Department of Energy
National Waste Terminal
Storage Program Office
505 King Avenue
Columbus, Ohio 43201

October 11, 1983

Stanley Goldsmith
Director
Office of Nuclear Waste Isolation
505 King Avenue
Columbus, Ohio 43201

Dear Mr. Goldsmith:

GUIDANCE FOR SCP PREPARATION

As indicated in our letter dated August 18, 1983, during the last several weeks we have been evaluating our approach toward accomplishing the near-term goals (i.e. EA's and SCP's) of the salt program. As part of this evaluation, we have considered several recommendations from the NPO staff and held several internal meetings to discuss the situation. At this time, we have finalized our decision on what we consider to be the proper approach. This letter is to communicate this decision to ONWI and to provide you with general guidelines regarding the SCP preparation process.

In developing these guidelines, we have considered the following factors:

- guidance recently provided to us by DOE-HQ with reference to the site nomination-recommendation process;
- our interaction with NRC;
- our perception of the EA preparation process as currently in progress;
- your July 8, 1983 recommendations addressing SCP preparation activities; and
- your past achievements, including the draft of SCR-Permian Basin.

The SCP preparation process is an important element within our task of developing the first repository. As such, this process deserves careful consideration, planning and execution.

In our view, the SCP's principal objective is to demonstrate that selection of: a) a set of technical issues to be addressed during the detailed site characterization, b) a set of methods and technical procedures to be utilized in resolving these issues, c) a set of engineering design measures, and d) a set of methods of construction and operation of the test facilities; is sufficient to yield an adequate data base for evaluating the ultimate performance of the disposal system, without jeopardizing its isolation capabilities.

It is our considered opinion that at each stage of development of a nuclear waste repository, including the formulation of an SCP, an understanding of the evaluation of ultimate performance of the disposal system is required. This understanding must be developed through performance assessment considerations, as presented on Figure 1. In a sense, the performance assessment considerations should be considered the "guidance mechanism" for the entire SCP preparation process, including: identification of the most urgent data and analysis needs, development of technical issues, development of engineering design concepts, development of technical activity plans and technical procedures, etc. We request that ONWI adopt this philosophy in formulating the SCP.

It is also our conviction that the SCP preparation process should encompass two broad areas of activity:

i) <u>development and consolidation of the data, analysis, and design basis</u> (the scope of this activity should be defined taking into account the following factors: a) the salt program schedule, b) objective technical needs of the salt program, and c) depth and extent of the existing data base); and,

ii) <u>"manufacturing" the necessary documents for submission to NRC</u> (the emphasis of this activity should be on: a) quality, objectivity and completeness of the presentation, b) compatibility of engineering design measures with known site and system specific performance characteristics, and c) plans and procedures which are adequate to yield a data base for a realistic evaluation of the ultimate performance of a disposal system).

Considering the uncertainties regarding the salt-program schedule and the potential for further schedule slippage, we believe it is prudent to set up the SCP preparation process in such a manner that it is flexible in some aspects but rigid in others. The flexibility should pertain to: a) the depth of the data base to be presented in Part B of the SCP, and b) the depth of

plans and procedures. The rigidity, however, shall apply to all aspects of project management including quality assurance, areas of responsibilities, the data management system, decision making process, etc. Furthermore, in consideration of the uncertainty concerning the outcome of the nomination - recommendation process, it is only prudent to proceed with SCP preparation for all three geohydrologic settings (i.e., the Paradox Basin, the Permian Basin, and the Gulf Coast).

As the first step toward developing the SCP, we request that ONWI develop a comprehensive SCP preparation project plan. The project plan should be required to:

1) provide a general framework for the project in terms of: a) relationship to the site nomination - recommendation process, and b) regulatory and functional requirements;

2) specify: an initial set of definitive project technical objectives;

3) provide a detailed definition of the project structure in terms of: a) compositional elements, b) specific responsibilities of these elements, and c) technically qualified responsible individuals;

4) specify: a) acceptable document control rules, including quality assurance records, and b) acceptable technical procedures for data acquisition and reduction, for data analysis and interpretation and for use of computer codes; and

5) provide an acceptable means of modifying the project structure, emphasis, objectives, and schedules, all in accord with changes in circumstances and requirements.

An elaboration of each of the project plan requirements is provided in attachments B through F. These attachments outline in considerable detail what NPO expects of ONWI in terms of a philosophy for development of an SCP, as well as the purpose and content of the SCP Preparation Project Plan. In 4 to 5 weeks time, ONWI should provide a draft SCP Preparation Project Plan to NPO for its approval. The project plan should be considered as the NPO controlled milestone. The procurement of all professional services deemed necessary to fulfill requirements of the project structure must be approved by NPO. Should ONWI feel it needs some assistance in understanding the requirements of the plan or in developing its content, arrangements can be made to provide this.

Questions regarding these instructions should be directed to J.S. Szymanski of my staff. In closing, we apologize for our imposition on ONWI, particularly with regard to your preparation of ONWI's FY 84 budget, while we performed our evaluation and prepared this guidance.

Sincerely,

J. O. Neff
Program Manager
NWTS Program Office

NPO:JSS:ksw

Enclosures: 1) Figure 1
2) Figure 2
3) Figure 3
4) Attachment A
5) Attachment B
6) Attachment C
7) Attachment D
8) Attachment E
9) Attachment F

cc: NPO Staff
N. Carter, BPMD
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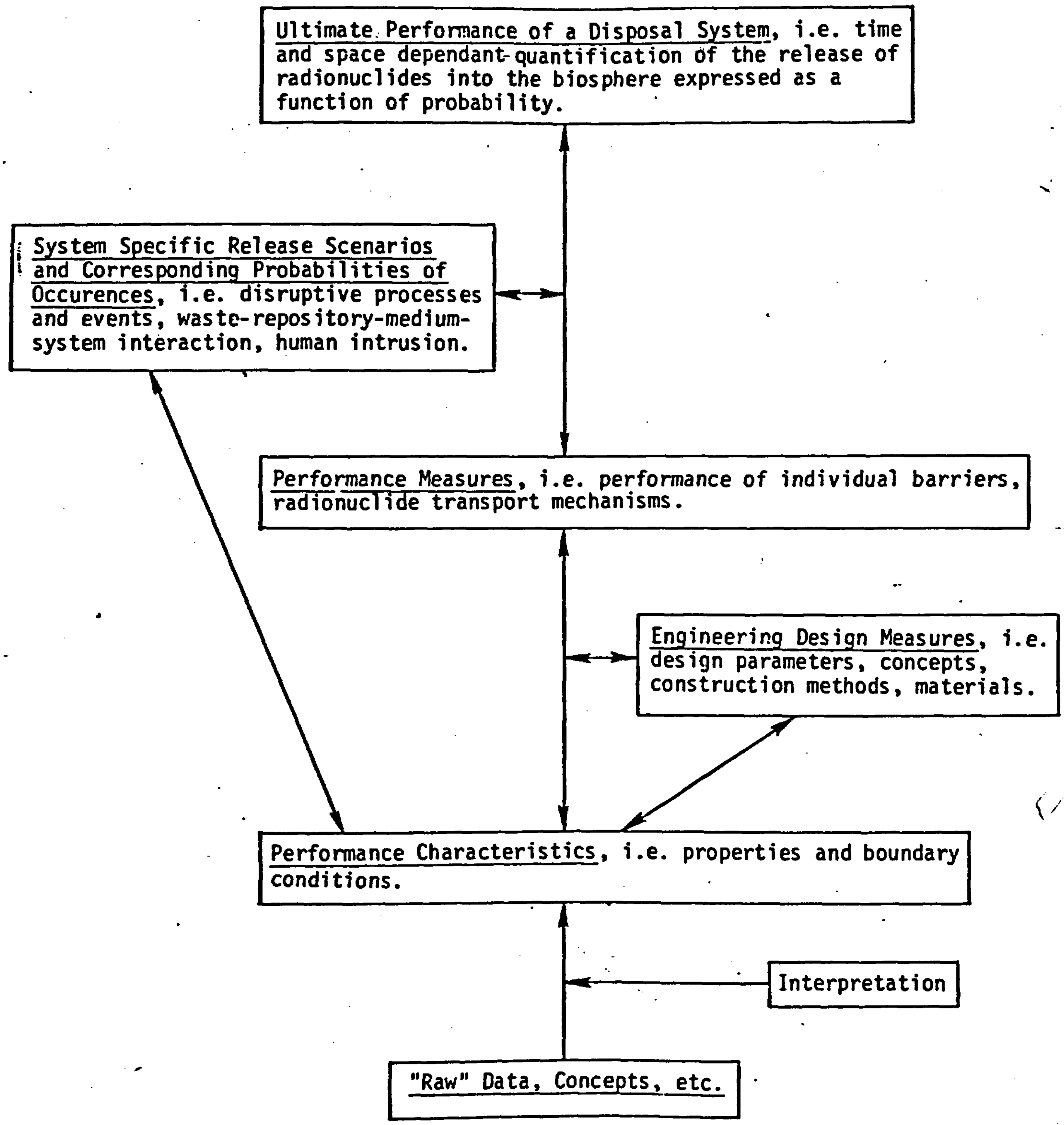

PERFORMANCE ASSESSMENT CONSIDERATIONS

FLOW DIAGRAM

Note: Explanation of terminology used is provided in Attachment A.

Figure 1

SCP PREPARATION PROCESS

SCP PROJECT PLAN → SITE NOMINATION → SITE RECOMMENDATION → SCP SUBMISSION TO NRC

PHASE I

- Consolidation, visibility, and accessability of project base.
- Definition of the project needs and requirements, including;
  1. performance characteristics;
  2. engineering measures;
  3. technical procedures;
  4. generic activity plans;
  5. sensitivity of engineering measures.

PHASE II

- Data and analysis - performance characteristics.
- Technical procedures.
- Generic activity plans.
- Part C of the SCP.
- Sensitivity of performance measures to engineering design and the performance characteristics.

PHASE III

- The SCP final draft (Parts A, B and C);
- The final draft of technical procedures;
- The final draft of generic activity test plans.

DELIVERABLES PHASE I

- Early draft of Part B for PB, PB and GC SCP.
- File and index existing data.
- Performance assessment plan.
- Performance assessment status.
- Relative importance of performance characteristics.
- Task force report.
- Project needs.

DELIVERABLES PHASE II

- Topical reports on each investigated performance characteristic;
- Early draft of technical procedures;
- Draft of generic activity plans; and
- Part C of the SCP for each setting.

DELIVERABLES PHASE III

- SCP submission approved by ONWI, NPO, ANL and HQ.

Figure 2

SCP PREPARATION PROCESS

SUGGESTED PROJECT STRUCTURE

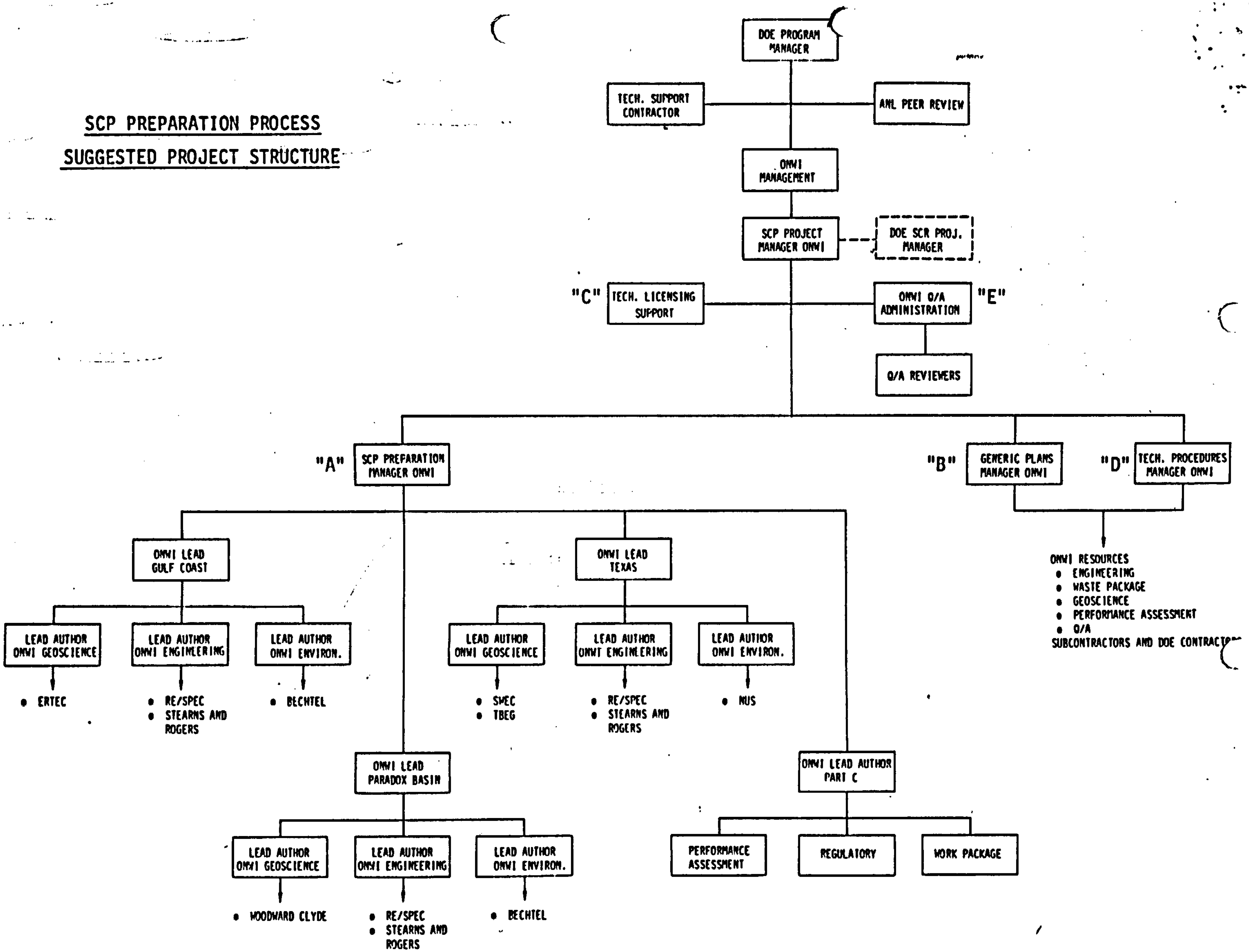

Figure 3

ATTACHMENT A

Explanation of Terminology Used

Introduction

From a geoscience point of view, which is the main factor of the problem of nuclear waste isolation and safe disposal, each geohydrologic setting offers a unique potential with regard to isolating the waste from the biosphere. Each setting is different in terms of its geological history and evolution, composition, and contemporary behavior. Consequently, it may be safely assumed that each offers a unique set of performance characteristics. It is likely that each setting requires its own set of engineering design measures, in order to achieve similar results with regard to performance objectives. It is conceivable that for a given salt body, located in a given geologic setting, there may be a performance characteristic or a release scenario which will cause a desired level of performance of a disposal system to not be achieved, regardless of sophistication of the applied engineering measures. Clearly, our job is to understand factors which may contribute to such eventuality and design our testing plans and testing procedures to evaluate these factors early in the overall process of developing the first repository.

"Raw" Data and/or Concept

Within the context of this letter, a "raw" datum and/or a concept is defined as an observation, measurement or understanding involving a given region, a given site, and a given salt body. This may pertain to either geological

materials or geological processes. Examples of "raw" data and concepts are: a lithological log; a measurement of hydraulic conductivity or head; results of various laboratory or in-situ measurements (thermal properties, rheological behavior, composition, strain relief, hydraulic fracturing, etc.); facies changes and depositional environment; various geodynamic concepts; rheological nature of geological materials; non-Darcian movement of fluids and gases through geological materials, etc.

Information concerning the "raw" data or concepts must be obtained through: a) field observations and measurements, b) laboratory observations or measurements, c) research and development, and d) interaction with the scientific community.

Performance Characteristics

Within the context of this letter, a performance characteristic is defined as a natural characteristic of a geologic given setting or a given salt body which substantially influences a particular performance measure, and may influence the applicability and/or effectiveness of a particular engineering design measure. This natural characteristic may pertain to either boundary conditions (geological processes) or properties of geologic materials involved. Examples of performance characteristics are: in-situ strain state; various in-situ properties of the host material; chemical composition of brines and fluid inclusions; retardation potential of the host and country

rock; hydraulic conductivity or head; contemporary tectonic straining of the disposal system; erosion potential; climatologic changes; etc.

For a given disposal medium, performance characteristics should be identified based on: a) parametric analyses, b) research and development, and c) interaction with the scientific community.

Each performance characteristic is an integrated product of the disposal system history, contemporary behavior, and composition. Therefore, each of these characteristics is setting specific, to a lesser degree site specific, and may be substantially different from one geohydrologic setting to another. A qualitative and quantitative evaluation of a particular performance characteristic must be achieved through an appropriate interpretation of the "raw" data and/or concepts.

Engineering Design Measure

An engineering design measure is defined as an engineering decision involving the design, construction, and operation of the nuclear waste repository. This decision may pertain to: a) a design parameter, b) an engineering material, c) an engineering concept, d) safety margins, and e) construction and/or manufacturing methods. Examples of engineering design measures are: allowable thermal loading; waste retrievability; design concepts for tunnels, shafts, pillars, etc.; waste emplacement configuration; construction methods for undergound openings; design concepts for the waste package; seismic design of the facility; ventilation of underground openings; materials and methods used in manufacturing the waste package, etc.

In order to be effective, the engineering design measures must be rooted in the disposal system performance characteristics and must be specifically tailored to meet certain objectives with regard to: a) first, the performance measures, and b) second, the ultimate performance of the overall disposal system. A degree of dependance between a particular engineering design measure and a corresponding performance characteristic or a set of these characteristics may be greatly varied depending upon: a) a given geologic setting, b) a given salt body and site, c) a given design measure, and d) a given performance characteristic. Evaluation of the degree of this dependance must be achieved through sensitivity analyses made with reference to the performance measure objectives. For a given disposal system, identification of a set of proper design measures must be achieved through: a) application of common engineering practice, b) research and development, c) interaction with the scientific community, d) at-depth testing, and e) numerical simulations.

Performance Measure

A performance measure is a numerically expressed facet of the ultimate performance of the disposal system, (i.e., a facet of a time and space dependent interaction between waste, repository, and geologic system). Examples of these measures are: life expectancy of the waste package; migration of brine, fluid and gas inclusions; time and space dependent changes in hydraulic conductivity whether natural or induced; various aspects of deterioration of the disposal system and its isolation capabilities caused by waste, repository and natural processes, etc.

For a given disposal medium, identification of performance measures is achieved through: a) parametric analyses using system specific performance characteristics, b) research and development, c) interaction with scientific community, and d) interaction with regulatory bodies. However, quantification of these measures can only be achieved through numerical simulations, which must use: a) defined performance characteristics, b) a given engineering design, and c) valid computer codes.

Release Scenario

A release scenario is a sequence of events having a specified probability of occurrence, involving a release of radionuclides to the biosphere after the waste emplacement and after the repository closure. There are two basic elements comprising any conceivable release scenario. The first element is a radionuclide transport mechanism which constitutes the release scenario base. It includes the following two aspects: a) a natural (i.e. in existence prior to repository construction) transport mechanism and its characteristics (e.g., ground water flow system), and b) any perturbations in the transport mechanism caused by interaction between waste, repository, and geological system (e.g., repository construction induced fracturing of the country rock; thermally induced fracturing; thermal and/or stress gradient induced migration of brines, fluid and gas inclusions; thermally induced vertical buoyancy flow; thermally induced salt dissolution; thermally induced domal growth, etc).

The second element is a postulated disruptive process(es) or event(s) as applicable to a given geological system and a given salt body. This element, if combined with the first element, forms the complete release scenario. Examples of the disruptive processes and/or events are: earthquake induced fracturing; human intrusion; erosion; in-situ salt flowage; tectonic straining of the disposal system, etc.

The formulation of applicable release scenarios with corresponding probability of occurrence must be achieved through: a) numerical simulations and understanding of interraction between waste, repository and geological system, b) field and laboratory observations and tests, c) at depth in-situ testing, and d) interaction with the scientific community and regulatory bodies.

Ultimate Performance of the Disposal System

The ultimate performance of the disposal system is a time and space dependent quantification of the release of radionuclides into the biosphere expressed as a function of probability. This quantification must be achieved through integration of various performance measures, considering radioactive decay, retardation characteristics of the disposal system and various geologic system specific release scenarios. Needless to say, an evaluation of the ultimate performance requires a very extensive data base and a deep understanding of the disposal system coupled with sophisticated performance assessment capabilities. Intuitively, such an evaluation is meaningful only in the context of a given engineering design of the repository.

ATTACHMENT B

The plan should provide a general framework for the project in terms of its relationship to the site nomination-recommendation process and in terms of its regulatory and functional requirements.

In order to maintain the degree of flexibility desired, we request that the SCP preparation process be divided into three phases, as shown on Figure 2. These are:

Phase I - NPO acceptance of the project plan-to-Nomination;

Phase II - Nomination-to-Recommendation; and

Phase III - Recommendation-to-the SCR submission to the NRC.

These phases should not be viewed as rigid in terms of calender dates, rather the project scheduling should be considered as dependent on the progress made in the site nomination-recommendation process. Any unforeseen, at this time, schedule slippage shall be utilized to expand the scope of activities for any particular phase.

During Phase I, emphasis should be on:

1) consolidation and enhancement of the visibility of the project basis including: data, analysis, and engineering design measures; and
2) definition of the project needs and requirements in terms of: a) performance characteristics and their relative inportance, b) engineering design measures,c) technical procedures, and d) generic activity plans.

According to the current schedule, the nomination of sites for further characterization will occur in July, 1984. At this time, the SCP preparation process will enter Phase II, during which the project emphasis should be:

1) site specific issues and, if appropriate, site based exploration,
2) filling up the gaps in the data base and analysis,
3) development of the technical procedures and the generic activity plans,
4) development of the engineering design measures in accord with the defined performance characteristics,
5) evaluation of the sensitivity of engineering design measures to the performance characteristics and their integrated impact on the performance measures, and
6) development of Part "C" (Issues and Plans) of the SCP.

The recommendation of one or two sites for further characterization is currently scheduled to be made in January of 1985. Once the recommendation is made and accepted, the SCP preparation process will enter Phase III. During this phase, attention will be focused only on the recommended site(s), with emphasis on:

1) development of the SCP final draft, including Parts A, B, and C,
2) completion of the Technical Procedures final draft, and
3) finalizing the drafts of the Generic Activity Plans.

We request that SCP preparation effort be conducted in such a manner that the final product will satisfy the following regulatory and functional requirements:

1) The SCP submission shall consist of three interrelated parts as requested by NRC. These parts are: a) the SCP report itself, the format of which is given by Reg. Guide 4.17, b) the technical procedures to be used in performing various tests and activities (e.g., waste package deterioration tests, in-situ properties of host medium, mining induced damage, etc.), and c) the generic test plans (e.g., in-situ test plan, performance assessment plan, waste package testing plan, etc.).

2) The SCP submission shall comply with all requirements contained in the National Nuclear Waste Policy Act of 1982 and Title 10 Part 60 of the Code of Federal Regulations.

3) The SCP preparation process must function within a framework of an effective and interactive quality assurance program.

4) Part "C" of the SCP (Issues and Plans) must be developed taking into account: a) the regulatory requirements with emphasis on the post-closure performance, b) the character of salt as a given disposal medium, and c) the character of a site as a part of a given geologic system.

5) The material presented in the SCP must be fully accountable, traceable, justifiable, and accessible in terms of its origin, data base, assumptions, and analyses.

6) The engineering design measures proposed, at the time of completion of the SCP, must be justifiable in light of all known performance characteristics.

7) For performance characteristics the site specific nature (quantification) of which is either uncertain or unknown, the SCP should contain an evaluation of the degree of dependence between the engineering design measures and the performance characteristics. Also, an evaluation of the influence of the design measures on the performance measures should be presented in light of their potential to enhance the ultimate performance of the disposal system.

8) According to the current schedule of the NWTS program, the SCP is scheduled to be submitted to the NRC no earlier than May, 1985.

ATTACHMENT C

The plan must specify an initial set of definitive project technical objectives.

We request that the project objectives for Phase I of the SCP preparation process be defined as follows:

- Objective I - development of a clearly visible and totally accessible project base (i.e., data, analyses and engineering design measures);
- Objective II - development of a generic understanding of the project data requirements and analysis needs with reference to the evaluation of the ultimate performance of a given disposal system;
- Objective III - definition of the projects most urgent needs with reference to the performance characteristics and the engineering design measures for each geologic system and site to be nominated; and
- Objective IV - definition of the project needs with regard to technical procedures and generic activity plans.

The specific project objectives for Phase II and Phase III of the SCP preparation process should be defined, at a later date, following general framework as presented on Figure 2. This definition shall take into account the following two factors:

1) developments in the site nomination-recommendation process, and
2) results of activities during the Phase I and/or Phase II.

ATTACHMENT D

The plan should provide a detailed definition of the project structure in terms of its compositional elements, specific responsibilities of these elements, and technically qualified responsible individuals.

In order to ensure effective control of the SCP preparation process and at the same time, ensure the desired degree of flexibility, we strongly suggest that ONWI develop and maintain an SCP project structure similar to that illustrated on Figure 3, with a strong technical profile rather than the currently portrayed regulatory image. Such a project structure should include the following:

1) a project manager;
2) an element of of project structure responsible for technical and regulatory support;
3) project quality assurance, including a quality assurance administration and quality assurance technical review capacity;
4) an element of the project structure, which is responsible for preparation of Part A, Part B, and Part C of the SCP for the Paradox Basin, the Permian Basin, and the Gulf Coast;
5) an element of the project structure responsible for the performance assessment considerations which within the context of this letter is considered a "guidance system" for the entire project; and
6) an element of the project structure responsible for the technical procedures.

We request that a visible and accessible data base be developed by the element of the project structure designated by "A" on Figure 3. There are two aspects of this activity:

1) completion by subcontractors of Part B of the SCP for each geohydrologic setting, as currently in progress; and
2) development of an index for each geohydrologic setting of: a) existing topical and generic reports, including their data base, content and scope, and b) the free floating "raw" data. Also, as part of this activity a central integrated hard copy file system, which will contain the entire data base, should be developed.

This activity, on the part of element "A", should yield three deliverables:

1) an early draft of Part B of the SCP for the Paradox Basin, the Permian Basin, and the Gulf Coast;
2) a central integrated file system; and
3) an index of the existing data base.

It is requested that element "B" of the project structure develop the understanding of the project requirements with reference to the evaluation of the ultimate performance of a disposal system. There are three aspects of the activity.

The first aspect is the development of a generic plan to perform the evaluation of ultimate performance of a disposal system for each salt body considered. This plan should identify all pertinent elements, aspects, and components of: a) the performance measure set, b) the performance characteristic set, c) the system specific release scenarios, and d) the engineering design measures which are sensitive to the system specific performance characteristics and which influence some performance measures. This identification could be made by breaking down the flow diagram presented on Figure 1.

The second aspect is an assessment of the relative importance of various elements comprising the performance characteristics set and the performance measures set. An evaluation of sensitivity of various aspects of the engineering design and their integrated impact on the system performance measures must be included in this activity. This will be achieved through performance of numerical parametric studies and numerical sensitivity analyses.

The third aspect is an identification of the current status of performance assessment as a "guidance mechanism" for the entire project. This identification shall involve two steps:

Step I For each geologic system: a) identify the performance characteristics available at the present time, including their data base and methods of interpretation; b) interpret and synthesize the existing data base in terms of known, but unavailable, performance characteristics; and c) cross-reference to the integrated file system.

Step II For each geologic system: a) identify performance measures which are known and available, including methods of integration and performance characteristics used; and b) cross-reference to the integrated file system.

The results of this activity by element "B" shall be provided in three deliverables:

1) a plan to perform the evaluation of ultimate performance for each salt body considered;
2) a report on the relative importance of the elements of the performance characteristic set and their influence on the engineering design measures and the performance measures for each salt body considered; and
3) a report on the status of performance assessment.

We request that definition of the project needs, with regard to the generic activity plans to be implemented during the site characterization, also be performed by element "B" on Figure 3. This definition should be made in

cooperation with the "A" element of the project structure. The definition must be based on the generic plan to perform the evaluation of ultimate performance of a disposal system, taking into account: a) a nature of salt as a disposal medium, b) the nature of a specific salt body, and c) the nature of the geologic system as defined in Part B of the SCP.

The generic activity plans must be broad enough to encompass the entire spectrum of factors which contribute to the ultimate performance, including: the performance characteristics, the engineering design measures, the performance measures, and the release scenarios. The results of this activity by element "B", shall be presented in a topical report which will become the framework for the generic activity plans during the Phase II.

We request that element "C" on Figure 3 define the project's most urgent needs with reference to the performance characteristics and the engineering design measures. This definition must be made in cooperation with other elements of the salt program such as ANL, NPO, ONWI, and subcontractors (i.e., by a "task force"). The definition shall pertain to the performance characteristics and shall be made through a comparison of "what is available" and of "what is required", taking into account: a) sensitivity of engineering design to a given performance characteristic; b) developments in the site nomination - recommendation - acceptance process; and c) the resulting salt program schedule.

The input into the technical procedure activity must be provided by elements "A" and "B". The results of this activity shall be presented in a topical report which will become the framework for the element "D" activities during Phase II.

We request that element "E" implement the Quality Assurance Program for the purposes of developing the SCP. The responsibilities of this element should be broader than currently practiced and shall include: a) administration of the Q/A program, b) technical Q/A review of deliverables, c) document control and Q/A records, d) development of corrective action, e) review of methods for data acquisition and reduction, data analysis and interpretation; f) review of technical procedures for data gathering and development and use of computer models.

The SCP preparation process shall adopt the Q/A standards and criteria which are mandated by 10 CFR Part 50 and further explained in the NRC review plan entitled "Quality Assurance Programs for Site Characterization of High-Level Nuclear Waste Repositories". To derive the maximum benefit from the activities of element "E", its program must be both effective and interactive.

In order to be effective, the Quality Assurance program must be applied to the following two areas: a) document control, and b) independent peer review by qualified technical personnel of technical procedures, data acquisition and reduction, data analysis and interpretation, etc.

In order to be interactive, the Quality Assurance program must also include peer review of technical project requirements and of specific activity plans and their implementation. Furthermore, the interactive Quality Assurance Program should: a) monitor the development of regulatory and technical requirements, and b) develop and implement corrective actions deemed to be necessary.

ATTACHMENT E

<u>The plan should specify acceptable document control rules and acceptable technical procedures for data acquisition and reduction, for data analysis and interpretation and for the use of computer codes.</u>

Carefully conceived and implemented document control procedures shall be the mechanism for achieving the objectives of traceability and accountability of the data base. Such procedures should be applied to all QA documents (e.g., audit reports, reviews, etc.), technical plans, technical procedures, and technical reports. The procedures should specifically identify the steps required for the development, review, and approval of all such documents. As a minimum requirement each report in the data file should be accompanied with a signed and dated QA document control sheet identifying: a) responsible individual, b) author, c) responsible QA officer, d) QA technical reviewer, and e) NPO responsible individual.

It will be noted in the plan that the resolution of all technical, reviewers' comments will be achieved by the responsible individual and/or author, and documented for inclusion in the central file.

The plan or subsequent amendments shall identify all appropriate technical procedures to be used in the development of the SCP. These procedures should pertain to:

1) data acquisition and reduction by subcontractors;
2) data analysis and interpretation by ONWI; and
3) the use of computer codes.

ATTACHMENT F

<u>The plan will provide an acceptable means of modifying the project structure, emphasis, objectives, and schedule.</u>

Because changing circumstances regarding the nomination - recommendation process, changes in the requirements of various aspects of the SCP preparation process can not be anticipated at present, the plan must be capable of being modified. Hence, the plan must specify procedures for its amendment. The amendment procedures must provide descriptions of the mechanism for:

1) identification of the need for amendment;
2) development of amendments;
3) review and approval of amendments; and
4) implementation of amendments to the plan.