



Department of Energy
Washington, DC 20585

NOV 26 1991

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Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
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U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Linehan:

During the September 16, 1991, Exploratory Studies Facility (ESF) design control technical exchange, you indicated that you were satisfied that the U.S. Department of Energy (DOE), in the presentations, appeared to have addressed the ESF design control portion of Objection 1 of the Site Characteriation Analysis (SCA) of the Site Characterization Plan (SCP) for the Yucca Mountain Site. This letter documents, by enclosure 1, DOE actions taken to resolve the design control portion of Objection 1.

In addition to resolving the specific design control process concern of Objection 1, we have addressed key points raised by Objection 1 that the U.S. Nuclear Regulatory Commission (NRC) staff believed were symptoms of the specific concern, and that are implicitly or explicitly related to design control. We believe that we have satisfactorily resolved Objection 1 by addressing these points and the design control process concern. Enclosure 1 is an itemized response to Objection 1, including the basis for Objection 1, for your consideration for removing Objection 1. Enclosure 2 is a crosswalk between Objection 1 and our response.

DOE strongly believes that an adequate design control process (which meets applicable QA requirements) is in place. This belief is further supported by some of the examples noted in enclosure 1 regarding limited implementation of the process, and our discussions during the technical exchange concerning how the process works. Audits and surveillances since the SCA was issued (enclosure 3) show that DOE's design control process has been conducted in accordance with applicable procedures. These past surveillances and audits have been attended by NRC observers. Future surveillances and audits will ensure that Title II design activities also conform to DOE's quality assurance program.

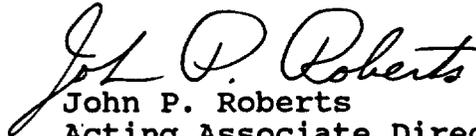
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We believe that the actions described in enclosure 1, as well as the discussions at the September 16, 1991 technical exchange, provide sufficient basis for the resolution of SCA Objection 1 regarding the design control process.

DOE will continue to address specific NRC concerns identified in Objection 1 of the SCA during Title II design, such as planning test durations. These items are tracked and their status is noted on our CARS relational database mentioned in enclosure 1. By continuing to track these items and by the actions described in enclosure 1, we believe that we have satisfactorily resolved Objection 1, in light of 10 CFR 60.16 that requires DOE to consider comments by NRC before sinking shafts. As we have discussed before, NRC has ample opportunity during the Title II process to interact with DOE and provide comments and observations (e.g., design reviews, QA audits, Site Characterization Progress Reports). As we get ready to start the ESF Title II design, we look forward to such continued interactions.

If you have any questions, please contact Priscilla Bunton at (202) 586-8365.



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Enclosures:

1. U.S. Department of Energy's Response to SCA Objection 1
2. Crosswalk between NRC's SCA Objection 1 and DOE's Response to NRC's SCA Objection 1
3. Surveillances and Audits of Design Process Completed in Fiscal Years 1990 and 1991

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U.S. DEPARTMENT OF ENERGY'S RESPONSE
TO U.S. NUCLEAR REGULATORY COMMISSION'S
SITE CHARACTERIZATION ANALYSIS (SCA) OBJECTION 1

Objection 1 of NRC's SCA states:

"The exploratory shaft [studies] facility (ESF) is intended to become an integral part of the repository if the site is found acceptable. However, the SCP and its references do not demonstrate the adequacy of ESF Title I design control process, and the adequacy of the ESF Title I design which is the basis for the SCP. For example, neither the design nor the subsequent Design Acceptability Analysis (DAA) considers some of the applicable 10 CFR 60 requirements. Also, the process used to integrate currently available technical data into decisions regarding shaft location appears to have overlooked evidence of a potential fault near the location of the exploratory shafts. In addition, it has not been demonstrated that the underground test facility and currently identified test durations will permit all tests to be conducted for the time periods required without interference. Furthermore, resolution of the problems identified with the Title I design may result in considerable corresponding modifications to the SCP."

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ESF Design Control Process During the DOE-NRC Technical Exchange on ESF Design Control (September 16, 1991) DOE described the design process, as modified to incorporate the required controls since the time Objection 1 was raised in July 1989. The design control process used during the Title I design study that led to the revised Title I Design Summary Report was consistent with the documented Quality Assurance (QA) program accepted by NRC for the Office of Civilian Radioactive Waste Management (OCRWM) and the Yucca Mountain Site Characterization Project participants. Furthermore, the design control process to be used during the Title II design complies with our accepted QA program. The Title II design control process is illustrated in attachment 1, which addresses the following: design input, design activity, reviews, design output, construction, and inspection, all of which are controlled by applicable procedures (see attachment 2) at various levels of the organization. This process was discussed in detail at the above-mentioned technical exchange.

Enclosure 1

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Symptoms of the Specific ESF Design Control Process Concern

- 2 } Consideration of 10 CFR Part 60 Requirements: Past ESF design activities (i.e., the Title I design in the SCP and the DAA) incorporated the 10 CFR Part 60 requirements that were believed at the time to be applicable. In Comment 128 of the SCA, the NRC staff identified 11 additional requirements to be considered. On
- 3 February 27, 1990, (letter, G. Appel to J. Linehan), DOE provided the rationale for how these additional requirements were to be addressed, and committed to considering them in future ESF design activities, starting with the ESF Alternatives Study (ESFAS). On May 11, 1990, (letter, J. Linehan to R. Stein), NRC concurred with DOE's rationale. Since that time, the DOE requirements documents have been revised to reflect these requirements. These requirements have been incorporated in the program-level Waste Management Systems Requirements (WMSR), Volume IV, as well as the project-level requirements documents (Mined Geologic Disposal System Requirements (SR) and ESF Design Requirements (ESFDR)).
- 3 Specific Consideration of 10 CFR 60.21(c)(1)(ii)(D): An evaluation of alternatives to the major design features, as called for in 10 CFR 60.21(c)(1)(ii)(D), was conducted as part of the ESFAS that was completed earlier this year. The ESFAS evaluated 15 repository configurations and 52 basic ESF configurations (historical, as well as new, concepts). Major features of design, including interfaces between the repository and the ESF, were identified. From the list of regulatory requirements mentioned above, a discriminating subset was selected to develop basic repository/ESF concepts. From this screening, 34 alternative repository/ESF options were developed for more detailed evaluation. During the ESFAS, various factors (including waste isolation) were considered and, as a result, favorable design features were identified. These evaluations are documented in the ESFAS Report, SAND91-0025, which was submitted to you on July 18, 1991 (letter, Shelor to Linehan). While the major comparisons of these alternative design features were conducted in the ESFAS, DOE intends to perform further evaluations during the Title II design. In addition, throughout the Title II design, DOE will be continually evaluating the repository design to ensure that the total system is being properly integrated. By the time the ESF Title II design is completed, appropriate changes to the reference repository conceptual design will be made.
- 4 Integration of Technical Data Into Design: With respect to the integration of technical data into the design, the general manner in which the process works is as follows: (1) the Site Characterization Program Baseline (SCPB) identifies the program's needed technical activities (the SCPB was transmitted to you on July 15, 1991 (letter, Shelor to Linehan)); (2) these activities produce the technical data that are incorporated in the technical

support documentation, per the Technical Support Documentation Management Plan (TSDMP) (the TSDMP was transmitted to you on April 30, 1991 (letter, Shelor to Linehan)), the Reference Information Base (RIB) and other project technical databases that have been discussed with NRC (most recently at the Technical Exchange on Technical Data Management in Las Vegas, Nevada, on July 30, 1991); and (3) the architect-engineer obtains the needed data from the appropriate database or report for use in its Basis for Design document.

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4 At the September 1991 design control technical exchange, DOE presented two examples of how the process has been implemented. The first example was related to the concern that a geophysical anomaly near the SCP's location for exploratory shafts was not considered in locating the shafts. A Technical Assessment Review (TAR) was performed per Quality Management Procedure (QMP) 02-08, and the recommendations were entered into the project's Comment and Response Status (CARS) relational database. Any changes to the SCPB resulting from such recommendations, or comments originating from external parties, are controlled by project Administrative Procedure (AP) 3.3Q, Change Control Process.

4 The TAR recommendations were also entered into the ESFDR as requirements, where appropriate (e.g., requirements to allow for geologic mapping at pad excavations). The second example presented at the September technical exchange was the dispositioning of the recommendations that resulted from the DAA. Those recommendations that pertained to requirements have been incorporated into the ESFDR and assigned, via a responsibility matrix, to the various project participants. The responsible participants must track the recommendations as design input and address/analyze them during the design. The actual design reviews will serve to verify compliance with these requirements.

5 Potential for Test Interference: A test interference analysis was performed for the ESF configuration contained in the SCP; this was included in SCP Section 8.4. Also, the ESFAS used test interference as a major criterion for evaluating options. As a result, the study produced a recommended configuration with a much larger core test area. The revised ESF Title I Design Summary Report describes the current design/test layout. During the Title II design, DOE plans to continue to re-evaluate the core test area for potential test interference. Revisions to the SCPB and the Title II design will document the analyses.

5 Also, to ensure that the potential for test interference is adequately considered, certain controls are in place. Requirements related to consideration of interference and potential impacts to waste isolation are maintained in appropriate requirements documents. Assessments of potential impacts to waste isolation are required to be conducted for any field activity that could have an adverse impact on the site, in

accordance with AP-5.32Q, Test Planning and Implementation. The Test and Evaluation Plan (transmitted to you on April 30, 1991 (letter, Shelor to Linehan)), implemented by AP-5.32Q, governs the planning, implementation, and analysis of tests, with test interferences being specifically addressed. Any resulting changes to the SCPB are made as required. Study plans, which implement the SCPB, are then modified via AP 1.10Q, Preparation, Review, and Approval of SCP Study Plans.

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**U.S. Department of Energy's Response to the
Basis for SCA Objection 1 on the ESF**

6 1. NRC Statement:

"In planning the underground test facility, the overall performance confirmation testing program and the need for starting certain performance confirmation tests (e.g., waste package testing) as early as practicable during site characterization should be considered."

DOE Response:

Although it is presently DOE's policy that there will not be HLW testing in the ESF (DOE, 1990a), the ESF Alternatives Study (ESFAS) (SNL, 1991) evaluated options for their ability to be flexible to accommodate such testing should DOE's policy change. The ESFAS results provide the basis for a new ESF configuration that could more easily accommodate such testing than the ESF configuration in the SCP.

7 2. NRC Statement:

"The design of the ESF should take into account the need for preliminary information from in situ seal testing to be available in the License Application submittal."

DOE Response:

The ESFAS (SNL, 1991) specifically addressed this concern in scoring the 34 options (see Volume I, Section 2.2). Should DOE decide to perform in situ seal testing earlier than currently planned, the ESF Main Test Level (MTL) layout presently being considered contains additional space to accommodate such testing.

8

3. NRC Statement:

"Independence of the [DAA] reviewers is in question. Five reviewers who were certified not to have significantly contributed to the ESF Title I design and SDRD (sub-system design requirements) are identified as authors, reviewers, and/or contributors to specific documents which were input documents to the ESF design. (Question 63)"

DOE Response:

This concern is closed (letter, Bernero to Bartlett, dtd. 7/31/91).

9

4. NRC Statement:

"Neither the ESF Title I design nor the subsequent DAA considers (qualitatively or quantitatively) 11 of the applicable 10 CFR 60 requirements. (Comment 128)"

DOE Response:

All applicable regulations are now being considered. Appendix E of the Waste Management Systems Requirements (WMSR) Volume IV provides a complete list of the 10 CFR 60 requirements that apply to the ESF. The list includes some 52 provisions originally identified by DOE, plus 11 provisions identified by the NRC. These requirements have also been incorporated in the Exploratory Studies Facility Design Requirements (ESFDR) (DOE, 1991b).

10

5. NRC Statement:

"Of the 52 requirements considered by DOE to be applicable to the ESF design, only 22 were considered quantitatively. The remaining were said to have been considered qualitatively. Included in the remaining 30 are the requirements of Subpart F (Performance Confirmation Program) which according to 10 CFR 60.140(b), "shall have been started during site characterization." Several of these 30 requirements are potentially important in evaluating the acceptability of the ESF Title I design. (Comment 130)"

DOE Response:

Appendix E of the WMSR Volume IV (DOE, 1991a) lists all applicable regulations that are implemented in subordinate documents. In the case of the ESF, the ESFDR converts regulations into general criteria. For example, whenever the ESFDR addresses a topic that is regulated by 10 CFR 60,

the appropriate provision is first quoted and cited. Next, design criteria and constraints specified either qualitatively or quantitatively adopt the provision to the circumstances under which it will be applied, such as to prevent test interference, ensure mine safety, or avoid impacts on waste isolation.

It is appropriate to note that, in many cases development of quantitative requirements is unrealistic given the lack of specific information now available on in situ conditions. The lack of quantitative criteria does not, however, preclude consideration of the specific 10 CFR 60 requirement. Consequently, quantification of requirements will be undertaken on a case-by-case basis whenever such quantification is practicable and realistic.

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11 6. NRC Statement:

"Of the 22 requirements that were considered quantitatively [in the DAA], some inadequacies have been identified. For example, in considering the regulatory requirements related to alternatives to major design features important to waste isolation (60.21(c)(1)(ii)(D), the analysis presented was limited and incomplete. As a result, comparative evaluation of alternatives to the major design features was limited to comparative evaluation of five alternative ESF locations. Hence other comparative evaluations such as the number of man-made openings were not considered. (Comment 132)"

DOE Response:

The requirement to analyze alternatives to major design features that are important to waste isolation (10 CFR 60.21(c)(1)(ii)(D)) was addressed in the ESFAS. This study examines 34 ESF/repository configurations, each with variations in major design features (e.g., number, size, location, and type of accesses). In developing these 34 options, the ESFAS evaluated 15 repository configurations, as well as 52 ESF configurations. Various factors (including waste isolation; see Volume I, Section 2.1) were considered.

12 7. NRC Statement:

"[Design Acceptability Analysis] DAA did not thoroughly check the adequacy of data used in the ESF Title I design. For example, several key documents which were part of ESF Title I design were not reviewed. (Comment 131)"

DOE Response:

This concern is closed (letter, Bernero to Bartlett, dtd. 7/31/91).

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13 8. NRC Statement:

"DAA has not demonstrated that DOE has considered information that indicates the presence of an anomaly in the immediate vicinity of the proposed locations of exploratory shafts 1 and 2. (Comment 127) By not considering this readily available information in reaching decision on the locations of ES-1 and ES-2, uncertainties regarding the design control process are further heightened. The design itself is further questioned since the comparative evaluation of the major design features (i.e., ES-1 and ES-2) with respect to waste isolation did not assess the impact of the anomaly."

DOE Response:

A Technical Assessment Review (TAR) (DOE, 1990b) was performed in accordance with QMP 02-08 (DOE, 2) to address the validity and significance of this specific anomaly to design and performance of the ESF. Results of the TAR were reported to the NRC. Recommendations regarding further work on this anomaly and on Yucca Mountain Project practices (to preclude future problems of this nature) were made, and will be factored into Yucca Mountain Project activities, via the Commitment Action Response Systems, as controlled by AP 1.14.

The potential new ESF configuration has ramp accesses in new locations. Consistent with the TAR recommendations, these locations are being assessed for potentially adverse features such as faults, which could have design or performance impacts on the ESF openings. Results will be reported to Raytheon Services Nevada and incorporated into the Preliminary Siting Analysis Report and ultimately reported in the Title II Design Summary Report (RSN, 1991).

Another recommendation of the TAR which will be implemented concerns the improved entry of data into a Graphical Information System (GIS). This practice will improve data management practices, such that future information on geologic features of interest would be incorporated, and available to users.

14 9. NRC Statement:

"SCP does not clearly address the potential incompatibility of some of the tests with construction operations. It has not been demonstrated that operational requirements (e.g., storage of mobile equipment, drill steel, blasting materials, vent pipes, water pipes, support/reinforcement, disabled equipment, etc.) will not encroach on some of the identified test locations. For example, sequential drift mining test, heated block test, and canister-scale heater experiment are currently shown to be located adjacent to the first loop access drifts to the shafts and therefore subject to potential operational interference."

DOE Response:

The ESFDR contains requirements for designers to minimize construction-to-test interferences. DOE's Plan for the Phased Approach to ESF Design Development and Implementation (DOE, 1991c) describes the testing sequence (Section 2.2, Design Phases). Those tests that could be incompatible with construction activities will be deferred until after construction.

15 10. NRC Statement:

"The zones of influence presented for thermal tests are based on short test durations. Thermal tests such as the canister-scale heater experiment, heated block test, and heated room experiment are planned to run for relatively short durations (30 months, 100 days, 36 months). The staff considers that longer durations will very likely be necessary. The need to obtain additional site characterization data beyond the planned time periods may result in larger zones of influence.

DOE Response:

The ESFAS specifically considered this concern when evaluating and ranking the 34 ESF options (ESFAS Volume I, Section 2.2) and, as a result, the revised design will provide more MTL space and greater separation of tests than the SCP ESF design, thereby decreasing potential for test interferences.

This concern will be more fully addressed during the Title II design. Test Planning Packages, compiled under AP 5.32Q, will address test durations as a potential constraint or impact.

16

11. NRC Statement:

"It is stated in the SCP that in some cases the same space can be used for more than one test by sequencing the tests. However, it is not clear if it has been fully considered that delays during initial testing could affect the timing for the tests to be followed in the same space."

DOE Response:

This concern will be more fully addressed during Title II design. As part of the Title II design effort, YMPO will provide a test planning package for each test, including a detailed description of the test, the test/design requirements, and schedule/network information relevant to that test. The planning packages will address such things as delays in tests, resulting in schedule interferences, and controls to prevent such interferences.

In addition, DOE's Plan for the Phased Approach to ESF Design Development and Implementation (DOE 1991c, Section 2.2) addresses the sequencing of tests, and recognizes the need for flexibility in this regard, should test durations require change.

17

12. NRC Statement:

"It is not clear that uncertainties have been sufficiently considered in the calculations of zones of influence for various tests. For example, uncertainties associated with the numerical models and material properties have not been considered in calculating zones of influence."

DOE Response:

Preliminary estimates of zones of influence of various tests are presented in SCP 8.4.2.3.1. Further refinements of these calculations (including uncertainties) will be included as part of the Title II Design Summary Report. However, it must be recognized that refinements in the calculations, numerical criteria and uncertainties are dependent on underground exploration results, and will involve an iterative process.

18

13. NRC Statement:

"The location of the canister-scale heater test shown in Figure 8.4.2-39 (p. 8.4.2-209) has been erroneously indicated on the layout. As a result, its zone of influence apparently overlays the heated block test. In addition, the SCP gives the following two constraints for locating the

canister scale heater test (p. 8.4.2-120):

- located greater than 9 m from drifts or alcoves running parallel to the axis of the heater.
- located in a "low traffic" area.

Neither of these constraints has apparently been met."

DOE Response:

During Title II design, test planning packages per AP 5.32Q will address test positioning and the MTL layout will be re-evaluated for test interferences. At that point, the configuration is likely to change, obviating the need to change this particular figure. This information will be included in the Title II Design Summary Report.

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19 14. NRC Statement:

"The locations of several major tests identified in the SCP have not been specifically identified. These include some tests that could have a considerable zone of influence (e.g., heated room experiment) and some that require extensive test area (e.g., horizontal drilling demonstration test). Examples of other tests for which specific location have not been identified include thermal stress measurements, development and demonstration of required equipment, three of the four diffusion tests identified on p. 8.4.2-140, seal tests and other performance confirmation tests."

DOE Response:

During Title II design, the MTL layout will be re-evaluated (RSN, 1991). At that point, more specific information, such as test location, will be provided. As a result of the ESFAS, the area being considered for the MTL is considerably larger than the one in the SCP ESF design..

To address NRC's general concern regarding test-to-test interference in the ESF, the ESFDR contains requirements addressing the need for designers to position tests to avoid test-to-test interference. Likewise, tests will be sequenced to avoid test-construction interference.

20 15. NRC Statement:

"Page 8.3.2.1-14 of the SCP states that "there are other tests that have not yet been completely defined that will investigate coupled interactions." Information has not been

presented to indicate if any of these undefined tests will be in the main test area."

DOE Response:

Until the tests for coupled interactions are more fully defined beyond SCP 8.3.2.1.2, the DOE will not know where they will be located. Test Planning Packages, compiled during Title II design, will provide this information. DOE believes that the MTL will be able to accommodate almost any reasonable type of testing, since the MTL area is being significantly enlarged.

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16. NRC Statement:

"The space designated for tests within the underground test area layout is very likely to be inadequate. DOE assumes that all the space within the dedicated test area may be or is usable. This is unlikely to be the case. For example, some areas may not be suitable for use because of faults, lithophysal content, breccia, etc. In addition, offsets from waste emplacement areas (30 m) and from proposed multipurpose boreholes (two drift diameters) may further reduce the available test area."

DOE Response:

The ESFAS options considered included increased MTL area, which provides flexibility to locate tests (see ESFAS Volume I, Section 6.2.3).

The specific design, construction, and test packages, as well as the tests described in the SCP, are likely to change during the trade-off studies being performed in preparation for resumption of the Title II design. In support of Title II design, those aspects of the test program that may be affected by a change in ESF configuration will be identified and documented in the SCPB.

22 17. NRC Statement:

"The zone of influence from the drilling activities of existing borehole USW G-4 located within the dedicated test area should be considered in evaluating the size of suitable available test space. In calculating the zone of influence for USW G-4 it should be considered that a total of 342,255 gallons of water were lost to various formations. Over 81,000 gallons of soap were used in the operation; however, how much soap was lost is unknown."

DOE Response:

In response to concerns such as this, the ESFDR has been updated to require the controlled use of water (e.g., tracers added to drilling fluid.) In addition, DOE will implement a phased approach towards ESF design, construction, and test activities, to allow the program to consider newly obtained information (e.g., high water saturations associated with water loss from USW G-4), which may after or change current designs, construction, or testing strategies.

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18. NRC Statement:

"Potential impacts of long-term performance confirmation testing on ESF design have not been addressed (see Comment 119)."

DOE Response:

As indicated in the SCA Response Document (DOE, 1990a), details of the performance confirmation program must await more information on site characteristics, waste package characteristics, and potential repository configuration. For the performance confirmation testing done in the ESF, the impacts of these tests on design will be addressed along with other ESF tests, during Title II design, as part of test planning packages. During underground construction and testing, these performance confirmation tests can be modified if necessary because the potential new ESF configuration contains additional features ensuring flexibility, such as ramps and increased MTL area.

24 19. NRC Statement:

"The SCP has not provided sufficient demonstration that in situ waste package testing will not be needed during site characterization to reduce uncertainties associated with long-term waste package performance prediction for license application and closure. If such testing is found necessary, an analysis of the impact on ESF design is not presented. (Question 58 and Comment 82)"

DOE Response:

The DOE does not plan to use any form of high-level radioactive waste during site characterization (DOE, 1990a). Should this position change, DOE will request the NRC's approval and take the necessary precautions.

As a result of the ESFAS, the ESF configurations presently being considered more readily permit testing with HLW than the SCP ESF design. Among other major features, the configurations include ramps rather than shafts, and increased MTL area for testing.

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20. NRC Statement:

"Some of the ESF design criteria are not sufficiently justified. These include:

- (a) Seismic design basis;
- (b) ES-1 drainage volume and long-term drainage reliability; and
- (c) effect of liner removal at closure."

DOE Response:

Generally, the process of developing and justifying numerical design criteria involves submission of these values to the RIB. Acceptance of values into the RIB is a technically reviewed and documented process, controlled via AP 5.3Q. This documentation would be available for examination.

With respect to Item (a), DOE is presently continuing to evaluate what is an adequate seismic design basis for the ESF. This will be completed during Title II design. Items (b) and (c) are closed (Letter, Bernero to Bartlett, dtd. 7/31/91).

26 21. NRC Statement:

"The subsurface drifting and exploration planned in the SCP have not been shown to be sufficient to yield the data needed for repository design and site suitability demonstration at license application.

DOE Response:

The ESFAS evaluated a range of options for various parameters, including representativeness of the drifting program (see ESFAS Volume I, Section 2.2). The most highly ranked option was one that offered a significantly greater amount of subsurface drifting than the SCP ESF design. The extent of the necessary subsurface exploration will be addressed in phases. With a phased approach (DOE, 1991c), DOE considers the most recent data as underground exploration proceeds. The nature of the data dictates the scope of future exploration.

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CROSSWALK PAGE 1

4.0 OBJECTIONS, COMMENTS, AND QUESTIONS

4.1 Objections

Section 8.4.2.3.1 Exploratory Shaft facility testing, operations, layout constraints, and zones of influence, pp. 8.4.2-93/147

OBJECTION 1

The exploratory shaft facility (ESF) is intended to become an integral part of the repository if the site is found acceptable. However, the SCP and its references do not demonstrate the adequacy of ESF Title I design control process, and the adequacy of the ESF Title I design which is the basis for the SCP. For example, neither the design nor the subsequent Design Acceptability Analysis (DAA) considers some of the applicable 10 CFR 60 requirements. Also, the process used to integrate currently available technical data into decisions regarding shaft location appears to have overlooked evidence of a potential fault near the location of the exploratory shafts. In addition, it has not been demonstrated that the underground test facility and currently identified test durations will permit all tests to be conducted for the time periods required without interference. Furthermore, resolution of the problems identified with the Title I design may result in considerable corresponding modifications to the SCP.

BASIS

In response to CDSCP objection number 3, the SCP described an acceptable approach for assessing the potential for test-to-test and construction-to-test interference. However, the SCP has not established that this approach has been appropriately implemented to resolve potential interference problems. In responding to NRC CDSCP objection number 3, the discussions and analyses presented in the SCP did not completely address the following NRC staff recommendations:

a. In planning the underground test facility, the overall performance confirmation testing program and the need for starting certain performance confirmation tests (e.g., waste package testing) as early as practicable during site characterization should be considered.

b. The design of the ESF should take into account the need for preliminary information from in situ seal testing to be available in the License Application submittal.

The Design Acceptability Analysis (DAA) undertaken by DOE in response to NRC concerns for evaluating the acceptability of the ESF Title I design did not consider certain concerns critical to NRC ac-

ceptance of DAA conclusions. The following are some examples:

a. Independence of the reviewers is in question. Five reviewers who were certified not to have significantly contributed to the ESF Title I design and SDRD (sub-system design requirements) are identified as authors, reviewers, and/or contributors to specific documents which were input documents to the ESF design. (Question 63)

b. Neither the ESF Title I design nor the subsequent DAA considers (qualitatively or quantitatively) 11 of the applicable 10 CFR 60 requirements. (Comment 128)

c. Of the 52 requirements considered by DOE to be applicable to the ESF design, only 22 were considered quantitatively. The remaining were said to have been considered qualitatively. Included in the remaining 30 are the requirements of Subpart F (Performance Confirmation Program) which according to 10 CFR 60.140(b), "shall have been started during site characterization." Several of these 30 requirements are potentially important in evaluating the acceptability of the ESF Title I design. (Comment 130)

d. Of the 22 requirements that were considered quantitatively, some inadequacies have been identified. For example, in considering the regulatory requirement related to alternatives to major design features important to waste isolation (60.21(c)(1)(ii)(D)), the analysis presented was limited and incomplete. As a result, comparative evaluation of alternatives to the major design features was limited to comparative evaluation of five alternative ESF locations. Hence other comparative evaluations such as the number of man-made openings were not considered. (Comment 132)

e. DAA did not thoroughly check the adequacy of data used in the ESF Title I design. For example, several key documents which were part of ESF Title I design were not reviewed. (Comment 131)

f. DAA has not demonstrated that DOE has considered information that indicates the presence of an anomaly in the immediate vicinity of the proposed locations of exploratory shafts 1 and 2. (Comment 127) By not considering this

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readily available information in reaching the decision on the locations of ES-1 and ES-2, uncertainties regarding the design control process are further heightened. The design itself is further questioned since the comparative evaluation of the major design features (i.e., ES-1 and ES-2) with respect to waste isolation did not assess the impact of the anomaly.

Cross-walk #

- The analysis presented did not demonstrate that the underground test area layout can accommodate currently identified tests in the ESF while avoiding interference between tests and between tests and construction operations. Also, information presented in the SCP did not clearly show that thermal tests can be conducted for sufficient lengths of time to gather necessary site characterization data without interference problems. The bases for these concerns are as follows:
- 14 a. SCP does not clearly address the potential incompatibility of some of the tests with construction operations. It has not been demonstrated that operational requirements (e.g., storage of mobile equipment, drill steel, blasting materials, vent pipes, water pipes, support/reinforcement, disabled equipment, etc.) will not encroach on some of the identified test locations. For example, sequential drift mining test, heated block test and canister-scale heater experiment are currently shown to be located adjacent to the first loop access drifts to the shafts and therefore subject to potential operational interference.
- 15 b. The zones of influence presented for thermal tests are based on short test durations. Thermal tests such as the canister-scale heater experiment, heated block test, and heated room experiment are planned to run for relatively short durations (30 months, 100 days, 36 months). The staff considers that longer durations will very likely be necessary. The need to obtain additional site characterization data beyond the planned time periods may result in larger zones of influence.
- 16 c. It is stated in the SCP that in some cases the same space can be used for more than one test by sequencing the tests. However, it is not clear if it has been fully considered that delays during initial testing could affect the timing for the tests to be followed in the same space.
- 17 d. It is not clear that uncertainties have been sufficiently considered in the calculations of zones of influence for various tests. For example, uncertainties associated with the numerical models and material properties have not been considered in calculating zones of influence.
- 18 e. The location of the canister-scale heater test shown in Figure 8.4.2-39 (p. 8.4.2-209) has been erroneously indicated on the layout. As a result, its zone of influence apparently overlays the heated block test. In addition, the SCP gives the following two constraints for locating the canister scale heater test (p. 8.4.2-120):

 - located greater than 9 m from drifts or alcoves running parallel to the axis of the heater.
 - located in a "low traffic" area.

Neither of these constraints has apparently been met.
- 19 f. The locations of several major tests identified in the SCP have not been specifically identified. These include some tests that could have a considerable zone of influence (e.g., Heated room experiment) and some that require extensive test area (e.g., Horizontal drilling demonstration test). Examples of other tests for which specific locations have not been identified include thermal stress measurements, development and demonstration of required equipment, three of the four diffusion tests identified on p. 8.4.2-140, seal tests and other performance confirmation tests.
- 20 g. Page 8.3.2.1-14 of the SCP states that "there are other tests that have not yet been completely defined that will investigate coupled interactions." Information has not been presented to indicate if any of these undefined tests will be in the main test area.
- 21 h. The space designated for tests within the underground test area layout is very likely to be inadequate. DOE assumes that all the space within the dedicated test area may be or is usable. This is unlikely to be the case. For example, some areas may not be suitable for use because of faults, lithophysal content, breccia, etc. In addition, offsets from waste emplacement areas (30 m) and from proposed multi-purpose boreholes (two drift diameters) may further reduce the available test area.
- 22 i. The zone of influence from the drilling activities of existing borehole USW G-4 located within the dedicated test area should be considered in evaluating the size of suitable available test space. In calculating the zone of influence for USW G-4 it should be considered that a

total of 342,255 gallons of water were lost to various formations. Over 81,000 gallons of soap were used in the operation; however, how much soap was lost is unknown.

Cross-
walk #

- 23 • Potential impacts of long-term performance confirmation testing on ESF design have not been addressed (see Comment 119).
- 24 • The SCP has not provided sufficient demonstration that in situ waste package testing will not be needed during site characterization to reduce uncertainties associated with long-term waste package performance prediction for license application and closure. If such testing is found necessary, an analysis of the impact on ESF design is not presented. (Question 58 and Comment 82)
- 25 • Some of the ESF design criteria are not sufficiently justified. These include:
- (a) Seismic design basis (Comment 121);
 - (b) ES-1 drainage volume and long-term drainage reliability (Comment 124, Question 27); and
 - (c) effect of liner removal at closure (Question 24)
- 26 • The subsurface drifting and exploration planned in the SCP have not been shown to be sufficient to yield the data needed for repository design and site suitability demonstration at license application. (Comment 35)

RECOMMENDATIONS

- An acceptable baselined QA process should be used during Title II design.
- The Title II design should ensure that the design process, which appears to have overlooked key regulatory requirements and information about the suitability of exploratory shaft locations during Title I design, is adequate and that the number of shafts and their locations in the final repository contribute to reduce uncertainty with respect to waste isolation.
- The DOE should evaluate existing technical data (e.g., geophysical, geological) with respect to ESF location decisions and criteria; and, if deemed necessary, the DOE should consider additional geological and geophysical surface based tests in the vicinity of the exploratory shafts to investigate potentially adverse features and conditions.
- The ESF Title II Design should present the basis for selected test durations, address the suitability of es-

tablished test durations, and assess their impact on the testing program.

- The ESF Title II Design should provide a complete conceptual layout of the main test level and related test schedules. The layout and schedule should account for the following: (a) uncertainties in the zones of influence calculations; (b) construction and facilities operations; (c) contingencies for unsuitable test areas; (d) drilling effects of USW G-4; (e) contingencies for tests that will need to be running longer than planned; (f) effect of sequencing tests on the overall license application and performance confirmation test programs; and (g) coupled interaction tests mentioned on p. 8.3.2.1-14. Based on these considerations, the ESF Title II design should recognize the potential need for additional underground testing area and demonstrate sufficient flexibility to accommodate likely contingencies.

Section 8.6: Quality Assurance Program

OBJECTION 2

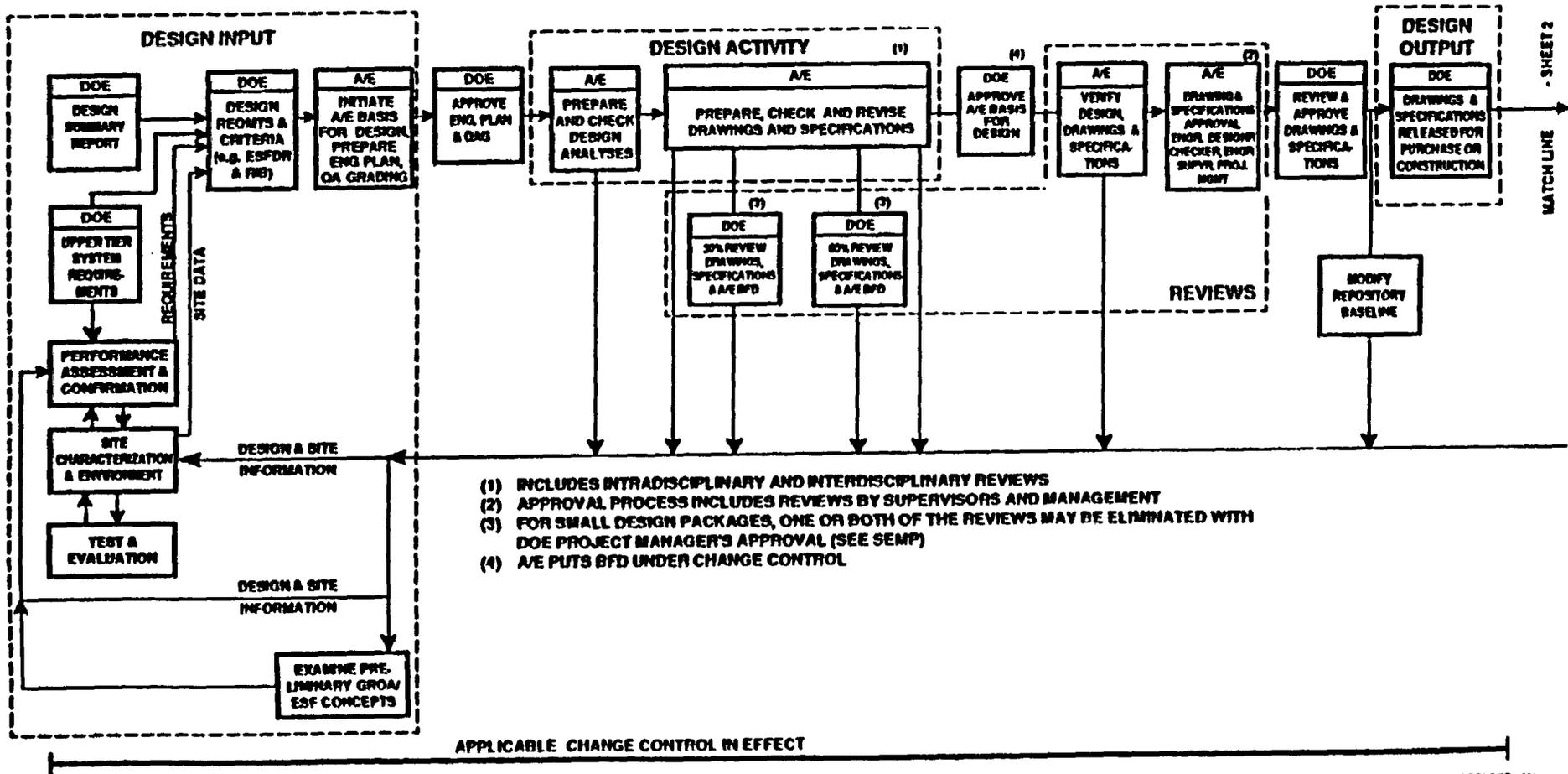
Section 8.6 of the SCP describes the quality assurance (QA) program to be applied to site characterization activities including the exploratory shaft design and construction. Prior to conducting activities in the various program areas, it commits to having an appropriate program in place for those site characterization activities, which meets Subpart G of 10 CFR Part 60, and to qualify site exploration data supporting the license application. DOE has developed an acceptable approach for qualifying its QA program, but some of the milestones are not yet completed. In addition, although the information presented and referenced in the SCP on the responsibilities and independence of the QA managers is acceptable, the NRC staff is concerned that DOE will be impeded in demonstrating the ability to implement the approach because the QA management positions in DOE's headquarters (OCRWM) and field (YMPO) offices have not been filled with full-time individuals with appropriate knowledge and experience. Also, staff QA concerns on the Design Acceptability Analysis (DAA) will need to be resolved. Finally, the Overview of the Site Characterization Plan incorrectly states that all organizations participating in the site characterization program have developed and are implementing a QA program that meets the NRC's requirements.

BASIS

- CDSCP Objection No. 5 noted that DOE's QA program for site characterization was still being developed and did not yet conform to the requirements in Subpart G of 10 CFR Part 60. It recommended that DOE submit plans and procedures for NRC staff review, facilitate NRC staff verification reviews such

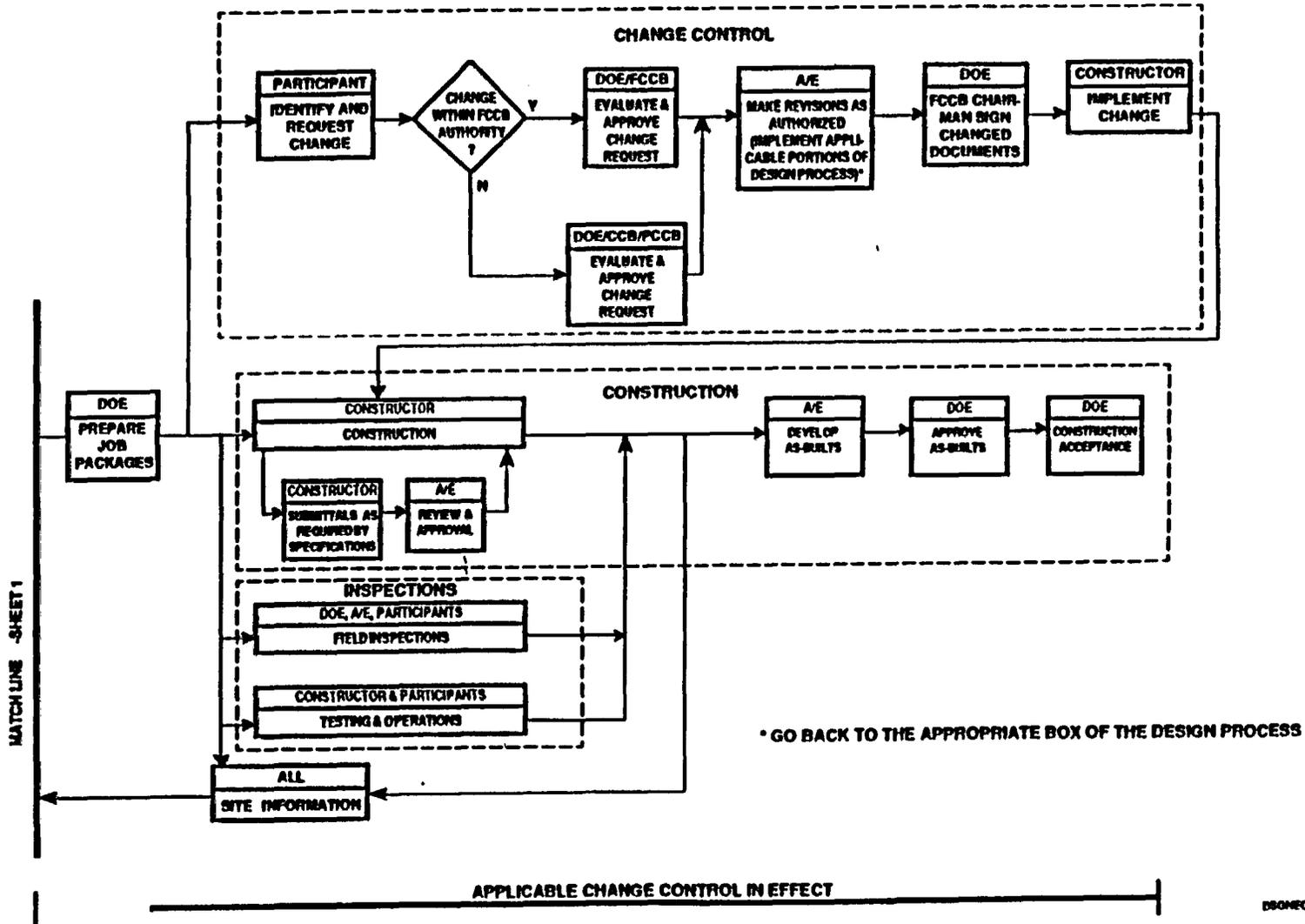
4.1 ESF TITLE II DESIGN PROCESS

MONTHLY DESIGN PROGRESS MEETINGS CONDUCTED BY DOE →



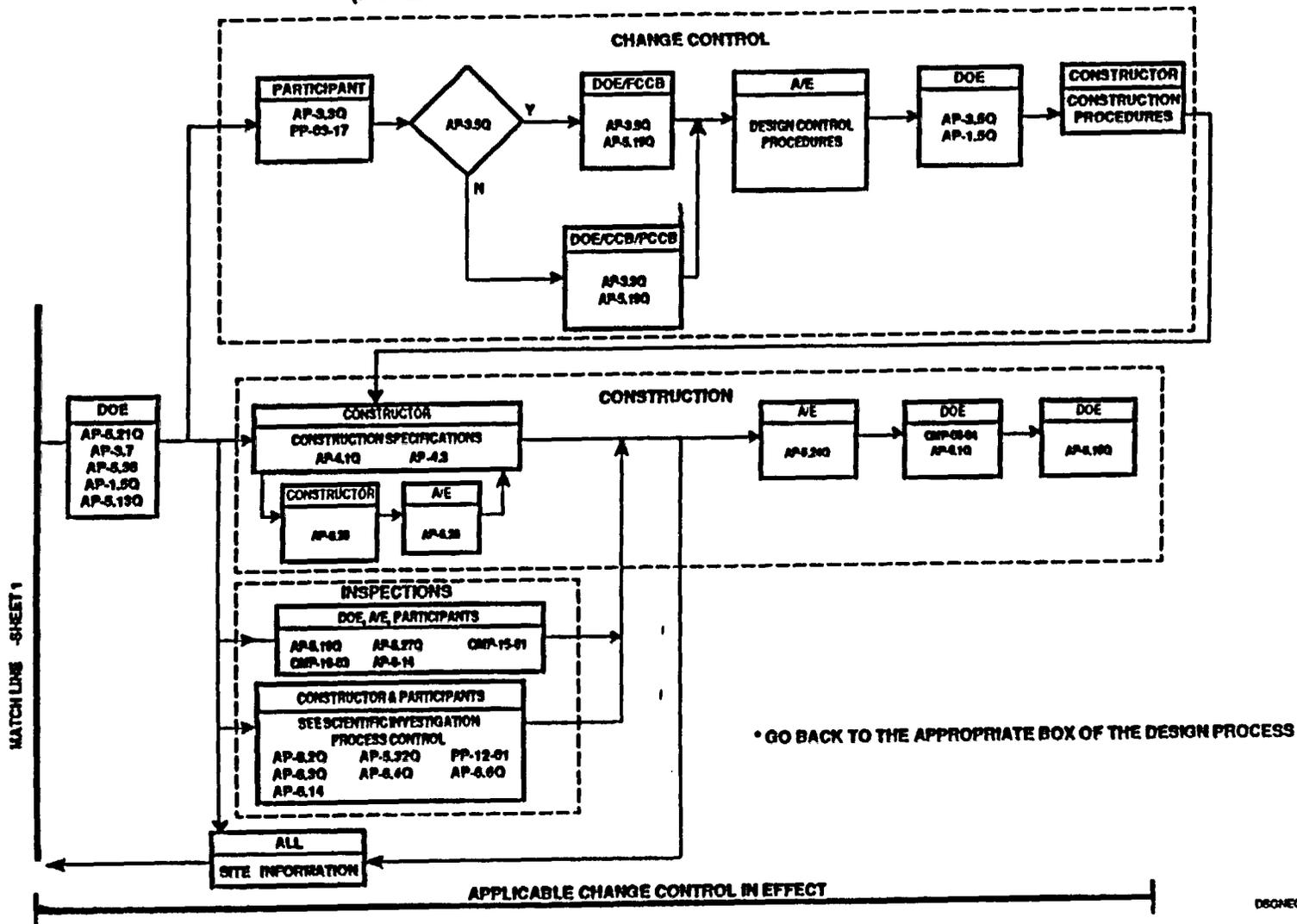
4.1 ESF TITLE II DESIGN PROCESS

(NOTE: INCLUDES TITLE III & CONSTRUCTION ACTIVITIES)



4.1 ESF TITLE II DESIGN PROCESS as of 9/91

(NOTE: INCLUDES TITLE III & CONSTRUCTION ACTIVITIES)



Surveillances of Design Process Completed in Fiscal Years 1990 and 1991

<u>References</u>	<u>Participant</u>	<u>Subject</u>
YMP-SR-90-022	Holmes and Narver	Development of Design Package #1
YMP-SR-91-010	Technical and Management Support Services	Calico Hills Risk Benefit Analysis
YMP-SR-91-017	Technical and Management Support Services	Appendix J to the ESF Design Requirements Document SCP Baseline Document Associated training and review record packages
YMP-SR-91-018	Yucca Mountain Site Characterization Project Office	System Requirements System Description Repository Design Requirements SCP Baseline Document Associated change control, records, and personnel training
YMP-SR-91-026	YMPO/Raytheon Services Nevada	Design Process and associated personnel training and records

Audits of Design Process Completed in Fiscal Years 1990 and 1991

<u>References</u>	<u>Participant</u>
90-07	Fenix and Scisson Nevada
90-I-01	Yucca Mountain Site Characterization Project Office
91-04	Raytheon Services Nevada
91-I-01	Yucca Mountain Site Characterization Project Office