

D. Brooks

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SUBJECT: SIGNIFICANT CHANGES TO THE CNWRA FY93-94 OPERATIONS PLAN:  
PERFORMANCE ASSESSMENT PROGRAM ELEMENT AND GEOLOGIC SETTING  
PROGRAM ELEMENT

We have reviewed the CNWRA Operations Plan for FY93-94 (Enclosure 1 and 2). We have listed and identified the locations of significant changes in a marked-up version of the Plan with an asterisk. Corrections in the Operations Plan text not marked with an asterisk are only suggested (optional) changes.

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Enclosures:

- 1. Comments by PA Element
- 2. Comments by GS Element

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ENCLOSURE #1

SIGNIFICANT CHANGES TO THE CNWRA FY93-94  
OPERATIONS PLAN FOR THE PERFORMANCE ASSESSMENT ELEMENT

GENERIC COMMENTS

- Refer to all TBD for FY93-94 in the Plan as "TBD FY93-94" unless indicated otherwise. J. Linehan may wish to clarify further these designations during the month of September 1992.
- Consider substitution of the verb "may", for the verb "will", which indicates a contractual obligation.

SPECIFIC COMMENTS

- o Page 3.4-13

Geologic Setting Subtask 3.1: Description, Paragraph 1: HLHP requests that it be clarified how this work supports the Iterative Performance Assessment study. A review of the GS element for consistency with the level of detail with other program elements should also be conducted.

- o Page 3.7-1

Subtask 1.1: Milestones/Deliverables: Add milestones for reviews of SCP Progress Reports that will be required to support the Performance Assessment Element. The Center should enter a single milestone in the "OXX" format for each year to provide the flexibility that may be required to accomplish this work.

- o Page 3.7-2

Subtask 1.3: Description, Paragraph 2, Sentence 1: Modify to read: "...Study Plans, detailed Technical Reviews, and other special topics."

- o Page 3.7-3

Subtask 1.3: Description, Paragraph at top of page: Delete this paragraph. Technical Exchanges are of all types. They are not limited only to those times that follow reviews of SCP Progress Reports.

Subtask 1.3: Milestones/Deliverables, Paragraph 1, Sentence 1: Delete Sentence 1, and substitute words similar to the following: "Milestones for Technical Exchange meetings to support the Performance Assessment Element are included as stated." The Center should enter a single milestone in the "OXX" format for each year to provide the flexibility that may be required to accomplish this work.

Subtask 1.3: Milestones/Deliverables, Paragraph 1, Sentence 3: Delete "October," and substitute "December".

Subtask 1.4: Description, Paragraph 2, Sentence 1: Delete FY93 and substitute FY92.

Subtask 1.4: Description, Paragraph 2: Insert language in this paragraph to reflect the following concepts: "This audit review will provide a list of topics that will serve as the focus for the detailed review, a main objective in Phase 3 of the Iterative Performance Assessment (Subtask 5.1). The CNWRA will assist the NRC staff in the development of a review plan based on this audit review."

Subtask 1.4: Description, Paragraph 2, Delete the last sentence of paragraph 2. Add a new paragraph 3 to read: "The sections selected for detailed review will then be checked by independent calculations as part of Subtask 5.2 (IPA Phase 3) and will involve the use of alternative conceptual models, alternative data sets, and/or various computer codes. The computer codes may be those developed by the NRC through the IPA efforts, developed by DOE and its contractors, and/or developed by third parties. The CNWRA will provide technical assistance required to acquire and maintain those codes in a configuration management system (Subtask 5.4)."

Section 5.2 should be modified to cross reference the review activities.

o Page 3.7-4

Subtask 1.4: Description, paragraphs 1 and 2 at top of page: Delete these paragraphs. The language suggested to follow the last sentence in Subtask 1.4: Description, Paragraph 2, is a more accurate description of the support the NRC staff expects from the Center for these reviews.

Subtask 1.4, Milestone box: The milestone table should be modified to include an intermediate milestone for the contribution to the audit report which must be completed by December 1992. Additional intermediate milestones are also required for the various contributions to the report that contain detailed reviews of critical sections of the DOE trial performance assessment. For the detailed reviews, the Milestone Number should be changed to "061004-0XX." The Deliverable Description should be changed to read:

006100-010 "Contributions to audit review" "December 1, 1992"  
006100-0XX "Contributions to detailed reviews," "TBD FY93-94."

Note that the text omits page 3.7-5; jumps from 3.7-4 to 3.7-6.

o Page 3.7-6

Subtask 2.1: Description, Sentence 3: Replace this sentence with the following: "Two CDSs (i.e., Individual Protection and Containment) that were started in FY92 will be completed in early FY93." Add two intermediate milestones for these two CDSs.

Subtask 2.1: Description, Sentence 5: Modify this sentence to read "...with the view of coordinating them with all of the other CDSs that were developed in FY91-92 and that will be developed in FY93." Then, add the following sentence 6: "As envisioned by the PURL for 60.112/60.122, Key Technical Uncertainties, and their respective review strategies that are identified in other CNWRA elements that pertain to the 60.112 performance objectives, will be incorporated into CDSs for 60.112. Revisions to the CDS for the EPA standard will be initiated following completion of the other CDSs."

Subtask 2.1: Required Expertise: Add Hydrology.

o Page 3.7-9

Subtask 2.4: Description:

During FY93, the CNWRA will support the NRC staff as requested by NRC in reviewing the FCRG utilizing the procedure for the development of Technical Review Components (TRC), TOP-001-12. The purpose of this review will be to examine the content of the FCRG to evaluate its adequacy and sufficiency as guidance to DOE for the production of a quality license application. In FY94, the CNWRA will assist the NRC, as requested, in preparing a revised FCRG based on the review conducted in FY93 and on any other appropriate source of input. The general nature of the Center support is expected to be limited to using selected specialists to conduct focused reviews as requested by NRC of either sections of the FCRG itself or the NRC staff's review and revision to the FCRG.

o Page 3.7-10

Subtask 2.4: Milestones/Deliverables

Milestone Number	Milestone Type	Deliverable Description	Completion Date
	TBD	Support FCRG Review	FY93
	TBD	Support FCRG Prep.	FY94

Subtask 2.4: Required Expertise: Add Health Physics.

Subtask 2.5: Description, Paragraph 1, Sentence 3: Substitute the following: "The PA strategy will be consistent with the ORS."

Subtask 2.6: Description, sentence 2: Modify the sentence to read "...revised in FY93 to incorporate key technical uncertainties which are raised in reviews of other draft CDSs..." To prevent confusion with the procedures of SRA in the WSE&I Program Element, we also suggest that the Center distinguish between a URM and a CDM in the Description section.

o Page 3.7-13

Subsection 3.7.5.1, Objective, Paragraph 3, following the last bullet: Add the following words.

---Provide a basis and mechanism for reviewing DOE's iterative performance assessments that are issued periodically during the prelicensing consultative phase of repository development.

---Provide a basis for, and develop techniques for, the evaluation of the regulatory significance of technical uncertainties as inputs to Systematic Regulatory Analyses (SRAs).

o Page 3.7-14

Subtask 5.1: Description: Provide a more detailed description of the roles and responsibilities of the team leads and technical coordinators. Utilize descriptions similar to those used previously in the phase 2 program plan.

o Page 3.7-15

Subtask 5.1: Milestones/Deliverables: Modify the Completion Date to read "TBD FY 93."

Subtask 5.2: Description, last bullet: Delete the last bullet since it refers to IPA phase 2 and not to phase 3. Include the concluding activities on the phase 2 SOTEC computer code development and documentation in the discussion for phase 2 on page 3.7-16. Provide a separate description of the SOTEC code development in phase 3.

o Page 3.7-17

Subtask 5.2: Description: Delete all bullets. The text as written contains too many details (level of detail is in appropriate).

o Page 3.7-19

Subtask 5.2: Milestones/Deliverables: Change all of the Intermediate Milestones to Administrative Items except for 065700-010 and 065700-40 which should remain as Intermediate Milestones. Retain 065250-020 as a Major Milestone. Change the Completion Dates for these milestones to read "TBD FY93-94." The Center should enter a single major milestone in the "OXX" format for each year to facilitate the conversion of final CNWRA

documents for publication as the NUREG/CR documents (one of these is the final report on the SOTEC code that is to be converted into a NUREG/CR document).

Subtask 5.2: Required Expertise: Add Health Physics, Meteorology.

o Page 3.7-20

Subsection 3.7.5.4, Subtask 5.3: Description, Sentences 2 and 3: Delete Sentence 3. Substitute words similar to the following for Sentence 2: "The CDS for the requirements of 10 CFR 60.112 will be developed by the end of FY91-92 and will require that the NRC develop its own models to verify the critical parts of the DOE PA."

o Page 3.7-21

Subtask 5.3: Required Expertise: Add Climatology.

Subtask 5.4: Computer Code Management and Technology Transfer: Expand narrative to describe the role of the INEL in assisting with software QA and configuration management. Describe the revision of the TOP-018 procedure.

o Page 3.7-22

Subtask 5.5 : Description: Add a new paragraph 4 that describes the participation by the CNWRA in the activities of the Performance Assessment Advisory Group (PASAG).

MARK-UP FOR HLHP

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### 3.7 PERFORMANCE ASSESSMENT ELEMENT

#### 3.7.1 Task 1: Prelicensing Activities

##### 3.7.1.1 Objective

The objective of this task is to assist the Nuclear Regulatory Commission (NRC) staff in its prelicensing activities that are related to performance assessment (PA). Properly executed, these activities will assist in streamlining the license application review process by providing timely guidance so that the Department of Energy (DOE) can submit a quality license application (LA). To meet this objective, this task is divided into four subtasks: (i) review the PA-related portions of the DOE Site Characterization Plan (SCP) progress reports; (ii) review DOE Study Plans; (iii) assist in on-site visits and DOE/NRC Technical Exchange meetings related to PA; and (iv) assist in other prelicensing activities such as detailed technical reviews in FY93-94 or others as requested by NRC.

The description of work scope and the approach to accomplish it for the four subtasks of Task 1 are described below.

##### 3.7.1.2 Subtask 1.1: Assist in Reviews of PA-Related Portions of DOE Site Characterization Plan Progress Reports

###### Subtask 1.1: Description

The SCP progress reports are expected to be issued every six months after release of the SCP. Review of DOE current plans for PA is an integral part of the prelicensing review process. Failure to evaluate the site characterization activities in terms of their impact on PA could result in potential critical issues being identified subsequent to submittal of the LA. The Center for Nuclear Waste Regulatory Analyses (CNWRA) will assist the NRC staff, as requested, in reviewing site characterization activities and their results. Of high priority will be those activities which are the subject of NRC previously identified concerns, and any newly identified concerns. The review will be based on NRC relevant review plan and will be coordinated with other reviewers. At the conclusion of the review, a report will be prepared and submitted to NRC for integration with other reviews.

###### Subtask 1.1: Milestones/Deliverables

There are no specific milestones scheduled for reviews of site characterization periodic reports. The review of PA aspects of SCP progress reports will begin at the request of NRC. Reviews of two updates of the SCP are expected to be performed per year. The deliverable for an SCP progress report review will be in the form of point papers (as defined by the SCP Review Plan), which will be submitted to NRC at the conclusion of the review.

###### Subtask 1.1: Required Expertise

Review of SCP progress reports will require expertise in geosciences, health physics, and engineering, as well as experience in PA.

**3.7.1.3 Subtask 1.2: Prelicensing Review: Assist in Reviews of Study Plans Related to PA**

**Subtask 1.2: Description**

Study Plans are detailed descriptions of certain activities discussed in the SCP and as such are integral parts of the SCP. The review of these Study Plans complements the SCP reviews of Subtask 1.1. In FY93-94, NRC expects to receive approximately forty-five of the proposed Study Plans. Due to limited resources, NRC plans to review only a small number of these Study Plans. Some of these Study Plans may have material relevant to PA and may require a review by the CNWRA PA Program Element. The selection of these Study Plans for review will be based on NRC guidance.

The level of review on the selected Study Plans will be determined by NRC guidance, consistent with the Overall Review Strategy (ORS), and the available resources of the CNWRA.

**Subtask 1.2: Milestones/Deliverables**

There are no predetermined milestones or deliverables scheduled for the reviews of Study Plans. The Study Plan reviews will begin at the request of NRC. The deliverable for each Study Plan will be a set of point papers (as defined by the SCP Review Plan), which will be submitted to the NRC at the conclusion of the review. Like review of the SCP updates, review of study plans has high priority.

**Subtask 1.2: Required Expertise**

Review of DOE study plans will require expertise in geosciences, engineering, and mathematics, as well as experience in PA.

**3.7.1.4 Subtask 1.3: Prelicensing Review: Assist in On-Site Visits and DOE/NRC Technical Exchange Meetings Related to PA**

**Subtask 1.3: Description**

The regulation contained in 10 CFR 60.18(h) provides for NRC staff visits to and inspections of sites and locations where site characterization activities are taking place, and for the observation of such activities. Moreover, the Commission wishes to assure that the staff conducts an effective review during site characterization. On-site visits are designed to assist in achieving an effective review.

DOE/NRC Technical Exchange Meetings are proposed to be included in the review process of SCP progress reports, Study Plans, ~~and~~ detailed Technical Reviews. Resolution of open items, new concerns, appropriateness of results, and alternatives for data collection will be part of the discussions in the Technical Exchange Meetings.

*TECHNOLOGIES, AND OTHER SPECIAL TOPICS.*

Among the activities that provide prelicensing interactions with DOE, on-site visits provide unique opportunities for NRC staff and its contractors to gain orientation in or more knowledge of ongoing PAs and to have access to information needed for certain types of detailed review activities. In addition, on-site visits provide opportunity for tracking the ~~implementation of resolved~~ technical concerns and site characterization activities and for identification of new concerns related to PA.

DELETE LANGUAGE

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DOE/NRC Technical Exchange Meetings will be held at an appropriate time after the SCP progress report reviews, to discuss new concerns and technical uncertainties identified in the draft reports. The purpose of these meetings is to provide an early resolution to outstanding issues which will streamline the LA review process and also help develop NRC Compliance Determination Methods (CDMs).

The CNWRA staff will provide agendas and technical background material for proposed site visits, as requested. The CNWRA will also prepare reports of meetings and other observations following each site visit as requested by the NRC.

Subtask 1.3: Milestones/Deliverables

~~There are no predetermined milestones for this subtask.~~ Exchange meetings will be supported as directed by the NRC. In addition, the CNWRA will assist with preparation of the agenda and preparatory material. Meeting reports will be prepared as directed by NRC after each site visit in which the CNWRA staff assists. At the time of preparation of this document, one DOE/NRC Technical Exchange Meeting is scheduled for ~~October~~ 1992. At this meeting, currently completed PA studies will be discussed by the DOE. The NRC staff will also discuss results of its Iterative Performance Assessment (IPA) Phase 2.

DECEMBER

The deliverable for each precicensing Technical Exchange Meeting will be a meeting report submitted within 30 days of attendance at the meeting.

The site visits are expected to occur only after the DOE begins to gather significant data from its site characterization activities. Attendance at the Technical Exchange Meetings is of high priority.

Subtask 1.3: Required Expertise

Assistance with on-site visits will require expertise in the geoscience and engineering disciplines, as well as experience in PA.

3.7.1.5 Subtask 1.4: Precicensing Review: Assist in Other Precicensing Activities Related to PA

Subtask 1.4: Description

As part of this subtask, detailed Technical Reviews of DOE PAs are planned in FY93. The NRC detailed Technical Review will provide a preliminary test of its Compliance Determination Strategy (CDS) completed in FY92.

INSERT NEW LANGUAGE

The current understanding is that DOE will complete a trial PA of the high-level waste (HLW) system in early ~~FY93~~ <sup>FY92</sup>. NRC review of this PA will begin with a Technical Exchange Meeting described in Section 1.3 above. Once the DOE report is obtained, the audit approach set out in the PA strategy will be followed to review it. This approach requires that the entire report be reviewed first and a few critical sections selected for detailed review. ~~The sections selected for detailed review will then be checked by independent calculations using NRC developed codes and using alternate conceptual models, where appropriate.~~

The sections selected for detailed review will then be checked by independent calculations as part of Subtask 5.2 (IPA Phase 3) and will involve the use of alternative conceptual models, alternative data sets, and/or various computer codes. The computer codes may be those developed by the NRC through the IPA efforts, developed by DOE and its contractors, and/or developed by third parties. The CNWRA will provide technical assistance required to acquire and maintain these codes in a configuration management system (Subtask 5.4).

The detailed review of DOE trial PA will be undertaken jointly with the NRC staff. A review plan will be developed before the start of the review. This review plan will assign responsibilities to different reviewers and provide for coordination. The deliverable for this subtask will be a report describing the results of the review.

Detailed review of DOE PA is assigned a medium priority.

Subtask 1.4: Milestones/Deliverables

The following Intermediate Milestone (IM) has been identified for this subtask.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
061004	Intermediate	<del>Contribution to Detailed Review Report</del>	

Subtask 1.4: Required Expertise

Members of the IPA team (See Task 5 description) will also participate in the detailed review. Expertise in geosciences, engineering, health physics, numerical modeling, and material sciences will be represented in the review team.

CONTRIBUTIONS TO AUDIT REVIEW December 1992

CONTRIBUTIONS TO DETAILED REVIEW TBD  
FY 93-94

3.7.2 Task 2: Regulatory and Technical Guidance Development

3.7.2.1 Objective

The objective of this task is to provide technical assistance which will include Systematic Regulatory Analysis (SRA) in the development of (i) technical positions important to PA, (ii) rules and amendments related to the Environmental Protection Agency (EPA) rule, (iii) other technical guidance documents related to total system PA, and (iv) identification and resolution of technical uncertainties in compliance determination with 10 CFR 60.112.

Task 2 is organized into six subtasks.

*INSERT NEW LANGUAGE*

3.7.2.2 Subtask 2.1: Systematic Regulatory Analysis of EPA Standards

*INSERT NEW LANGUAGE*

Subtask 2.1: Description

The SRA of the EPA standard, which was started in FY92, will be continued into FY93-94. In FY92, the Regulatory Requirement (RR) — Regulatory Elements of Proof (REOP) structure was revised to adapt to the Format and Content Regulatory Guide (FCRG). The EPA standard now has three RRs associated with it — one each for the containment, groundwater protection, and dose to man requirements in 40 CFR Part 191. ~~CDSs for the three RRs were developed in FY92.~~ These strategies are expected to be finalized before October 1992. Since no funding is available for development of the CDMs in FY93, the work scope of this subtask in FY93 is limited to review of the CDSs with the view of coordinating them with all of the other CDSs that will be developed in FY93. The RR-REOP structure and the CDSs may also be revised if the EPA is able to publish its final standard during FY93-94.

Subtask 2.1: Milestones/Deliverables *WERE DEVELOPED IN FY91-92 ETC.*

A letter report providing any revision of the RR-REOP structure and the CDSs will be submitted at completion of the subtask.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
062020-010	Intermediate	Revise RR-REOP and CDSs for EPA Standard	TBD

As the work consists primarily of revising the completed CDSs, this subtask has been assigned a medium priority.

Subtask 2.1: Required Expertise

Expertise in total system PA is essential for this task. Also, training in system engineering and knowledge of geology and engineering will be helpful.

*HYDROLOGY, 3.7-6*

### 3.7.2.3 Subtask 2.2: Implementing the EPA HLW Standards

#### Subtask 2.2: Description

The focus of this subtask is to support development of amendments that may be required in 10 CFR Part 60 to facilitate the implementation of the EPA standard. Under the Nuclear Waste Policy Act (NWPA), it is the NRC responsibility to enforce the EPA standard. It is possible that the implementation of the standard may be simplified if some of the considerations for implementation are included in the amendment. An example of such amendments will be the way the NRC intends to include the requirements of 10 CFR 60.122 in the method for showing compliance with 10 CFR 60.112. Completion of this subtask may require use of the Total System PA Code developed under Subtask 5 to develop application examples.

Even though the EPA standard is not final, it is expected that certain features such as its probabilistic nature and consideration of scenarios (including human intrusion) in the estimation of complementary cumulative distribution function (CCDF) will be retained in the rule. The technical approach for this subtask includes performing regulatory and technical analysis to determine the nature of rulemaking and/or amendments, if any, required to implement the EPA rule. For SRA, the interface points with Waste Systems Engineering and Integration (WSE&I) will be developed in conjunction with the WSE&I program element.

The CNWRA will develop the regulatory background to identify potential amendments that would assist in implementing the standards, especially with regard to acceptable approaches to validating models and computer codes and for identifying and screening scenarios. Other topics that are expected to play a major role in implementing the EPA standard include the formal use of expert judgment and data and parameter uncertainty.

The NRC staff will take the lead in developing the language of the implementation amendment. The CNWRA staff will provide technical assistance as needed which will include:

- Review of other applicable reports prepared, for example, by Sandia National Laboratories (SNL).
- Assistance to the NRC in preparing the basis for draft potential amendments including, but not limited to:
  - Acceptable methods for validating models and computer codes;
  - Acceptable methods for estimating the likelihood of potentially disruptive processes and events;
  - Elaboration on the conditions for evaluating potential human-induced disruptions of a repository;

- An acceptable method for identifying and screening scenarios;
- Elaboration on methods for evaluating favorable and potentially adverse conditions.

A phased approach will be used in the approach to this subtask. The first phase will identify the issues and uncertainties for which dispositive rulemaking would be desirable. The second phase would investigate the technical feasibility of doing so (for example, determining feasibility of an inclusive list of events and processes from which scenarios would be developed). Included in this phase is consideration of the technical sufficiency of work done to date for addressing these aspects and identification of remaining technical issues. In the second phase, the feasibility of amending the rule along the lines suggested by the technical feasibility studies will also be addressed. In both phases, interface points between the PA Element and the WSE&I Element will be identified and maintained. The WSE&I element will provide procedures, training, and coordination where appropriate in support of this effort.

#### **Subtask 2.2: Milestones/Deliverables**

A report will be prepared to recommend the nature and form of guidance to DOE (rulemaking, technical position, etc.) needed for the issues analyzed in the first two phases. In the third phase, the CNWRA will provide support for rulemaking or alternative guidance selected by NRC staff. The schedule for completion of this subtask will depend upon the publication of the final standard by the EPA. Specific milestones will be introduced when specific technical guidance is received from the NRC.

#### **Subtask 2.2: Required Expertise**

Expertise in regulatory issues, SRA, PA methods, geosciences, scenario development, and engineering is essential for this task.

#### **3.7.2.4 Subtask 2.3: Rules and Amendment Support to Conform to the EPA Standard**

##### **Subtask 2.3: Description**

Work under Subtask 2.3 will consist of three activities as follows.

##### **Activity 1**

Review EPA technical documentation. As directed by the NRC, the CNWRA will critically review EPA technical support for its HLW standards and will provide comments to the NRC in a form suitable for transmittal to EPA. Reviews will emphasize identification of inconsistencies between the EPA standard and 10 CFR Part 60, and include an evaluation of the appropriateness of EPA technical basis for its standards. Reviews will not critique those features of EPA standards (for example, the level of safety required by the standards) that are judgmental or policy matters of discretion within EPA standard setting authority. The first such review will be completed after receipt of Working Drafts and accompanying information from EPA. The CNWRA will also complete a review of EPA proposed standards and supporting material within a timeframe to be specified by the NRC, after publication of those standards for public comment.

**Activity 2**

Perform a completeness review of conforming amendments. The CNWRA will complete a comparison of the NRC staff's proposed conforming amendments with EPA standards to ensure completeness and consistency of the conforming amendments. The CNWRA will report the results of its completeness review to the NRC staff within a mutually agreed time after the receipt of the proposed conforming amendments.

**Activity 3**

Analyze the technical link between rules. As and when requested by NRC, the CNWRA will provide technical analyses to demonstrate the relationship between the existing criteria of 10 CFR Part 60, (or any proposed changes to those criteria) and EPA standard (or any proposed changes to the standard). Such analyses will incorporate the results of any PAs for real or hypothetical repository sites completed under Task 5, and will be designed to determine the role of the 10 CFR Part 60 criteria in ensuring compliance with the EPA standard. Direction for initiation of work will specify the version of EPA standards and the 10 CFR Part 60 criteria (existing or draft conforming amendments) to be evaluated. The nature and schedule for deliverables will also be specified.

**Subtask 2.3: Milestones/Deliverables**

The deliverables for this subtask will be identified through consultation with the NRC at the time the activity is started.

**Subtask 2.3: Required Expertise**

Required expertise includes regulatory analysis, geosciences, and health physics as well as PA.

**3.7.2.5 Subtask 2.4: Format and Content Regulatory Guide Support**

**Subtask 2.4: Description**

X update  
During FY93, the CNWRA will review the FCRG utilizing the procedure for the development of TRC, TOP-001-12. The purpose of this review will be to examine the content of the FCRG to evaluate its adequacy and sufficiency as guidance to the DOE for the production of a quality LA. The results of this review will be presented as a ~~major milestones~~ report which will make recommendations concerning additions, deletions, or modifications to the content of the FCRG. In FY94, CNWRA will assist the NRC in preparing a revised FCRG, based on the review conducted in FY93 and on any other appropriate sources of input. Deliverables/milestones may be assigned to support the preparation of the revised FCRG. H

TBC of Robert Johnson for ALL PROGRAM ELEMENTS

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Subtask 2.4: Milestones/Deliverables

**DELETE**

Milestone Number	Milestone Type	Deliverable Description	Completion Date
062410-010	Intermediate	Review of the FCRG	TBD FY93
062410-011	TBD	Prepare Revised FCRG	TBD FY94

Subtask 2.4: Required Expertise

Completion of this subtask will require staff with expertise in system engineering, materials and structural engineering, earth sciences, risk analysis, regulatory analysis, PA, and information/data management

HEALTH PHYSICS

3.7.2.6 Subtask 2.5: Review Plan Preparation

Subtask 2.5: Description

The focus of this subtask is to assist the NRC in developing its Overall Review Strategy (ORS), a draft of which was prepared by the NRC in FY92. A PA Review Strategy, which was prepared in FY91, is also scheduled for revision. The PA strategy will ~~be incorporated~~ be incorporated into the ORS.

BE CONSISTENT WITH

The PA review strategy will be revised in the light of experience gained from the IPA Phase 2 work. More details regarding specific steps for integrating subsystem PA with the total system PA and for schedules for developing tools for PA review will be included in the revised strategy.

Subtask 2.5: Milestones/Deliverables

The strategy document will be a joint product of the CNWRA and the NRC. It will be prepared as a team effort. The CNWRA will take the lead in its preparation and submit it as a major milestone (MM) letter report.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
062510-010	Major	PA Review Strategy	1/20/93

Subtask 2.5: Required Expertise

Experience in PA is essential for the completion of this task.

IDENTIFY KEY TECHNICAL UNCERTAINTIES  
 WHICH ARE RAISED IN REVIEWS OF OTHER  
 DRAFT CDS.

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3.7.2.7 Subtask 2.6: Uncertainty Analysis and Reduction

Subtask 2.6: Description

Key technical uncertainties in implementing the EPA standard (1985 version) were identified in FY92 during the development of the CDS. The CDS is expected to be revised in FY93 to coordinate with other CDSs and also because the EPA may issue its final standard. New uncertainties may be identified during this revision process. All of the key technical uncertainties identified so far in implementing the EPA standard are such that significant technical work will be required in developing the Uncertainty Reduction Methods (URM) for these. As indicated in the description of Subtasks 2.2 and 2.3, these same uncertainties will affect the proposed amendments to 10 CFR Part 60.

During FY93-94, preliminary steps towards developing the URM will be taken. The procedure codified in TOP-001-14 will be followed for recording the URM and entering it in the PADB.

Subtask 2.6: Milestones/Deliverables

A letter report detailing the URM for each uncertainty will be submitted as an IM.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
062610-0XX	Intermediate	Letter Report on URM	TBD

Subtask 2.6: Required Expertise

Multidisciplinary expertise along with experience in PA will be necessary for successful completion of this subtask.

### 3.7.3 Task 3: Undefined at this Time

There are no Task 3 activities at this time.

### 3.7.4 Task 4: Review Plan Preparation

This task has been subsumed in Task 2 of PA Program Element and in Task 3 of the WSE&I Program Element. No separate activity on this task is planned in the PA Element.

### 3.7.5 Task 5: IPA

#### 3.7.5.1 Objective

The objective of Task 5 is to participate in the IPA, which will be accomplished as a joint effort between the NRC Office of Nuclear Material Safety and Safeguards (NMSS) and Office of Nuclear Regulatory Research (RES) and the CNWRA staff. The primary objective of IPA is to develop, maintain, and enhance the NRC staff capabilities ~~to do an~~ effective review of DOE HLW PA in its LA for a HLW repository.

*AND TO DEVELOP METHODOLOGIES TO*

Although the responsibility for the review of PAs in the LA cannot be delegated to others by the NRC staff, it is expected that contractors to the NRC, notably the CNWRA, will provide significant technical input to assist the NRC in this review.

In addition to the primary objective to develop, maintain, and enhance the staff capability to review PAs, there are other objectives of IPA. These include:

- Evaluating the DOE Site Characterization Program, including field studies, laboratory studies, and analyses;
- Providing information for regulatory guidance and other regulatory products related to PA, especially the PA Review Strategy;
- Providing information for the continuing evaluation of the Federal Regulations for a HLW repository, primarily 40 CFR Part 191 and 10 CFR Part 60.

*\* INSERT BULLET POINTS*

*\**

IPA will achieve these objectives by ~~illustrating~~ *EVALUATE* how site characterization data and general information can be used to ~~demonstrate~~ *DEMONSTRATING* regulatory compliance. *DEMONSTRATION* In the course of such exercises, the need for additional site characterization data, regulatory guidance, or potential changes to regulations will be revealed. Sensitivity and uncertainty analyses will be key to identifying those data, assumptions, or regulatory interpretations with the greatest potential for introducing uncertainty into demonstrations of compliance. Similarly, auxiliary analyses will provide information on sources of uncertainty in the models used in various stages of the IPA.

The objective of Task 5 includes coordination and technical integration with system PA work being done in many disciplines and in other program elements. The work related to these subtasks will

be assigned as appropriate to teams that include various technical elements [Geologic Setting (GS), Repository Design, Construction, & Operation (RDCO), and Engineered Barrier Systems (EBS)]. It is the responsibility of the PA element to establish a technically integrated team of CNWRA staff to work together with NRC staff on this task. In planning for Task 5, it is assumed that IPA Phase 3 will begin in FY93, ~~and continue through the middle of FY94.~~

Task 5 is organized into five subtasks. The objectives of each of the subtasks are discussed below.

### 3.7.5.2 Subtask 5.1: Coordinate Activities of IPA

#### Subtask 5.1: Description

IS FUTURE

The Phase 3 and subsequent phases of the IPA will be interdisciplinary endeavors involving staffs from various elements of the CNWRA, and staffs from NRC offices of RES and NMSS. From past experience, it is evident that a significant coordinating effort is required for the overall success of the task. Such coordination effort will be performed under this subtask. Planning of future phases will also be carried out under this subtask. For example, Phase 2 of IPA is scheduled to be completed FY92 with the documentation being finalized in the first quarter of FY93. ~~On completion and issuance of this documentation, the planning for Phase 3 will be initiated.~~ AS PHASE 2 IS BROUGHT TO A CONCLUSION.

The IPA Phase 2 activities were ~~extended~~ <sup>CONCLUDED</sup> by assigning one coordinator from each of the participating groups, that is, from NRC RES and NMSS and from the CNWRA. The same approach will continue to be followed in Phase 3. The CNWRA coordinator will help plan the activities, staff each activity with qualified members, and assure that the CNWRA input to various activities is provided on schedule. In addition, the coordinator will participate in monthly management meetings and technical workshops to coordinate both the management and technical activities of IPA.

This is an activity that will continue throughout the life cycle of Task 5. This subtask will include the following items.

- Participation in planning of IPA activities, including attendance at planning meetings and support to NRC in developing a project plan.
- Assembling a competent interdisciplinary team of scientists/engineers to effectively execute the work required for the completion of an activity.
- Attending ~~at~~ working level meetings <sup>AS APPROPRIATE</sup> to assure that the work being done is following the plan and is on schedule.
- Providing support to NRC in preparing the final report and in presenting it to other professional groups.

**Subtask 5.1: Milestones/Deliverables**

Contribution to the NRC Phase 3 Project Plan will be an Intermediate Milestone for this subtask.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
065050-010	Intermediate	Contribution to IPA Phase 3 Plan	7-30-93

**Subtask 5.1: Required Expertise**

One person from the CNWRA will be assigned as the coordinator. The coordinator will have experience in multidisciplinary PA tasks and will most likely be the PA Program Element Manager.

**3.7.5.3 Subtask 5.2: Overall PA Modeling**

**Subtask 5.2: Description**

*OR PERFORMING AUXILIARY ANALYSES.*

The objective of this subtask is to participate in various interdisciplinary teams that are either modifying or developing PA models, reviewing available data, and applying models to obtain quantitative results. A total system PA code was developed during Phase 2 of IPA. This code will be enhanced in Phase 3. Specifically, the objectives of this subtask are as follows:

- Familiarize the CNWRA and NRC staff with various models of gas and liquid flow and radionuclide transport in the unsaturated and saturated zones. The models considered will be those that are sensitive to geophysical and geochemical factors affecting migration of radionuclides in the geosphere; including migration path length, groundwater velocity, degree of saturation, and partition (distribution) coefficients of solutes between the dissolved and adsorbed states. *THE GEOCHEMICAL BEHAVIOR OF RADIONUCLIDES IN GROUNDWATER THAT AFFECT THE SOURCE TERM.*
- Assist NRC staff in using the overall PA code in such a way that both a complete CCDF and/or a conditional CCDF may be calculated using appropriate input scenarios. *AND THE METHODOLOGY IT IMPLEMENTS*
- Evaluate (develop, if needed) and use a system code(s) for estimating total system performance.
- Evaluate and use models of gas and liquid flow and radionuclide transport in the hydrologically unsaturated and, ~~to a lesser degree,~~ the saturated zone.
- Evaluate, develop (or adapt), and use a source term model for inclusion in the Total System Code.

Verify and document the Source Term Code (SOTEC) developed/adapted for NRC use.

*DELETE*

- Perform auxiliary analyses to evaluate, validate, interpret, and otherwise support the results of total system PAs. Note that the processes considered in the auxiliary analyses are generally more complex than those included in the total system model.
- Develop and use probabilistic methods for sensitivity and uncertainty analyses of the total system PA.

The IPA Phase 2 activities were divided into six major activities. These are: (i) Systems Code; (ii) Scenario Analyses; (iii) Flow and Transport; (iv) Source Term; (v) Disruptive Consequences; and (vi) Sensitivity and Uncertainty Analyses. The same activities are expected to continue in Phase 3, although that will not be firmly known until the NRC and the CNWRA jointly complete the planning process for Phase 3 which will begin in November, 1992. The CNWRA staff will participate in all of the activities identified but will take the lead role in only a few.

*FUNDAMENTAL*  
 The NRC conducted the Phase 1 activities with the objective of training the NRC ~~and the CNWRA~~ staff in PA so that the DOE LA can be reviewed in the mandated three year period. Such a training aspect also will persist in the future iterations. To assess compliance, it is necessary to consider both the engineered and the natural barrier. In Phase 1 of IPA, NRC staff used simplified computer models to generate a very approximate CCDF. In Phase 2, a number of advances have been made in both the near- and far-field simulations. Four ~~basic~~ disruptive ~~scenario classes~~ were analyzed in Phase 2 rather than the two in Phase 1. To obtain greater analytical reliability, models of even greater sophistication will be used in Phase 3. These ~~will~~ include an upgrade of all modules developed in Phase 2 as well as ~~those~~ for other disruptive scenario classes.

*DEVELOPMENT OF MODULES TO TREAT*  
 In Phase 2, development of SOTEC was started. Version 1.0 of SOTEC was completed and used in Phase 2. Although more sophisticated than the Phase 1 model, SOTEC Version 1.0 is based on a number of simplifying assumptions. ~~Many~~ of these assumptions ~~will be relaxed~~ during Phase 3. Specifically, parametric equations for the corrosion processes will be based on more realistic mechanistic corrosion modeling. Similarly, the process of liquid water contacting the waste container will be studied in greater detail.

*RELAXATION OF SOME IS PLANNED FOR*  
 An overall total system code (named TPA) with the following attributes was developed in Phase 2.

- Sequence through all scenarios to be considered;
- Choose the consequence models and parametric distributions corresponding to the scenario being analyzed;
- Sample the parameter space appropriate to the given scenario;
- Estimate consequences based on the models and parameter values for the scenario;
- Combine the parametric and scenario probabilities and the calculated consequences to generate a CCDF.

In addition, the TPA code includes automatic transfer of data between five different modules. Such an arrangement is beneficial from the view of quality control as well as to facilitate use of the code by many more investigators. In Phase 3, more realistic consequence modules will be included. ~~The phenomena modeled will include:~~

- Flow through the unsaturated zone, both in the matrix and in fractures, considering the possibility of perched water at bedding planes;
- Variations of infiltration;
- Effects of waste generated heat on convective flow, and the possibility of convective transport;
- Gas phase transport;
- Matrix diffusion and fracture flow through the saturated zone;
- Mechanisms for possible acceleration or retardation of radionuclide transport including chelation, physical and chemical adsorption and desorption, colloid transport, ion exclusion, and other relevant geochemical effects;
- Radioactive decay and decay chains, taking into account the differential chemical behavior of radioactive daughters;
- Model of the biosphere to calculate dose to humans.

In order to verify the accuracy of the results from the Total System Model as well as to support improvements in the consequence modules in the future, a number of auxiliary analyses will be conducted. These auxiliary analyses will use detailed models perhaps of higher dimensionality than the ones used in the Total System PA and will determine the validity of the simplifying assumptions. ~~Such auxiliary analyses will include the following:~~

- Detailed analyses of the near-field of the waste packages. These analyses will involve modeling of multiphase nonisothermal flow and transport processes. The basic idea will be to investigate how liquid water comes into contact with heated waste packages.
- Detailed analyses of the far-field flow and transport field. Such analyses will either be two- or three-dimensional and consider both the saturated and the unsaturated zones. The saturated zone simulations will be used to determine the fluctuations in water table in response to climatic factors while the unsaturated zone simulations will provide guidance regarding the detailed distribution of velocity fields.

This subtask covers all of the work done specifically for the current phase of the IPA. Development and testing of models, documentation of codes, review of DOE data, and application of codes are included in this subtask. As stated before, the CNWRA staff will participate in all aspects of

*will*  
the IPA, however, it will take the lead in only some of the activities. The description and technical approach for this subtask may be revised following development of the NRC IPA Phase 3 Project Plan.

**Subtask 5.2: Milestones/Deliverables**

The milestones for FY93-94 are not fully defined at this time. For example, all of the auxiliary analyses for FY93 have been lumped in a single activity. These milestones will be defined more clearly at a later time. In addition, because the IPA Phase 3 will involve the participation and collaboration of many NRC and CNWRA scientists, the full completion of individual parts at the Phase 3 work on a fixed schedule is very difficult to assure. Thus, the work on IPA Phase 3 is not completed in FY93 will necessarily be carried into FY94. If this occurs, the NRC will be given early notification and the OPS plan will be appropriately revised. *of*

Milestone Number	Milestone Type	Deliverable Description	Completion Date
065700-010	Intermediate	Report on Flow Around a Waste Package <del>3</del>	TBD <del>08/17/93</del> 13-94
065700-020	AI <del>Intermediate</del>	Report on Two-Dimensional (2D) Reactive Transport	<del>08/20/93</del>
065700-030	AI <del>Intermediate</del>	Report on 3D Flow in the Saturated Zone	<del>08/15/93</del>
065700-040	Intermediate	Report on 3D Flow in the Unsaturated Zone <del>3</del>	TBD F1 13-94 <del>12/11/93</del>
065250-010	AI <del>Intermediate</del>	Evaluation of Alternate Sensitivity/Uncertainty Analysis Method in TPA	<del>08/16/93</del> *
065250-020	Major	Contribution to Phase 3 IPA Report	TBD F1 13-94
065250-030	AI <del>Intermediate</del>	Update on Total System PA Code	<del>12/15/93</del>
065255-0XX	AI <del>Intermediate</del>	Report on <del>EMT</del> System Code FOR PHASE 3	<del>08/15/93</del>
065350-0XX	<del>Intermediate</del>	<del>Report on Reassessment of SOTEG Code</del>	<del>01/15/94</del>
065355-0XX	AI <del>Intermediate</del>	Report on <del>FY94</del> Source Code FOR PHASE 3	<del>08/15/93</del>
065710-0XX	AI <del>Intermediate</del>	Report on FY94 Auxiliary Analyses	<del>08/15/93</del>

Subtask 5.2: Required Expertise

Considerable expertise in many disciplines is needed for successful completion of this subtask. Such expertise will be drawn from all of the elements of the CNWRA. This will include geology, geochemistry, hydrology, material science, structural and mining engineering, computer science, mathematics, soil science, system engineering, numerical analysis, and PA.

HEALTH PHYSICS, METEOROLOGY

3.7.5.4 Subtask 5.3: Support Development, Evaluation, Testing, and Validation of NRC Compliance Determination Methods Related to Overall System Performance, Other Than Those Covered in Subtasks 5.1 and 5.2

Subtask 5.3: Description

As stated in Task 2, the SRA process will be used to develop the NRC CDSs and CDMs for the EPA Standard. Although not developed yet, the CDS for the requirements of 10 CFR 60.112 will likely require that the NRC develop its own models to verify the critical parts of DOE PA. Such development for adaptation of models if they are available, and their verification and validation will be undertaken under this subtask. Therefore, the objectives of this subtask can be stated as:

- Assess the need for additional modeling capability beyond that required by Subtask 5.2, and advise NRC of any such need;
- Acquire, modify and execute additional codes as requested by NRC.

PA and PA review could potentially require modeling efforts in addition to the modeling activities outlined in Subtask 5.2. Such efforts may require use of new and emerging technology such as the massively parallel processors, testing of newly emerging DOE codes, and new concepts that may emerge from research activities.

Examples of <sup>POTENTIAL</sup> additional modeling efforts include probabilistic risk assessment, demographic models, and climatological and meteorological models. Changes in EPA standards could necessitate changes in CDMs (10 CFR 60.112) and might also require the use of expanded, different, or additional models. No work was conducted in FY92 under this subtask.

Activities will be included in this subtask in the future as appropriate. This will include the following:

- Timely reporting of the need for additional modeling and validation capability;
- Assistance to NRC staff, as requested, in acquisitions, modification, execution, validation, verification, and documentation of additional models.

This activity is related to gaining experience in eliciting expert opinion on a selected topic that is of importance to PA. Because the results of this activity will be used in IPA Phase 3 and because it will be conducted between Phases 2 and 3, it has become known as IPA Phase 2.5. The objective of this activity will be to implement all steps of expert elicitation on a particular topic to learn about the strengths and weaknesses of such an approach to obtaining information for use in PA. Such an experience is necessary for developing guidance for DOE on this topic. This activity complements work done under Task 2 in FY92.

IPA Phase 2.5 will be conducted as a team effort between the staffs of the CNWRA and the NRC. The CNWRA will be responsible for obtaining on contract both the normative expert and the subject matter expert as well as in coordination of the overall effort. The NRC staff will participate

during development and management review of the IPA Phase 2.5 plan. The subject for expert elicitation will be selected in consultation with the NRC staff.

#### Subtask 5.3: Milestones/Deliverables

The results of this study will result in a report which will provide details about all the steps executed during the study.

Milestone Number	Milestone Type	Deliverable Description	Completion Date
065850	Major	Report on IPA Phase 2.5	7/19/93

#### Subtask 5.3: Required Expertise

— CLIMATOLOGY

Expertise in system engineering, psychology, PA, and decision theory will be needed for this subtask. This is a high priority subtask because of the importance of developing timely guidance on the topic.

#### 3.7.5.5 Subtask 5.4: Computer Code Management and Technology Transfer

##### Subtask 5.4: Description

The NRC and the CNWRA are acquiring programs for their use in the IPA and in the review of the LA. Some codes have also been developed in the past specifically for NRC use and some would be developed in the future by the CNWRA. The DOE will also submit its codes to the NRC for review. All these codes need proper management. Accordingly, the objectives of this subtask are:

- Develop the ability to modify, execute, and maintain the computer codes transferred from the SNL, for example, NEFTRAN, DCM-3, and LHS;
- Maintain the codes provided by the DOE;
- Manage newly developed codes for the NRC;
- Place various codes under configuration management and control their modification and use.

The SNL codes transferred to the CNWRA were put under configuration management in FY92. All of the IPA Phase 2 codes and analyses were similarly configured. This process will continue in FY93-94.

##### Subtask 5.4: Milestones/Deliverables

No specific milestones are identified for this subtask at this time. On receiving codes from the NRC, milestones will be added as directed.

**Subtask 5.4: Required Expertise**

Expertise in various disciplines including computer science is needed for this subtask.

**3.7.5.6 Subtask 5.5: Participation in International Activities****Subtask 5.5: Description**

*ACTIVITIES*  
The NRC has a number of bi- and multi-lateral ~~contacts~~ with the HLW programs in other countries. The objectives of this task are to support NRC staff in their international activities. Specifically:

- Participate in activities of the Nuclear Energy Agency (NEA) — particularly in their Probabilistic Systems Analyses Group and other groups whose activities relate to PA;
- Participate in international model validation activities such as INTRAVAL.

INTRAVAL is an ongoing international study, initiated in 1987, to validate computer models used for the assessment of HLW repository performance. The NRC is one of twenty-one organizations from twelve nations who participate in INTRAVAL. INTRAVAL uses results from laboratory and field experiments, and from analog studies, in systematic model validation. Thus, participating organizations benefit by close interaction with ongoing experimental programs. At the present time, no NMSS funding has been allocated to participation in INTRAVAL. However, funding for an INTRAVAL workshop at the CNWRA in November 1993 has been included in the Overall Research project.

*INTER COMPARISONS*  
The Probabilistic Systems Analysis Group (PSAG) is a group organized by the NEA of the Organization of Economic Cooperation and Development (OECD) in Paris, France. This international group is organized to discuss the issues involved in probabilistic assessments of the HLW disposal concepts. This group is also involved in benchmarking of computer codes that are used for total system PA. The NRC has participated in the activities of this group since 1986.

*ADD NEW PARAGRAPH*  
There may be other international activities in which the NRC may elect to participate. Although no specific provision has been made in the plan, such activities will be undertaken under this subtask as the need arises.

**Subtask 5.5: Milestones/Deliverables**

*IMAY*  
Trip reports will be submitted at the conclusion of participation in each of the meetings. These trip reports, as is customary, are not identified as milestones. In addition, the CNWRA will participate in the Probabilistic System Assessment Code Intercomparison (PSACOIN) problems initiated by the PSAG. The current problems concern investigation of alternate conceptual models for use in PA models. The PSAG will produce a report documenting the work of various international teams on this problem. The CNWRA will contribute to this PSAG report.

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Milestone Number	Milestone Type	Deliverable Description	Completion Date
065590	Intermediate	Contribution to PSAG Report	TBD

**Subtask 5.5: Required Expertise**

Expertise in total system PA, hydrology, numerical analysis, statistics and probability theory is needed for this subtask.