The Under Secretary of Energy
Washington, DC 20585

February 27, 1997

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W.
Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

Thank you for your November 26, 1996, letter regarding the Defense Nuclear Facilities Safety Board's comments on Recommendation 95-1.

As described in the enclosed response, appropriate revisions and modifications will be made to the Systems Requirements Document, the Systems Engineering Management Plan, and the Cylinder Program Management Plan. Before proceeding with changes to these documents, we will meet with your staff to discuss the next revisions to the systems engineering documents and your comments. The enclosure to this letter would serve as the basis for discussions. We will also discuss the changes necessary in cylinder management projects due to congressional reduction of the Department's Uranium Programs budget.

If your have any questions concerning the enclosure, please contact my office or Mr. Ray Hunter of the Office of Nuclear Energy, Science and Technology at (202) 586-2240.

Sincerely,

Thomas P. Grumbly

Enclosure

Enclosure

Defense Nuclear Facilities Safety Board Comment 1, Cylinder Pedigree: The Systems Requirements Document, revision 2, and the Systems Engineering Management Plan still do not clearly address the board's comment on cylinder pedigree in its letter of January 22, 1996, that addressed manufacturing standards used for a defined population of cylinders.

Department of Energy Response: The Department agrees. The narrative in the Systems Requirements Document and Systems Engineering Management Plan will be modified to clarify our intent to meet the concerns expressed in your letter dated January 22, 1996. The Department identifies three areas of concern from your letter: (1) identify the population of cylinders not manufactured to American Society of Mechanical Engineers standards, (2) determine what standards were used, and (3) evaluate these cylinders for continued acceptability. Wherever possible, the manufacturing history of cylinders not meeting American Society of Mechanical Engineers code standards will be documented. We are proceeding to develop a storage standard and will develop the process for accommodating the subject cylinders in that standard once it is developed.

The Department would like to emphasize that activities have been implemented to address these issues. The following is an explanation of such actions to address the three areas of concern.

Based on system requirement 1.1.1 and the Systems Engineering Management Plan actions 1.1.1.2.3.1 and 1.1.1.2.3.2, activities to identify the noncoded cylinders have been completed. By this effort, it has been determined that all 48-inch-diameter cylinders have been designed to American Society of Mechanical Engineers Boiler and Pressure Vessel Standard section VIII criteria. However, some cylinders were not manufactured to strict code requirements sufficient to be code qualified. Attachment 1 identifies cylinders that are not code stamped.

To verify the code requirements for cylinders in storage, calculations were completed to determine the minimum wall thickness requirements as per the original design conditions, liquid transfer operations, and general storage conditions.* These efforts to date are in support of developing the cylinder acceptance criteria for safe storage as called for by technical requirement 4.1.2.a and Systems Engineering Management Plan action 4.1.2.2.2. Upon completion of these criteria, the noncoded cylinders can be inspected for acceptable long-term storage functions as called for by technical requirement 2.2.1.b and Systems Engineering Management Plan action 2.2.1.3.3.

Defense Nuclear Facilities Safety Board Comment 2, Reduction of Cylinder Wetness and Degradation: A key requirement in the Systems Requirements Document, revision 2, is requirement 5.2.2.c, stating, "[a]s part of continuous improvement, other methods for reducing

---

*Michael Lykins and Mark Frazier correspondence to Mike Taylor, "Minimum Wall Thickness Calculations for the UF_6 Storage Cylinders Using ASME Code Section VIII," POEF-38-342-96-507, November 5, 1996.

time-of-wetness and cylinder degradation shall be evaluated." This requirement is important to full implementation of subrecommendation 2 of Recommendation 95-1. While some ongoing actions are called out in the Engineering Development Plan, particularly with regard to reducing time-of-wetness, the Systems Engineering Management Plan does not delineate clear actions designed to explore and identify proactively other measures for reducing cylinder wetness and degradation.

Department Response: The Department agrees. The Systems Engineering Management Plan actions will be revised, or added, to state explicitly additional improvement efforts. It should be noted that many alternatives and additional improvements to the current system have already been considered. The Systems Engineering Management Plan, action 5.2.2.2.3, specifically responds to technical requirement 5.2.2.c. The Systems Engineering Management Plan action states:

> *Identify the factors for triggering an assessment of the configuration, i.e., revisions to the life-cycle and duration projections, substandard performance, identification of new technologies. New technologies include methods for reducing cylinder corrosion.*

This action is worded such that the effort to improve continuously is driven by the remaining life of the storage system and the maturity of the system configuration. Efforts to improve continuously must have significant cost/benefit potential. Given the initiation of the board's subrecommendation to paint cylinders and a diminishing inventory starting in the year 2020 (i.e., the Department's current long-range plan), continuous improvement efforts have been focused on coating systems and contingency measures prior to the coating of cylinders (e.g., removal from ground contact, stacking on concrete yards and chocks). The Cylinder Program Technical Manager is a member of the Corrosion Science and Technology Group of the Oak Ridge National Laboratory. He stays abreast of the state-of-the-art corrosion management techniques via interaction with his coworkers and attendance at international corrosion engineering conferences. His involvement in these areas provides the cylinder program with an active avenue of identifying other measures for reducing cylinder wetness and degradation.

Defense Nuclear Facilities Safety Board Comment 3, Cylinder Corrosion: The following corrosion issues outlined in "DNFSB/TECH-4" are not clearly addressed by actions in the Systems Engineering Management Plan, the Engineering Development Plan, or the Program Management Plan:

- Corrosion studies – There are no clear actions set forth to perform studies evaluating the effects (per Systems Requirements Document requirement 4.1.3.a) of accelerated corrosion (including corrosion after removal from ground contact), stiffener corrosion, pitting, crevice corrosion, and stress corrosion of packing nuts. In addition, the effect of internal corrosion through breaches is not clearly addressed.

- Integration of inspection program with corrosion studies and cylinder maintenance – Regarding this issue, the Systems Requirements Document, revision 2, appears not to incorporate requirement 5.4.2.2.5 of the Systems Requirements Document, revision 1, for inspecting cylinders and storage facilities for conformance to applicable cylinder functional criteria and the authorized safety basis.

Department Response to First Issue: The Systems Engineering Management Plan action identified as specifically responding to technical requirement 4.1.3.a is action 4.1.3.2.1.

Identify and grade for severity factors that could degrade cylinder integrity.

This Systems Engineering Management Plan action requires that degradation mechanisms be identified and graded for further evaluation and monitoring. Under the Plan, only those mechanisms and associated factors with potential to impact the system cost and risk are to be explored in greater detail.

The next revision to the Engineering Development Plan and the Program Management Plan will explicitly identify actions underway this fiscal year, and actions unfunded this year, that respond to this Systems Engineering Management Plan action. The funded actions are identified in the Fiscal Year 1997 Baseline Program Plan for Uranium Programs Activities that was issued in December 1996. These funded actions are: (1) ultrasonic thickness evaluation of a severely corroded cylinder, (2) planning and implementation of the three-site thickness inspection program for determining current corrosion rates, and (3) analysis of model 30A cylinder corrosion damage and evaluating corrosion in the head/skirt crevice.

Department Response to Second Issue: The requirement cited from the Systems Requirements Document, revision 1, has not been deleted but has been incorporated into multiple requirements in the Systems Requirements Document, revision 2. As noted on page C-2 of the Systems Engineering Management Plan, requirement 5.4.2.2.5 of the Systems Requirements Document, revision 1, has been incorporated into the Systems Requirements Document, revision 2, technical requirement 1.2.2a (safety basis monitoring of the cylinders and yards) and technical requirement 4.1.2e (risk-based cylinder condition inspections). In addition, the Systems Requirements Document, revision 1, requirement 5.4.2.2.5, has been incorporated into other technical requirements within system requirement 4.1.2.

Systems Engineering Management Plan actions associated with these technical requirements include 1.2.2.2.1.1, 4.1.2.2.4.1, and 4.1.2.2.4.5. The Program Management Plan actions associated with these Systems Engineering Management Plan actions include lines 105 (periodic walk throughs of yards), 107 (environmental monitoring), 112 (annual visual inspections), and 117 (periodic visual inspections).

Defense Nuclear Facilities Safety Board Comment 4, Flowdown of Systems Engineering Management Plan Actions: It is not clear how the details of the actions defined in the Systems Engineering Management Plan are implemented in the Program Management Plan and Engineering Development Plan actions for execution as called for by the Department's Implementation Plan for Recommendation 95-1. The Engineering Development Plan presents narrative in the "EDP Activity WCS Forms" that covers some details of the engineering development actions called for by the Systems Engineering Management Plan, but no such work breakdown structure/work control structure narrative is presented in the Program Management Plan for its actions.

Department Response: The Department agrees. As a result of our informal discussions with the board staff in September, the work breakdown structure dictionary in the Program Management Plan will be revised to strengthen the linkage to the Systems Engineering Management Plan actions. This revision will better demonstrate flowdown of the Systems Engineering Management Plan actions to the Program Management Plan and Engineering Development Plan authorized work. We are approaching this problem in the following ways:

- To ensure this linkage is maintained, verification steps will be taken much like those stated in the Systems Engineering Management Plan and Engineering Development Plan. The verification steps will require the use of the Systems Engineering Management Plan and the Systems Requirements Document by program personnel as these documents provide the basis for needed work.

- The relationship between key program documents is shown in Attachment 2. This "N2" diagram demonstrates the use of one systems engineering tool to be used per the Systems Engineering Management Plan.

- The specific approach to revising the work breakdown structure dictionary is to include a listing of the Systems Engineering Management Plan actions consolidated into a narrative element in the work breakdown structure, identifying development work, and work to achieve and preserve Systems Requirements Document compliance. Some modifications to this approach may be necessary after performing this upgrade on a few trial work breakdown structure elements. The likely document changes we anticipate making are listed in attachment 3.

3 Attachments

Attachment 1

DEPLETED URANIUM HEXAFLUORIDE CYLINDERS WITHOUT CODE STAMP (BY IDENTIFICATION NUMBER)

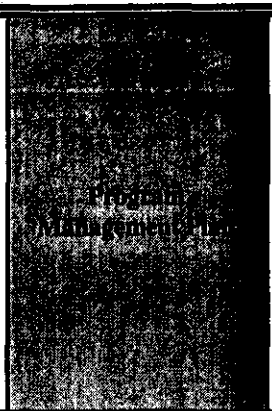
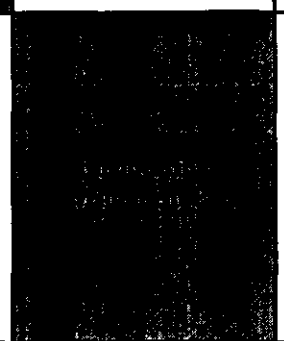
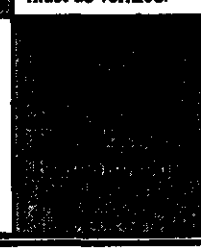
Cylinder Type	Number of Cylinders	Cylinder Identification Numbers	Procurement Dates	Remarks
48P	1000	1-1000	1951–54	When these cylinders were manufactured, the Department of Energy was self-regulating and did not require American Society of Mechanical Engineers-coded vessels. These cylinders were produced per code requirements at code-certified shops. However, funds to have an authorized inspector present during production were not provided. A representative from the procuring company was substituted for the authorized inspector. Because an authorized inspector was not present during production, these cylinders did not obtain a code certification.
48P	365	3001-3365	1954	
48OM	4450	16602-18801 100001-102250	1961–71	
48OH	30	9501-9530	1961	
48OHI (F)	60	9601-9660	1962	
CV	292	CV1-CV142, CV500-CV649	1958–59	These cylinders were designed to American Society of Mechanical Engineer section VIII. However, they were manufactured at the Paducah plant that was not code-certified at the time.
30A		not sequential	not sequential	All the 30A (2½-ton) cylinders were built to Department of Transportation Specification 106A500X. These cylinders are not American Society of Mechanical Engineer code-stamped pressure vessels.

Attachment 2

DRAFT N2 CHART DESCRIBING THE RELATIONSHIP (FLOW) OF KEY DOCUMENTS

(Key to reading Attachment 2: (1) Information to the right of the shaded block flows to the documents (shaded blocks) below it; (2) Information to the left of the shaded block flows up to the documents (shaded blocks) above it.

Final Safety Analysis Report	Provides the authorized system controls for risks and hazards.	Provides the authorized system controls for risks and hazards.	Provides the authorized system controls for risks and hazards.		Provides the authorized system controls for risks and hazards	Provides the authorized system controls for risks and hazards
Provides program mission links to requirements and identifies them as such. Provides implementation controls interpreting risk/hazard controls for program application.		Provides the mission/ objective requirements (system and technical) for the program. Enumerated requirements. Corresponding standards for requirements are identified.	Provides the basis for scoping actions.		Provides the mission/ objective requirements (system and technical) for the program. Corresponding standards for requirements are identified	Provides the mission/ objective requirements (system and technical) for the program. Corresponding standards for requirements are identified
Identifies means for implementation and preservation of risk and hazard controls specific to the program.	Identifies means for implementation and preservation of requirements. Lists the system and technical requirements and the corresponding standards stated in the systems requirements document.. Provides the comprehensive listing of actions necessary to meet requirements.		Identifies a comprehensive listing of actions (appendix D) necessary for the program to meet requirements. Identifies which actions are implementation actions. Enumeration of actions is an extension of system requirements numbering. Applicable technical requirements are noted. Provides the rationale for sequencing and prioritizing the Systems Engineering Management Plan actions for implementation or development authorization.	Identifies a comprehensive listing of actions (appendix D) necessary to meet corresponding requirements. Identifies which are development actions. Enumeration of actions is an extension of system requirements numbering. Applicable technical requirements are noted. Provides the rationale for sequencing and prioritizing Systems Engineering Management Plan actions for implementation or development authorization.	Describes the mechanism for a work control structure and configuration management which calls for the use of detailed authorization directives.	Describes the mechanism for the work control structure and configuration management which includes the use of task plans and sub-contracts

	Lists the requirements and the corresponding standards stated in the Systems Requirements Document. Provides the mechanism to verify requirements of the completion of necessary work.	Prioritizes, sequences, and organizes Systems Engineering Management Plan actions into the program work breakdown structure dictionary. This transitions the requirement numbering system to the work breakdown structure numbering system. Provides the link of authorized actions to Systems Engineering Management Plan actions. Provides the mechanism to verify the requirements.		Documents the program work breakdown structure dictionary that is also the development work breakdown structure. Provides the structure for identifying the purpose of specific development activities.	Provides the integration and sequencing of implementation actions with an emphasis on current year actions, their estimated cost and schedule. Identifies the implementing organization and their roles and responsibilities	Provides the integration and sequencing of actions with an emphasis on current year authoriz actions, their estimat cost and schedule.
		Provides the link of authorized development actions to Systems Engineering Management Plan actions by referencing Systems Engineering Management Plan action number in authorized development action . References the Systems Engineering Management Plan.	Provides the mechanism to control development activities; identifies specific development tasks, references specific development plans.		Provides the prioritized development activities for fiscal year selection and authorization	Provides the integration and sequencing of development actions with an emphasis on current year authoriz actions, their estimat cost and schedule.
		Identifies specific actions to be done in the fiscal year.	Identifies specific implementation actions to be done in the fiscal year.	Identifies specific development actions to be worked in the fiscal year.		Provides Department of Energy authorizati of specific tasks for t fiscal year. Specifies that work completion must be verified.
		Task plans identify applicable Systems Engineering Management Plan actions.	Provides sufficient scope detail necessary to verify implementation tasks, provides criteria for completion verification, when applicable specifies work methods, specifies cost of services.	Provides sufficient scope detail necessary to verify implementation tasks, provides criteria for completion verification, when applicable specifies work methods, specifies cost of services.	Provides the the mechanism to complete authorized work with principle developers and implementing organizations	

Attachment 3

ACTIONS TO FIX THE DOCUMENTS

I. Systems Requirements Document Upgrades

- Identify/incorporate final safety analysis report controls as system or technical requirements.
- Revise standards to incorporate work smart standards impact.
- Systems Engineering Management Plan upgrades.
- Revise requirements listing per systems requirements document.
- Revise listing of comprehensive actions per systems requirements document.
- Streamline planning and controls narrative (section 3) and incorporate Program Management Plan applicable text.
- Revise text in other sections as necessary.
- Revise the work control structure to reflect lessons learned.

II. Program Management Plan upgrades.

- Revise the work breakdown structure to reflect system functions.
- Meld appendix A with the work breakdown structure dictionary verbiage stating Systems Engineering Management Plan implementation actions.
- Meld Engineering Development Plan appendix C with the work breakdown structure dictionary verbiage stating Systems Engineering Management Plan developments actions.
- Eliminate sections that duplicate Systems Engineering Management Plan planning and controls narrative.
- Revise organization structure.
- Revise roles and responsibilities.
- Sequence and prioritize Systems Engineering Management Plan actions.
- Upgrade listing of performance metrics including long-range goals and their rationale.
- Provide a listing of the command media (procedures, training modules, contracts, agreements, detailed authorization directives, etc.).
- Revise program schedule to reflect available funds.
- Add list of requirements.

III. Engineering Development Plan

- Complete correlation of Systems Engineering Management Plan development actions to work breakdown structure (eliminate to-be-determineds).
- Revise development control process to reflect lessons learned.
- Provide a listing of the authorized task plans.
- Provide a description of the specific development actions to be funded in outyears (unauthorized task plans).
- Provide the standard (work control structure) forms for known necessary development.