify the significant issues to be addressed in the EIS.

In 10 CFR Part 60 and in guidance (Revision 1 to Regulatory Guide 4.17) to the DOE for the preparation of site characterization plans (SCPs) for geologic repositories, the NRC has indicated that the identification of the issues that must be resolved to complete licensing assessments of site and design suitability is an important step in the licensing process.

As required by the NWPA, the DOE prepared the Mission Plan for the Civilian Radioactive Waste Management Program (DOE/RW-0005, June 1985) to provide an informational basis sufficient to permit informed decisions to be made in carrying out the program for the development of the MGDS. To address the NWPA requirement that the information needed to support the siting and construction of repositories be identified, the Mission Plan included a hierarchy of generic issues derived from the applicable Federal regulations that define the requirements for the MGDS and that must be resolved to demonstrate that these requirements have been satisfied.

The issues hierarchy developed by the OGR for the MGDS and presented in this document is based on the issues-hierarchy concept presented in the Mission Plan. The OGR issues hierarchy presents the issues that the DOE will use to guide the development of SCPs and the conduct of site-characterization activities. These issues must be resolved to demonstrate compliance with applicable Federal regulations and to support site selection and licensing for an MGDS. Specific questions that may be identified during the licensing process and in the development of an EIS are encompassed by the general issue statements in the OGR issues hierarchy. The OGR issues hierarchy is limited to the issues related to the siting and licensing requirements of applicable Federal regulations and does not address the requirements of other regulations, functional or operating requirements for the MGDS, or requirements for the integration and the design/operational efficiency of the MGDS. Although the DOE believes that this document contains a comprehensive set of siting and licensing issues, this document will be revised as necessary during site characterization to encompass any additional issues that may arise.

The OGR issues hierarchy is a formal programmatic change-controlled document and is effective immediately. Its implementation will follow all standard procedures prescribed by the program's baseline procedure (see OGR/B-1). Any changes to this document must be made formally through the change-control procedure. It is to be implemented by the Project Offices in their preparation of SCPs and should specifically be incorporated into SCP Sections 8.1, 8.2, and 8.3.

TABLE OF CONTENTS

	<u>Page</u>
FOREWORD . . . . .	iii
1 INTRODUCTION . . . . .	1
2 RATIONALE FOR THE DEVELOPMENT AND STRUCTURE OF THE ISSUES HIERARCHY . . . . .	3
3 ISSUES HIERARCHY . . . . .	5
4 BASIS FOR THE WORDING OF ISSUES . . . . .	11
5 CORRELATION OF ISSUES WITH REGULATORY REQUIREMENTS . . . . .	17
6 ISSUE-RESOLUTION STRATEGY AND THE PERFORMANCE- ALLOCATION PROCESS . . . . .	21

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1	Correlation of Issues to Regulations for Key Issue 1 . . . . .	18
2	Correlation of Issues to Regulations for Key Issue 2 . . . . .	19
3	Correlation of Issues to Regulations for Key Issue 4 . . . . .	20
4	Issue-Resolution Strategy . . . . .	22

## 1. INTRODUCTION

The Office of Geologic Repositories (OGR) has adopted an issues hierarchy for use by all Project Offices. The issues hierarchy provides a framework for representing issues related to regulatory requirements for siting and licensing a mined geologic disposal system (MGDS) and for describing the work that needs to be completed during site characterization to resolve those issues. The issues in the issues hierarchy are defined as the questions relating to the performance of the MGDS that must be resolved to demonstrate compliance with the applicable Federal regulations (including 10 CFR Part 60, 10 CFR Part 960, 40 CFR Part 191, and 10 CFR Part 20).

The issues hierarchy is structured around four broad areas related to the requirements for siting and licensing an MGDS (postclosure performance; pre-closure radiological safety; environment, socioeconomics, and transportation; and the feasibility and cost of MGDS development) and provides the framework for defining the information needed to satisfy the applicable regulatory requirements in each of these areas. As such, the issues hierarchy does not specify the requirements that the MGDS must satisfy but rather defines issues related to requirements for siting and licensing. The Generic Requirements for a Mined Geologic Disposal System (the GR, OGR/B-2) and the associated requirements documents prepared by the Projects specify the requirements that must be satisfied by the MGDS. The GR, in combination with the Project-level requirements documents, addresses all aspects of the MGDS, including siting and licensing. The issues hierarchy and the GR are linked by an issue-resolution strategy and a performance-allocation process (see Section 6) that leads to the identification of the system elements that will be relied on to resolve the issue by meeting the related regulatory performance objectives and design criteria.

The OGR issues hierarchy was developed to provide a common basis for all Project Offices to plan site-characterization activities. It will be used in preparing the SCP for each site to be characterized and in reporting the status of site-characterization activities in the semiannual progress reports. The specific use of this hierarchy for other purposes has not yet been defined by OGR.

The purpose of this document is to present the issues hierarchy, describe the rationale used to develop the hierarchy, and describe how the issues hierarchy is used in program planning. Section 2 presents the overall rationale for the issues hierarchy and explains the structure and the organization of the hierarchy. Section 3 presents the issues hierarchy itself, and Section 4 describes the basis for the development of individual issues. Section 5 provides a correlation between the issues and the applicable Federal regulations. Section 6 describes how the issues drive the development of plans in support of siting and licensing requirements through the use of an issue-resolution strategy that includes performance allocation.

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## 2. RATIONALE FOR THE DEVELOPMENT AND STRUCTURE OF THE ISSUES HIERARCHY

The issues hierarchy consists of three levels of detail: key issues, issues, and information needs. This structure provides a convenient means for distinguishing broad questions of overall suitability (key issues) from (1) more-specific questions (issues) about the characteristics of the site, the features of the design, and the performance of the system and (2) requirements for the basic information (information needs) used to answer the specific questions. The portion of the issues hierarchy presented in Section 3 of this document and intended for use by all Project Offices includes the key issues and the issues but does not include information needs. The information needs required to resolve each issue will be developed on a site-specific basis and will be fully presented in the individual SCPs and other program documents.

Key issues relate to broad-level technical or institutional requirements grouped into four topical areas relating to the overall performance of the mined geologic disposal system, as identified by the DOE siting guidelines, 10 CFR Part 960.

Issues are subordinate to key issues. Collectively, the group of issues under a key issue indicate what questions must be answered to satisfy the key issue. Taken together, the issues provide a conceptual outline to structure the resolution strategies for each key issue. The issues are derived, in part, from the technical guidelines of 10 CFR Part 960, from the performance objectives and design criteria of 10 CFR Part 60, and from the requirements of 40 CFR Part 191.

Information needs represent information required to resolve issues and form the third level of the hierarchy. Although generally similar for all sites, site-specific information needs will be developed for each candidate site. Additional levels may be used, as appropriate, to identify the lowest level of detail required.

The issues hierarchy presented in Section 3 is based on the issues-hierarchy concept presented in the Mission Plan (DOE/RW-0005, June 1985, Volume 1, Part II, Chapter 1). The key issues in the hierarchy have been adopted nearly verbatim from the key issues in the Mission Plan, and thus they are derived directly from the system guidelines in 10 CFR Part 960. The issues defined for each key issue in the hierarchy, taken together, are identical in overall scope with the issues in the Mission Plan, but the structure and specific wording of the issues are different. The issues under each key issue are grouped into performance issues and design issues.

Performance issues generally address questions regarding compliance with regulatory requirements that are related to the performance of the mined geologic disposal system. They generally relate directly to the highest level of regulatory requirements to be satisfied or findings that must be made. For example, there are performance issues that correspond to each of the post-closure performance objectives set forth in 10 CFR 60.112. Performance issues identify the information related to design, site characteristics, and performance assessments needed to address the regulatory requirements. Information about performance assessments is addressed directly by the performance issues;

information about design and site characteristics is addressed by the design issues and the characterization program, respectively.

Design issues address questions regarding compliance with regulatory requirements related to the design of the repository, the seals, and the waste package. Design issues may address the design criteria specified in 10 CFR 60.130 through 60.134, the requirements of the preclosure system and technical guidelines in 10 CFR 960.5-1 and 960.5-2, or the information required to support the resolution of the performance issues. Design issues identify the information about site characteristics that is needed for design purposes.

The characterization program will be developed to evaluate the site characteristics, processes, and events that may affect waste-package and repository design and performance. The program will address the detailed information on site characteristics that will be used to develop site descriptions and support the resolution of related design and performance issues, including the information needed to demonstrate compliance with 10 CFR Part 960 in support of site selection.

Thus, the performance and the design issues provide requirements (priorities) for the characterization program. The characterization program results in data for the analyses needed to address design and performance issues. A characterization activity will take place only if that activity is necessary to provide data for resolving an identified design or performance issue.

The wording of each issue in the hierarchy was chosen to reflect the identified interrelationships among the issues and the characterization program and, where practical, to explicitly tie the issue to the associated regulatory requirement(s) by citing the applicable regulation(s). Although the key issues and issues are intended to convey precisely the same meaning as the regulations, in some cases the terms used in an issue are not the same as the terms used by the regulations. These differences reflect differences between the definitions of terms used in various regulations and the definitions that the DOE has chosen to adopt in the Generic Requirements for a Mined Geologic Disposal System. The issues hierarchy in Section 3 uses terms from this baselined DOE document.

## 3. ISSUES HIERARCHY

**KEY ISSUE 1:** Will the mined geologic disposal system at [site name] isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 40 CFR Part 191, 10 CFR Part 60, and 10 CFR Part 960?

PERFORMANCE ISSUES

- ISSUE 1.1:** Will the mined geologic disposal system meet the system performance objective for limiting radionuclide releases to the accessible environment as required by 10 CFR 60.112 and 40 CFR 191.13?
- ISSUE 1.2:** Will the mined geologic disposal system meet the requirements for limiting individual doses in the accessible environment as required by 40 CFR 191.15?
- ISSUE 1.3:** Will the mined geologic disposal system meet the requirements for the protection of special sources of ground water as required by 40 CFR 191.16?
- ISSUE 1.4:** Will the waste package meet the performance objective for containment as required by 10 CFR 60.113?
- ISSUE 1.5:** Will the waste package and the repository engineered barriers meet the performance objective for limiting radionuclide release rates as required by 10 CFR 60.113?
- ISSUE 1.6:** Will the site meet the performance objective for pre-waste-emplacment ground-water travel time as required by 10 CFR 60.113?
- ISSUE 1.7:** Will the performance-confirmation program meet the requirements of 10 CFR 60.137?
- ISSUE 1.8:** Can the demonstrations for favorable and potentially adverse conditions be made as required by 10 CFR 60.122?
- ISSUE 1.9:** (a) Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the postclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for geohydrology, geochemistry, rock characteristics, climate changes, erosion, dissolution, tectonics, and human interference; and (b) can the comparative evaluations required by 10 CFR 960.3-1-5 be made?

DESIGN ISSUES

- ISSUE 1.10:** Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.135 and (b) provide information for the resolution of the performance issues?

ISSUE 1.11: Have the characteristics and configurations of the repository and the repository engineered barriers been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.133 and (b) provide information for the resolution of the performance issues?

ISSUE 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?

KEY ISSUE 2: Will the projected releases of radioactive materials to restricted and unrestricted areas and the resulting radiation exposures of the general public and workers during repository operation, closure, and decommissioning at [site name] meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, 10 CFR Part 960, and 40 CFR Part 191?

### PERFORMANCE ISSUES

- ISSUE 2.1: During repository operation, closure, and decommissioning (a) will the expected average radiation dose received by members of the public within any highly populated area be less than a small fraction of the allowable limits and (b) will the expected radiation dose received by any member of the public in an unrestricted area be less than the allowable limits as required by 10 CFR 60.111; 40 CFR Part 191, Subpart A; and 10 CFR Part 20?
- ISSUE 2.2: Can the repository be designed, constructed, operated, closed, and decommissioned in a manner that ensures the radiological safety of workers under normal operations as required by 10 CFR 60.111 and 10 CFR Part 20?
- ISSUE 2.3: Can the repository be designed, constructed, operated, closed, and decommissioned in such a way that credible accidents do not result in projected radiological exposures of the general public at the nearest boundary of the unrestricted area, or workers in the restricted area, in excess of applicable limiting values?
- ISSUE 2.4: Can the repository be designed, constructed, operated, closed, and decommissioned so that the option of waste retrieval will be preserved as required by 10 CFR 60.111?
- ISSUE 2.5: Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for population density and distribution, site ownership and control, meteorology, and offsite installations and operations?

### DESIGN ISSUES

- ISSUE 2.6: Have the characteristics and configurations of the waste packages been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.135 and (b) provide information for the resolution of the performance issues?
- ISSUE 2.7: Have the characteristics and configurations of the repository been adequately established to (a) show compliance with the preclosure design criteria of 10 CFR 60.130 through 60.133 and (b) provide information for the resolution of the performance issues?

**KEY ISSUE 3:** Can the mined geologic disposal system at (site name) be sited, constructed, operated, closed, and decommissioned and can the associated transportation system be sited, constructed, and operated so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?

**Note:** The issues under key issue 3 will be identified after the EIS scoping hearings. The issues hierarchy will be amended at that time.

**KEY ISSUE 4:** Will the construction, operation (including retrieval), closure, and decommissioning of the mined geologic disposal system be feasible at [site name] on the basis of reasonably available technology and will the associated costs be reasonable in accordance with the requirements set forth in 10 CFR Part 960?

#### PERFORMANCE ISSUES

**ISSUE 4.1:** Can the higher-level findings required by 10 CFR Part 960 be made for the qualifying condition of the preclosure system guideline and the disqualifying and qualifying conditions of the technical guidelines for surface characteristics, rock characteristics, hydrology, and tectonics?

#### DESIGN ISSUES

**ISSUE 4.2:** Are the repository design and operating procedures developed to ensure the nonradiological health and safety of workers adequately established for the resolution of the performance issues?

**ISSUE 4.3:** Are the waste-package production technologies adequately established for the resolution of the performance issues?

**ISSUE 4.4:** Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of the performance issues?

**ISSUE 4.5:** Are the costs of the waste packages and the repository adequately established for the resolution of the performance issues?

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## 4. BASIS FOR THE WORDING OF ISSUES

Regardless of the regulatory source of the issue, the wording of the issues presented in Section 3 was chosen to make the terminology consistent with that used in the GR to describe the components of the preclosure and the postclosure mined geologic disposal system (MGDS). Additional clarification regarding the rationale for the wording of specific issues is presented in this section on a case-by-case basis. Citations of applicable regulations are abbreviated as follows:

<u>Regulation</u>	<u>Abbreviation</u>
10 CFR Part 60	Part 60
Sections of Part 60	60.x
10 CFR Part 960	Part 960
Sections of Part 960	960.x
40 CFR Part 191	Part 191
Sections of Part 191	191.x

## KEY ISSUE 1

Key issue 1 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation to the postclosure requirements of Part 960; key issue 1 of the Mission Plan is derived directly from postclosure system guideline 960.4-1, which defines the general long-term performance requirements for the MGDS; the requirements of 960.4-1 are based on the technical criteria of Part 60, Subpart E, and the environmental standards of Part 191, Subpart B.

PERFORMANCE ISSUES

## ISSUE 1.1

Overall system performance objective of 60.112 requiring conformance with applicable EPA standards for radionuclide releases to the accessible environment after permanent closure; the requirements of Part 191, Subpart B, of the final EPA standard are incorporated by inference; the containment requirements of 191.13 were the only applicable EPA standard for postclosure releases at the time 60.112 was written; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.13.

## ISSUE 1.2

Individual protection requirements of 191.15; as presently written, the overall system performance objective of 60.112 requires conformance with the applicable EPA standards for postclosure releases to the accessible environment and therefore incorporates the requirements of Part 191, Subpart B, of the EPA standard by inference; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.15.

## ISSUE 1.3

Ground-water protection requirements of 191.16; as presently written, the overall system performance objective of 60.112 requires conformance with the applicable EPA standards for postclosure releases to the accessible environment and therefore incorporates the requirements of Part 191, Subpart B, of the EPA standard by inference; future NRC rulemaking will conform Part 60 to specifically include the requirements of 191.16.

## ISSUE 1.4

Performance objective for waste-package containment from 60.113.

## ISSUE 1.5

Performance objective for the engineered-barrier system (NRC terminology) from 60.113, with the terminology revised to be consistent with the GR and indicate that the postclosure barriers of the MGDS being considered are the waste package and the repository engineered barriers.

## ISSUE 1.6

Performance objective for the geologic setting (NRC terminology), with respect to the pre-waste-emplacment ground-water travel time, from 60.113.

## ISSUE 1.7

Technical criteria from 60.137, linking design to the implementation of the performance-confirmation program required by Part 60, Subpart F; although the performance-confirmation program is conducted during the preclosure period, this issue is included under key issue 1 because it is required to provide assurance regarding postclosure performance.

## ISSUE 1.8

Identifies need to address the siting criteria of 60.122.

## ISSUE 1.9

Higher-level findings, as required by Part 960, Appendix III, with respect to the postclosure guidelines of Part 960 Subpart C; and comparative evaluations of alternative sites against these postclosure guidelines, as required by 960.3-2-4 according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

## ISSUE 1.10

Identifies need to address the postclosure design criteria of 60.135 for the waste package and provide information to support the resolution of related performance issues.

#### ISSUE 1.11

Identifies need to address the postclosure design criteria of 60.133 for the underground facility (NRC terminology), now identified as the repository and repository engineered barriers to be consistent with the GR, and provide information to support the resolution of related performance issues.

#### ISSUE 1.12

Identifies need to address the postclosure design criteria of 60.134 for shaft and borehole seals and provide information to support the resolution of related performance issues.

#### KEY ISSUE 2

Key issue 2 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation to the preclosure requirements of Part 960; key issue 2 of the Mission Plan is derived from preclosure system guideline 960.5-1(a)(1), which requires compliance with the applicable radiological safety requirements of Part 20; Part 60, Subpart E; and the environmental standards of Part 191, Subpart A.

#### PERFORMANCE ISSUES

##### ISSUE 2.1

Issue 2.1 of the Mission Plan, which is derived from preclosure technical guideline 960.5-2-1, with citations of the applicable preclosure radiological safety requirements for members of the public in unrestricted areas from 60.111, Part 20, and Part 191, Subpart A.

##### ISSUE 2.2

Preclosure radiological safety requirements for workers, with citations of the applicable regulatory requirements of 60.111 and Part 20.

##### ISSUE 2.3

Identifies need to address preclosure accident releases; no regulatory citation is given, as the NRC has not undertaken a rulemaking to define the allowable accident releases during the preclosure period.

##### ISSUE 2.4

Identifies need to ensure retrievability as required by 10 CFR 60.111.

##### ISSUE 2.5

Higher-level findings, as required by Part 960, Appendix III, with respect to the preclosure guidelines of Part 960, Subpart D, for preclosure radiological safety; and comparative evaluations of alternative sites against these preclosure guidelines, as required by 960.3-2-4, according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

## ISSUE 2.6

Identifies need to address the preclosure design criteria of 60.135 for the waste package and provide information to support the resolution of related performance issues.

## ISSUE 2.7

Identifies need to address the preclosure design criteria of 60.131 through 60.133 for the preclosure repository system and operations and to provide information to support the resolution of related performance issues.

## KEY ISSUE 3

Key issue 3 of the Mission Plan (DOE/RW-0005), revised to identify the site and incorporate the term "mined geologic disposal system" as used in the GR; the waste-transportation system is identified separately from the MGDS. Key issue 3 is derived from preclosure system guideline 960.5-1(a)(2) for the environment, socioeconomics, and transportation.

## KEY ISSUE 4

Key issue 4 of the Mission Plan (DOE/RW-0005), revised to identify the site and include a citation of the preclosure requirements of Part 960 and to include specific mention of retrievability, closure, and decommissioning with respect to feasibility and cost; key issue 4 of the Mission Plan is derived directly from preclosure system guideline 960.5-1(a)(3).

PERFORMANCE ISSUES

## ISSUE 4.1

Higher-level findings, required by Part 960, Appendix III, with respect to the preclosure guidelines of Part 960, Subpart D, for the ease and cost of siting, construction, operation, and closure and comparative evaluations of alternative sites against these preclosure guidelines, as required by 960.3-2-4, according to the basis for such evaluations as specified in 960.3-1-5.

DESIGN ISSUES

## ISSUE 4.2

Identifies the need to adequately characterize the nature and feasibility of the repository design and associated operating procedures needed to ensure the nonradiological health and safety of the workers in order to support the resolution of the related performance issue.

## ISSUE 4.3

Identifies the need to adequately characterize the nature and availability of the technology to be used for waste-package fabrication in order to support the resolution of the related performance issue.

#### ISSUE 4.4

Identifies the need to adequately characterize the nature and feasibility of the technology to be used during repository construction, operation, closure, and decommissioning in order to support resolution of the related performance issue.

#### ISSUE 4.5

Identifies the need to adequately characterize the costs associated with waste package fabrication and repository construction, operation, closure, and decommissioning in order to support the resolution of the related performance issue.

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## 5. CORRELATION OF ISSUES WITH REGULATORY REQUIREMENTS

This issues hierarchy provides a unified, comprehensive framework for representing the regulatory requirements that must be satisfied to site and license a mined geologic disposal system. The connection between the issues and the regulatory requirements was described in general terms in the rationale for the wording of individual issues, as presented in Section 4. Figures 1, 2, and 3 provide a graphical correlation between each of the issues and specific regulatory requirements from 10 CFR Part 960, 10 CFR Part 60, 40 CFR Part 191, and 10 CFR Part 20.

The matrices indicate (with a solid circle), for each specific regulatory requirement, the performance or design issue(s) that, when resolved, will satisfy that regulatory requirement. Although there are numerous secondary interrelationships and support requirements among the issues that are not indicated on the matrices, these interrelationships will be identified and accounted for in the approach to issue resolution and performance allocation described in Section 6.

**KEY ISSUE 1**  
Postclosure performance.

REGULATIONS \ ISSUES		PERFORMANCE										DESIGN		
		1.1 RELEASES TO ACCESSIBLE ENVIRONMENT	1.2 INDIVIDUAL PROTECTION	1.3 GROUND-WATER PROTECTION	1.4 WASTE PACKAGE CONTAMINANT	1.5 RELEASE RATE	1.6 GROUND-WATER TRAVEL TIME	1.7 PERFORMANCE CONFIRMATION	1.8 IIRC SITING CRITERIA	1.9 DOE GUIDELINE FINDINGS	1.10 WASTE PACKAGE	1.11 REPOSITORY	1.12 SEALS	
10 CFR 900	900 3.1-6 SITE EVALUATIONS													
	900 4.1 POSTCLOSURE SYSTEM													
	900 4.2-1 GROUND-WATER PROTECTION													
	900 4.2-2 GROUND-WATER PROTECTION													
	900 4.2-3 GROUND-WATER PROTECTION													
	900 4.2-4 GROUND-WATER PROTECTION													
	900 4.2-5 GROUND-WATER PROTECTION													
	900 4.2-6 GROUND-WATER PROTECTION													
	900 4.2-7 GROUND-WATER PROTECTION													
	900 4.2-8 GROUND-WATER PROTECTION													
10 CFR 60	60.112 SYSTEM PERFORMANCE OBJECTIVE	●												
	60.113 SUBSYSTEM PERFORMANCE OBJECTIVES			●	●	●								
	60.122 SITING CRITERIA								●					
	60.133 UNDERGROUND FACILITY DESIGN CRITERIA										●			
	60.134 SEAL DESIGN CRITERIA												●	
	60.135 WASTE PACKAGE DESIGN CRITERIA										●			
	60.137 PERFORMANCE CONFIRMATION REQUIREMENTS							●						
	191.13 CONTAINMENT REQUIREMENTS	●												
	191.18 INDIVIDUAL PROTECTION REQUIREMENTS		●											
	191.19 GROUND-WATER PROTECTION REQUIREMENTS			●										

NOTE:  
THE SYMBOL ● MEANS THAT RESOLUTION OF THE INDICATED ISSUE(S) WILL SATISFY THE INDICATED REGULATORY REQUIREMENT

Figure 1. Correlation of issues to regulations for key issue 1

**KEY ISSUE 2**  
Preclosure radiological safety.

REGULATIONS		ISSUES						
		2.1 PUBLIC SAFETY DURING NORMAL OPERATION	2.2 WORKER SAFETY	2.3 PUBLIC SAFETY DURING ACCIDENTS	2.4 RETRIEVABILITY	2.5 DOE GUIDELINE FINDINGS	2.6 WASTE PACKAGE DESIGN	2.7 REPOSITORY DESIGN
10 CFR 980	980.5-1 PRECLOSURE SYSTEM – RADIOLOGICAL SAFETY					●		
	980.5-2-1 POPULATION					●		
	980.5-2-2 SITE OWNERSHIP					●		
	980.5-2-3 METEOROLOGY					●		
	980.5-2-4 OFFSITE INSTALLATIONS					●		
10 CFR 60	60.111 RADIOLOGICAL PROTECTION AND RETRIEVABILITY	●	●		●			
	60.131 GENERAL DESIGN CRITERIA							●
	60.132 SURFACE FACILITY DESIGN CRITERIA							●
	60.133 UNDERGROUND FACILITY DESIGN CRITERIA							●
	60.135 WASTE PACKAGE DESIGN CRITERIA						●	
	40 CFR 191, Subpart A STANDARDS FOR MANAGEMENT	●						
	10 CFR 20 RADIATION PROTECTION STANDARDS	●	●					

NOTE:  
THE SYMBOL ● MEANS THAT RESOLUTION OF THE INDICATED ISSUE(S) WILL SATISFY THE INDICATED REGULATORY REQUIREMENT

Figure 2. Correlation of issues to regulations for key issue 2.

**KEY ISSUE 4**  
Ease and cost of development.

		PERFORMANCE					DESIGN				
		4.1	4.2	4.3	4.4	4.5	4.1	4.2	4.3	4.4	4.5
REGULATIONS		4.1	4.2	4.3	4.4	4.5	4.1	4.2	4.3	4.4	4.5
10 CFR 960	960.8-1 PRECLOSURE SYSTEM — EASE AND COST	•	•	•	•	•	•	•	•	•	•
	960.8-2-8 SURFACE CHARACTERISTICS	•					•	•	•	•	•
	960.8-2-9 ROCK CHARACTERISTICS	•					•	•	•	•	•
	960.8-2-10 HYDROLOGY	•					•	•	•	•	•
	960.8-2-11 TECTONICS	•					•	•	•	•	•

**NOTE:**

THE SYMBOL • MEANS THAT RESOLUTION OF THE INDICATED ISSUE(S) WILL SATISFY THE INDICATED REGULATORY REQUIREMENT

Figure 3. Correlation of issues to regulations for key issue 4.

## 6. ISSUE-RESOLUTION STRATEGY AND THE PERFORMANCE-ALLOCATION PROCESS

The OGR issues hierarchy provides a common framework to be used by all DOE Project Offices in planning and conducting site characterization activities supporting site selection and licensing. The rationale for systematic resolution of the issues in this hierarchy is presented in a generic "issue-resolution strategy" developed and agreed to by Headquarters and the Project Offices. Since the issues are derived from the applicable regulations, identification of the information needed to resolve these issues facilitates identification and planning of the work that needs to be done to demonstrate compliance with the regulatory requirements. The issue-resolution strategy provides a step-wise procedure for identifying and planning the work needed to support resolution of the issues.

### General Application

As shown in Figure 4, the issue-resolution strategy includes up to 12 separate steps, depending on the type of issue, and includes the concept of performance allocation. The overall strategy is based on the identification of regulatory requirements (step 1) and the preparation of a formal description of a proposed mined geologic disposal system (step 1a). This information is used to define the issues in the issues hierarchy (step 2). Next, a "licensing strategy" (step 3) is developed for each individual issue; it determines how the components of the MGDS will be relied on during licensing to demonstrate compliance with the regulatory requirements. Using the information available at the time the strategy is being developed (or revised), a statement identifying the site features, engineered features, conceptual models, and analyses that are expected to be relied on in resolving the issue is developed for planning purposes. This statement, relating to the strategy for the resolution of a single issue, is called a "licensing strategy," because, when combined with the strategies developed for all other issues, it establishes the basis for the plans to be followed in demonstrating compliance with regulatory requirements, eventually supporting the DOE's selection of a site for the development of a repository and the NRC's requirements for approving construction, operation, closure, and license termination for a repository. In the initial stages of site characterization, this plan will necessarily be based on a preliminary definition of licensing strategies. These strategies will guide the development of the programs for testing and analysis, however, and will help to make clear what tests and analyses are necessary to support the resolution of the issues. As the characterization of candidate sites proceeds and better information becomes available, the licensing strategies will be refined, as needed, to better support the site-selection and licensing requirements.

The licensing-strategy step and the next three steps define the performance-allocation process. Performance allocation entails deciding which system elements will be relied on in resolving an issue, identifying the functions that the elements will be expected to perform, and the processes that will affect the performance of each element, identifying and assigning specific quantitative goals to measures and parameters that represent the expected performance, and developing a testing program to obtain the information relevant to the identified parameters. The development of a licensing strategy (step 3 of Figure 4) is the first step in the performance-allocation process

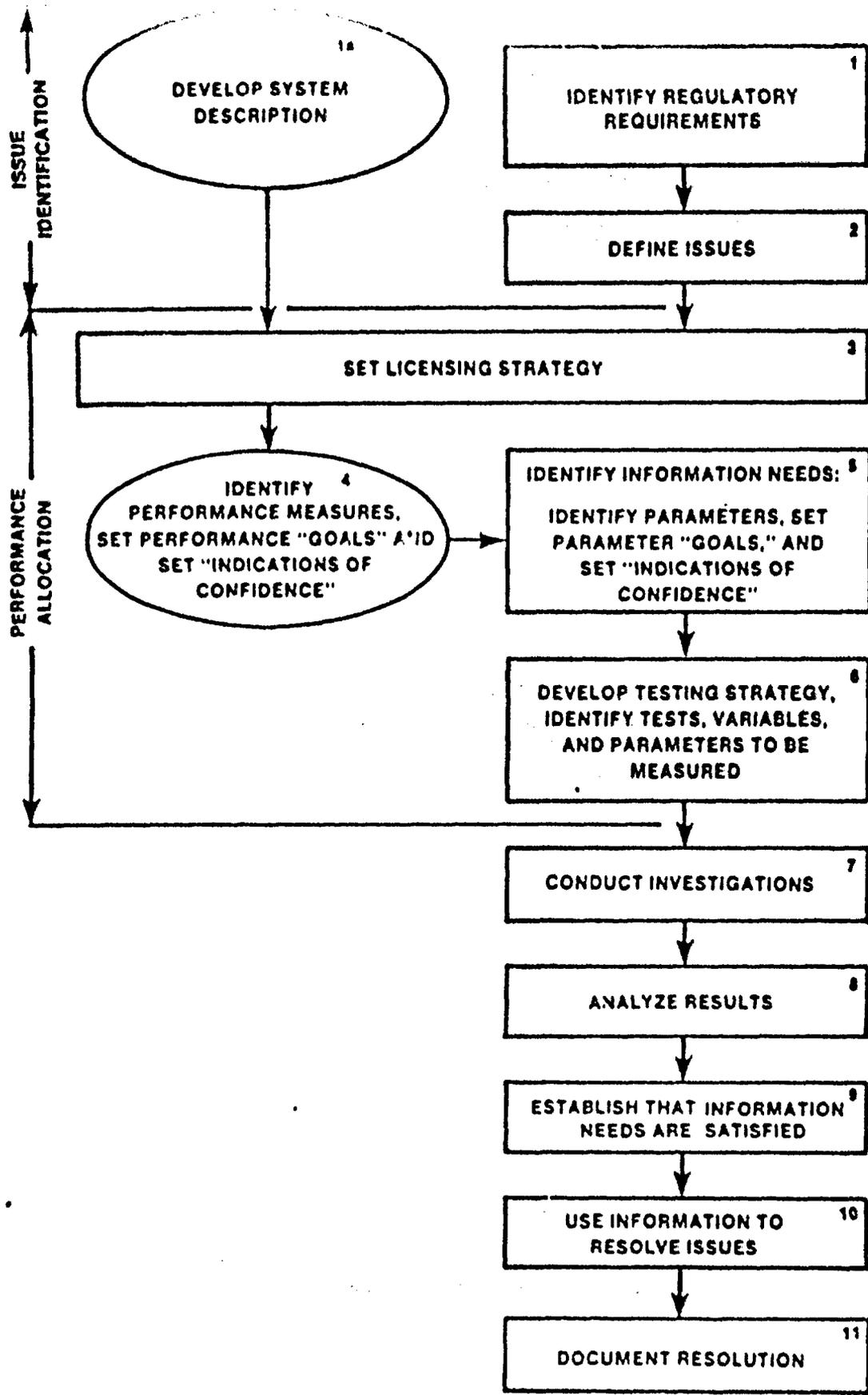


Figure 4. Issue-resolution strategy.

Steps 4 through 6 can be described as expressing the licensing strategy in certain specifically defined terms and using those expressions to continue the development of information needs for each issue in the hierarchy and to derive an explicit, detailed statement of the strategy and objectives of the test program needed to support the resolution of the issue. The tests themselves are defined in step 6 once the information and parameter needs have been identified for all issues and consolidated into nonredundant lists of the requirements for each area of testing or analysis. Steps 4 through 6 may be iterative in that the identification of the requirements for one step may reveal a need for changes in a preceding step or even in the licensing strategy.

After the performance-allocation process has been completed, the remaining steps include the conduct of the investigations (step 7) and performance of the analyses and evaluations needed to support issue resolution (step 8). In step 9 the results of the investigations and analyses are used to establish whether the information needs have been satisfied. Once this determination has been made, the information is employed to demonstrate issue resolution (step 10), and the resolution process is documented (step 11).

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**RATIONALE**

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**DRAFT**  
**Site Characterization Plan**

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*Yucca Mountain Site, Nevada Research  
and Development Area, Nevada*

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**August 17, 1987**

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*U.S. Department of Energy  
Office of Civilian Radioactive Waste Management  
Washington, DC 20585*

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## 8.1 RATIONALE FOR THE SITE CHARACTERIZATION PROGRAM

The site characterization program and Chapter 8 follow two organizing principles. The first is the issues hierarchy, which states the questions the DOE feels must be resolved about the performance of the mined geologic disposal system (i.e., the waste package, the engineered repository, and the natural system at the site) to demonstrate compliance with the applicable Federal regulations. The second principle is a general procedure, or "strategy," for determining how those issues are to be resolved. This general strategy can be used to develop a specific strategy for the resolution of each issue. One step in the application of the specific strategies results in the identification of the site information needed to support the resolution of the issues. An understanding of these principles is helpful in following the discussions in the rest of this document; this section therefore discusses them briefly.

### 8.1.1 THE ISSUES-BASED APPROACH TO PLANNING SITE CHARACTERIZATION

The issues hierarchy states questions about the performance of the disposal system and identifies the information that must be known before a site can be selected and licensed. It is based on the issues-hierarchy concept presented in the Mission Plan (DOE, 1985). The discussion that follows explains the derivation, structure, scope, and objectives of the issues hierarchy. More information can be found in the Issues Hierarchy for a Mined Geologic Disposal System (DOE, 1986d).

#### 8.1.1.1 Derivation, structure, and scope

The issues hierarchy is a three-tiered framework consisting of key issues, issues, and information needs. On the first, or highest, tier there are four key issues, which embody the principal requirements established by the regulations governing geologic disposal. Each of the key issues is followed, in the second tier, by a group of several issues that expand on the requirements stated in the key issue they represent. The third tier consists of still more detailed sets of information called the "information needs"--one set for each issue. This framework provides a convenient means for distinguishing broad questions of overall performance and suitability (key issues) from more specific questions about the characteristics of the site, the design of the repository and the waste package, and the performance of the total geologic disposal system. It also distinguishes the key issues and issues from requirements for the basic information needed to resolve the issues.

The issues hierarchy, then, defines issues that must be resolved to demonstrate compliance with key regulatory requirements. Other, detailed requirements that the disposal system must satisfy, such as functional requirements, are included in the specifications given in the Generic Requirements for a Mined Geologic Disposal System (DOE, 1986c), the Waste Management System Requirements and Descriptions (DOE, 1986f), and in the requirements document that will be issued for a repository at the Yucca

# DRAFT

Mountain site. As the definition of requirements progresses, the requirements and the issues hierarchy will be compared and correlated to ensure consistency and completeness in each. The role of the system requirements and descriptions in the issue resolution strategy is described in Section 8.1.2.

The key issues and the issues are common to all candidate sites. The information needs, though generally similar for all sites, have been developed specifically for the Yucca Mountain site, taking into account the characteristics of the site and the host rock as well as the data collected to date. The entire issues hierarchy for the Yucca Mountain site is presented in Section 8.2.1.1. Although care has been taken to ensure that this issues hierarchy contains a comprehensive list of siting and licensing issues, it will be revised as necessary during site characterization to encompass any additional issues that may arise.

## Key issues

The key issues embody the principal requirements established by the regulations governing repositories and have been adopted nearly verbatim from the key issues in the Mission Plan. They are stated as questions that must be answered affirmatively if a site is to be found suitable for development, selected, and licensed. The key issues are derived from the four system guidelines of the DOE siting guidelines promulgated in 10 CFR Part 960 and are therefore concerned with (1) the performance of the repository system after closure; (2) radiological safety before closure; (3) the environmental, socioeconomic, and transportation impacts of the repository; and (4) the ease and cost of repository siting, construction, operation, and closure.

Key Issue 1 (postclosure performance) is derived directly from the postclosure system guideline (10 CFR 960.4-1), which defines the general long-term performance requirements for the disposal system as a whole. These performance requirements reflect the general objectives of protecting the health and safety of the public and the quality of the environment; they are based specifically on the standards promulgated by the Environmental Protection Agency (EPA) in Subpart B of 40 CFR Part 191 (EPA, 1985), and the criteria adopted by the Nuclear Regulatory Commission (NRC) in Subpart E of 10 CFR Part 60 (NRC, 1983).

Key Issue 2 (preclosure radiological safety) is derived from the preclosure system guideline (10 CFR 960.5-1(a)(1)). It requires compliance with the applicable requirements of the EPA standards in Subpart A of 40 CFR Part 191, and the NRC criteria in 10 CFR Part 60 and 10 CFR Part 20. Because compliance with these regulatory requirements depends mainly on the design and operating procedures of the repository rather than on the geologic characteristics of the site, not all aspects of Key Issue 2 are directly addressed in the site characterization plan (SCP). Little information from the site characterization program is required for the resolution of Key Issue 2. Instead most of the information needed to resolve this issue will be obtained from design studies for the repository and the waste package and from studies conducted concurrently with site characterization. (Plans for such studies will be presented in an environmental program plan and a repository design plan for the Yucca Mountain site.)

# DRAFT

Key Issue 3, which is concerned with the environmental, socioeconomic, and transportation impacts associated with a repository, is derived from the preclosure system guideline (10 CFR 960.5-1(a)(2)). The resolution of this issue does not directly depend on information from site characterization activities and therefore this key issue is not addressed in the SCP. The information needed to resolve this issue will be collected during the environmental and socioeconomic investigations performed concurrently with site characterization. Plans for these studies will be presented in environmental and socioeconomic program plans, prepared concurrently with the SCP.

Key Issue 4 (the ease and cost of repository siting, construction, operation, and closure) is derived from the preclosure system guideline (10 CFR 960.5-1(a)(3)). The requirements of this issue are derived from those of the referenced preclosure system guideline, which requires that the technical feasibility and cost of repository siting, construction, operation, and closure be evaluated in light of the site characteristics and related design requirements. The resolution of this issue depends in part on site conditions and in part on information that can be developed independently of the description of site conditions. Plans to acquire this independent information will be presented in a repository-design plan; these plans are not presented in this SCP, because the activities they describe do not fall within the definition of site characterization in the Nuclear Waste Policy Act.

Matrices that correlate each issue with specific regulatory requirements are presented in Section 8.2.1.2, which also discusses the relationship of the issues hierarchy to other sets of issues--for example, those proposed by the NRC in the draft issue-oriented site technical positions.

## Issues

The issues defined for each key issue are also stated as questions (Section 8.2.1.1). When each group of issues was constructed, an effort was made to include in the group all the questions that must be answered to resolve the key issue. Taken together, the issues therefore provide a conceptual strategy for resolving each key issue. The issues defined for each key issue are identical in overall scope to the issues in the Mission Plan, but the structure and the wording are different. The issues are derived, in part, from the DOE siting guidelines of 10 CFR Part 960, from the NRC performance objectives and design criteria of 10 CFR Part 60, and from the EPA requirements of 40 CFR Part 191.

To accommodate the structure and the intent of the regulations in 10 CFR Part 60 and 10 CFR Part 960, the issues are divided into performance issues and design issues. The NRC criteria in 10 CFR Part 60 clearly make a distinction between performance objectives and design criteria; though obviously related, performance objectives and design criteria have different purposes and must be addressed from different perspectives.

The performance issues generally address questions about compliance with regulatory requirements for the performance of the disposal system. They are generally related directly to the highest level of regulatory requirements to be satisfied. For example, there are performance issues that correspond to each of the postclosure performance objectives stated in 10 CFR 60.112.

# DRAFT

There are also performance issues that correspond to the requirement to make higher-level findings for the postclosure guidelines and for each set of preclosure guidelines in 10 CFR Part 960.

The design issues address questions about the design of the repository, the shaft and borehole seals, and the waste package. They address the design criteria specified in 10 CFR 60.130 through 60.134, the design-related considerations of preclosure guideline 10 CFR 960.5-1(a)(3), and information required to support the resolution of performance issues.

The resolution of both the performance and the design issues requires information about the site, and to provide this information the site program described in Section 8.3.1 has been developed. This program will evaluate the site characteristics, processes, and events that may affect the design and the performance of the waste package and the repository; the results will provide the detailed site information that will be used to develop site descriptions and to support the resolution of design and performance issues, including the demonstration of compliance with the siting guidelines. The site program is organized by technical discipline (e.g., geohydrology, geochemistry, and rock characteristics), and it provides a means of controlling and integrating the investigations in each technical discipline.

The relationship among the two categories of issues and the site program can be summarized as follows: The performance and the design issues establish requirements and priorities for the site program, while the site program produces data for the analyses needed to address design and performance issues. An investigation or other type of activity in the site program will take place only if it is necessary to provide information needed to resolve a design or a performance issue.

## Information needs

On the third tier of the issues hierarchy is a set of statements called "information needs." Unlike the key issues and issues, the information needs are stated as requirements for technical information rather than as questions. In developing the information needs, an attempt was made to list the categories of information needed for resolving the issues. In principle, then, acquiring all the information called for at the third tier of the hierarchy will allow all the issues to be resolved through analyses and evaluations that use the information. If the issues are resolved affirmatively, the key issues will also have been resolved.

Site-specific information needs for the Yucca Mountain site have been identified and are listed in Section 8.2.1.1.

### 8.1.1.2 Application in the site characterization plan

The issues hierarchy, which is presented in Section 8.2.1.1, is useful in the SCP because it is a framework for developing the site characterization program described in Section 8.3 and for explaining why the proposed program is adequate and necessary. In simple terms, the site characterization program will be adequate if it addresses all the information needs in the third

# DRAFT

tier of the issues hierarchy. And the necessity for any particular planned study can be established by determining its role in supplying an information need. For these reasons, the issues hierarchy in Section 8.2.1.1 is used as an organizing principle for many parts of the SCP. In particular, Section 8.3, which describes the characterization program, is organized around the investigations and studies that are required to satisfy the information needs in the issues hierarchy. The defining of these issues was itself a part of the issues-based approach to site characterization described in this section and the issue resolution strategy described in the next section.

## 8.1.2 ISSUE RESOLUTION STRATEGY

To resolve the issues in the issues hierarchy, the DOE has adopted a general "issue resolution strategy" that guides the development of specific plans for resolving each issue. This general strategy is a procedure consisting of as many as 12 steps; it is outlined in Figure 8.1-1. Three of the steps, applied separately to each issue, lead to the identification of the information necessary to resolve the issue. Once the information needs have been identified, another step leads to the development of plans for acquiring that information. The reasoning used in carrying out those four steps is, then, the rationale for the particular site characterization activities that are intended to resolve the issue. The rationale and the plans for these activities are described in Sections 8.2 and 8.3. An understanding of the general issue resolution strategy is important for understanding these four steps and the site characterization program presented in Section 8.3.

### 8.1.2.1 Issue identification

The first section of the strategy, labeled "issue identification" in Figure 8.1-1, consists of three steps. Two of these steps (1 and 2) are the development of the issues hierarchy itself. Step 1 identifies the regulatory requirements; from them the issues are derived (step 2), as explained in Section 8.1.1. Also before specific plans for the resolution of each issue can be formulated, detailed description of the disposal system is needed (step 1a). This description for the Yucca Mountain site will be presented in site-specific requirements and system-description documents.

### 8.1.2.2 Performance allocation

The second section of the strategy, called "performance allocation," consists of the steps that provide the rationale for the establishment of particular site characterization activities. (In the issue resolution strategy the term "performance allocation" refers only to the four steps (steps 3 through 6) shown in Figure 8.1-1). Applied separately to each issue in the hierarchy, this section produces the principal guidance for planning the activities needed to resolve the issue. The performance-allocation concept was developed in formal discussions and documented in a written agreement between the DOE and the NRC.

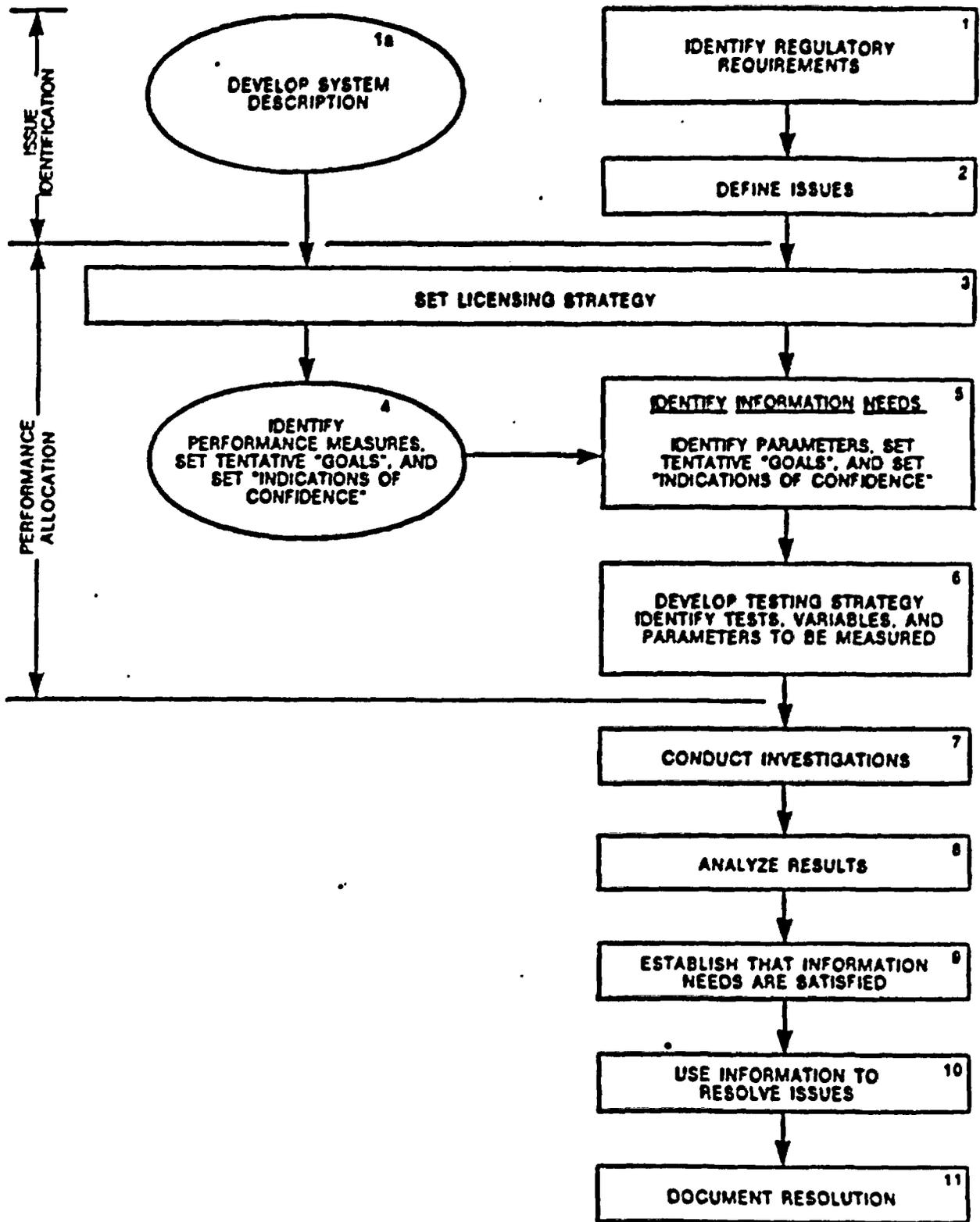


Figure 8.1-1. Issue resolution strategy

# DRAFT

The steps in performance allocation were defined with several objectives in mind: to provide uniform guidance for site characterization at all candidate sites, to ensure Program-wide consistency in implementing the process of performance allocation, and to provide specific kinds of information requested by the NRC.

## Licensing strategy

For each issue, the first step in performance allocation (step 3 in Figure 8.1-1) is the adoption of a "licensing strategy." This step uses available information to develop, for planning purposes, a statement of the site features, engineered features, conceptual models, and analyses that the DOE expects to use in resolving the issue. The statement is called a licensing strategy because the combined statements developed in step 3 for all the issues are the basis for the current DOE plans to show compliance with regulatory requirements. Eventually, plans developed from the current plans will support the selection of a site for development and the demonstration of compliance with NRC requirements for the construction, operation, closure, and decommissioning of a repository.

In this document, the licensing strategy is necessarily preliminary: not enough information is now available to make a definitive plan, because site characterization is only beginning. But the strategy is developed well enough to guide the preparation of the plans for tests and analyses and to make clear what activities are necessary and whether they will be sufficient to resolve the issue. As site characterization proceeds and additional information becomes available, the licensing strategy may be revised, and the performance allocation may be changed. The licensing strategies described in this document are likely to change before the submission of the license application to the NRC; for the purposes of this SCP, they are simply the basis for initial planning.

For guiding the development of the SCP, the principal product of step 3 is a statement of the disposal-system components on which the DOE currently intends to rely in resolving the issue; if these components perform as the licensing strategy expects them to perform, the issue is likely to be resolved. The statement may also identify, for each of the components, specific features or characteristics that the DOE expects will contribute to the performance of the component and, hence, to the resolution of the issue. The performance and design issues provide the statement of disposal-system components for use in later steps as a basis for deciding what specific information is needed for resolving the issue.

## Performance measures and tentative goals

Step 4 carries the strategy further by establishing "performance measures" for each of the components identified in step 3. A performance measure is a physical quantity that describes the performance of the component in meeting the licensing strategy. The measure may be a directly measurable quantity, or it may be a quantity derived from other, more directly measurable quantities.

For each performance measure step 4 establishes a tentative "goal." The word "goal" is written with quotation marks in Figure 8.1-1 to show that it

# DRAFT

has a special meaning in performance allocation. The tentative goal is not a target that the performance measure must attain if the repository is to perform properly, and therefore it does not have to be met. Instead, it is simply a guide for the development of a testing program--a guide that states the licensing strategy quantitatively and can be changed or discarded once the testing program has been established. In assigning goals to the performance measures, the DOE will specify values that are consistent with the licensing strategy for the issue. If the tests and analyses can demonstrate that a goal is attained, the licensing strategy for the issue will be satisfied, and the issue will be likely to be resolved. The goals are, therefore, guides for deciding, in the later steps of performance allocation, what information must be provided by the testing program. Whenever a goal is identified, the reasoning that led to its selection is also presented.

As a further guide for testing, step 4 accompanies each tentative goal with an "indication of confidence," a statement that further clarifies the role of the component in meeting the licensing strategy. The indication of confidence expresses, as quantitatively as possible, the confidence with which the licensing strategy desires the testing program to show that the goal has been attained.

For some goals, it is possible to use statistically rigorous numerical values as indications of confidence; for most of them, however, only a qualitative expression is now possible. When qualitative indicators are assigned, they are accompanied by further explanation of their intended meaning.

Because they depend on a licensing strategy that is preliminary, the goals and indications of confidence are also preliminary. As site characterization progresses and more information is acquired, these goals and indicators will probably be changed to guide continued testing toward the collection of the needed information.

## Information needs

The performance allocation process now proceeds to develop specific requirements for future work. Step 5 identifies "information needs," which state, for each issue, the categories or types of information needed to resolve the issue. The information needs identified for the Yucca Mountain site are listed in Section 8.2. Section 8.3 explains how these information needs were derived from the licensing strategy developed earlier in the performance allocation process.

Part of the development of an information need is the identification of the "parameters" needed to evaluate the performance measures. As already mentioned, many performance measures (e.g., the time of ground-water travel through a particular geohydrologic unit) are not directly measurable quantities. Often, however, they can be expressed by an equation in which quantities that can be measured more directly appear as parameters (e.g., hydraulic conductivity). Step 5 furthers the development of plans for testing by listing these parameters. Sometimes the performance measures cannot be expressed simply as an equation containing associated parameters; then in step 5, by an extension of the notion of mathematical parameters, lists are made of whatever quantities must be measured to demonstrate that the goal associated with the performance measure has been met. The performance allocations reported

# DRAFT

in later sections of this chapter call these quantities, as well as the quantities derived from rigorous equations, "parameters". Parameters derived for the resolution of design issues are usually called "design parameters"; those for performance issues are "performance parameters."

In step 5 a tentative goal is assigned to each parameter. Like the goals for performance measures, these goals are not values that must be achieved by the disposal system. They are simply quantitative statements about the values that the licensing strategy expects to use for the parameters in showing that the issue has been resolved. Frequently, the goals are expressed as inequalities because the licensing strategy may require only that the value of a parameter be shown to lie within a stated range or to be greater or smaller than some stated value.

If the results of site characterization can successfully demonstrate that the tentative goal has been met, the DOE plans for getting a license will be fulfilled as far as that parameter's contribution to the associated performance measure is concerned. The demonstration will not, of course, guarantee a successful license application because many other parameters will enter the calculations in support of the license. Moreover, failure to meet the goal would not be reason to suspect that the license application will be unsuccessful because the goals are not values that, by themselves, are essential to the performance of a disposal system. The reason for setting the goals is simply to guide the specification of tests in the characterization program--to tell quantitatively what information will lead to the resolution of the performance and the design issues.

As a further guide to the detailed specification of tests, step 5 also specifies two indications of confidence for the goal assigned to each parameter. Like the indicators for goals for performance measures, these indicators are not numerically rigorous but are expressed in qualitative terms: high, medium, and low.

The first of these two indications, called "needed confidence" in the performance allocation tables in this chapter of the SCP, answers the following question: When the DOE presents its license application, how confident must it be that the goal has been met? In other words, what confidence does the licensing strategy require for the demonstration that the goal has been met? In assigning the indicators of needed confidence, the DOE is guided primarily by two considerations:

1. Importance. How important to the licensing strategy is the associated goal? Usually the goal is so important that a value of "high" is assigned to the needed confidence. When the goal is a request for information that is not crucial to the license application, an assignment of low or medium confidence is usually appropriate.
2. Sensitivity of the parameter associated with the goal. In addition to considering the importance of a goal, the DOE may examine the sensitivity with which the associated parameter contributes to performance measures and other parameters. If a performance measure or

# DRAFT

another parameter is highly sensitive to the likely or expected variations in the parameter for which a goal is assigned, the needed confidence may be higher than it would be for a parameter whose variations make little difference.

The second indication of confidence, called "current confidence" in the performance allocation tables, answers the following question: If the DOE were to present its license application today and could use only currently available data in the presentation, how confident would it feel that the associated goal has been met? In assigning the indicators of current confidence, the DOE is guided by considering the amount and the quality of the available data.

Step 6 in Figure 8.1-1 uses the information needs, expressed in the terms adopted during step 5, to define the work that will produce the needed information. The parameters derived in step 5 are usually not directly measurable quantities, but must be derived from other quantities that can be measured through testing. For example, hydraulic conductivity, mentioned previously as a possible parameter for calculations of ground-water travel time, is not directly measurable in a field test. Step 6, then, identifies additional, more directly measurable, quantities that can contribute to determining values for the performance and design parameters derived in step 5. These additional quantities are generally called "characterization parameters." Some of the SCP sections describing the site program also use other kinds of parameters, called by different names, in explaining how characterization parameters are being developed.

Step 6 also defines a "testing basis," whose purpose is to give further information about the way in which the characterization parameters need to be measured. Some of the testing bases appearing in the later sections of this chapter describe the accuracy with which the associated characterization parameters need to be measured; some describe the confidence that the measurements should produce for licensing. As the later sections explain, the particular descriptions of a testing basis are tailored to the parameters they explain and to the development status of those parameters.

The parameters, confidences, and testing bases are the foundation for the strategy detailed in Section 8.3 in the descriptions of the planned site characterization work. That section describes the planned tests; it identifies the experimental variables and the parameters (from steps 5 and 6) that the tests will measure. It also describes plans for developing the needed analytical models and design information.

Because the issues in the hierarchy cover widely different topics, the four steps in performance allocation are intended to be applied flexibly. For example, the strategy for resolving design issues may differ from the strategy adopted for performance issues. And although the goals assigned to performance measures for engineered components can be useful in guiding design, the goals assigned to the properties of natural components cannot be altered by design. For reasons like these, the four steps cannot be applied with rigid uniformity to all issues; Section 8.2 therefore briefly summarizes the rationale behind the indicated allocation for each issue, and Section 8.3 the complete performance allocation.

# DRAFT

## 8.1.2.3 Investigations

After the performance allocation has produced the plans for resolving issues, the issue resolution strategy proceeds with the investigations called for in the plans (step 7 in Figure 8.1-1).

The analyses of the results of the investigations and the studies they encompass (step 8) begin as soon as the results are available and continue throughout the site characterization period and beyond. These analyses include all the evaluations needed to resolve the issues. The collection of needed information continues until the information needs have been satisfied (step 9). The collected information is then used in a concluding set of analyses that finally resolve the issues (step 10), and the resolution is documented (step 11).

## 8.1.2.4 Application of the issue resolution strategy

The entire issue resolution strategy is intended to be an iterative process. As explained previously, the licensing strategy, as well as the tentative goals and the indications of confidence for the performance measures and related parameters, may be changed to reflect new information or in response to comments about plans or test results. If they are changed, the steps that follow in the issue resolution strategy will also be reexamined and their products revised. The analyses of the results of the investigations (step 8) may produce new understandings that require the rethinking of earlier steps. Any of the steps may, in fact, lead to revisions of earlier steps. Sections 8.2 and 8.3, in presenting DOE plans for issue resolution and site characterization, report the current status of the issue resolution strategy.

This iterative process will furnish a vehicle by which the DOE will communicate to the NRC and the State the approaches that it intends to use in resolving the issues in the issues hierarchy. As already mentioned, the current versions of the strategies are preliminary and intended simply as a basis for initial planning; they are expected to be the primary focus for comments and discussions between the DOE and the reviewers of the SCP.

The rationale for future changes to the issue resolution strategies (e.g., revised licensing strategies and performance allocations) will be documented in the site characterization progress reports, which will also report the results of site characterization studies. The reviews, interactions, and reports will continue until the license application is submitted to the NRC.

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