Department of Energy

Washington, DC 20585
April 3, 2000

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

Dear Mr. Chairman:

This letter is in response to your November 9,1999, letter regarding safety management deficiencies and project management at the Y-12 Plant. The Department submitted a report on December 30, 1999, which included a list of project management root causes within the Department of Energy (DOE) organization, the contractor's organization, and on the interface between DOE and the contractor. A meeting with the Board's staff held at the Oak Ridge Operations Office (OR) on February 23, 2000, discussed the genesis of the root causes. They were developed by conducting analyses of the National Academy of Science Report on DOE Project Management, the Defense Programs Conceptual Execution Plan to improve Project Management, the Independent Assessment of the Hydrogen Fluoride Supply System project, and the Independent Review of Y-12 Capital Projects. The list of root causes was reviewed, and the corrective action plan strategy was validated by Paul Rice, a member of an external advisory team to DOE-OR and Lockheed Martin Energy Systems (LMES) for Project Management. The Department is providing the Corrective Action Plans (CAPs) for DOE (Enclosure 1) and LMES (Enclosure 2), addressing the root causes identified in the December 30, 1999, report.

The DOE and LMES CAPs are focused on rebuilding and reinforcing the fundamental infrastructure of project processes and procedures through implementing the fundamental guiding principles of Integrated Safety Management by: 1) establishing unambiguous and appropriate interfaces between DOE and LMES; 2) clearly defining and assigning project management roles and responsibilities; 3) establishing senior management's leadership roles and responsibilities; 4) developing and conducting required training; and 5) reviewing ongoing projects to ensure appropriate incorporation of planned corrective actions.

A key element of rebuilding and reinforcing project management infrastructure is the DOE-OR Defense Programs (DP) commitment to provide short-term and permanent qualified project management support. The DOE-OR DP is committed to: 1) fill the short-term needs from within the complex (or outside as necessary); and 2) support the needs identified in the long-term staffing plans, which are currently under development. These staffing plans will support the DP mission, and DOE-OR will communicate resource needs and funding requirements to DP at Headquarters.

The DOE Headquarters DP Construction Program Management Plan (CPMP) has been implemented as the basis for the management of projects. Local DOE implementation procedures are being developed. This suite of source and implementation procedures will provide clear definition of DOE's role as the project owner and contract manager. As part of

project definition, the mission requirements and safety standards for the project must be communicated to the contractor. Once these requirements have been accepted, the contractor executes the project management process outlined in the CPMP, obtaining DOE's approval at critical decision points in the project life. The DOE exercises design approval by rigorous technical review, ensuring the proposed contractor design meets system and safety requirements.

Throughout the execution of the DOE and LMES CAPs, the Y-12 Modernization Projects Advisory Team will be engaged to advise and assist DOE and LMES in their development and refinement of project management systems to ensure proper execution of major modernization and expense projects. The advisory team provides reviews and recommendations in critical project management areas including planning processes, execution, programmatic interfaces, DOE requirements, training, support systems, and proper incorporation of integrated safety management principles. The advisory team has met three times and provided reports with recommendations that have been shared with the Board's staff. In its most recent review during the week of March 13, 2000, they focused on the progress and effectiveness of the Independent Assessment of Hydrogen Fluoride Supply System Project corrective actions to strengthen project management performance in engineering, quality assurance, procurement, and operations. In addition, Mr. Rice has provided individual assistance to the DOE and LMES related to the development of the enclosed CAPs. He has provided input related to overall project management development strategy plan, coverage of development efforts, priorities of corrective actions, and roles and responsibilities.

The DOE and LMES CAPs are expected to be living documents that will be revised and updated, as a function of feedback and continuous improvement processes.

If you have any questions, please contact me or have your staff contact Dan Rhoades of my staff at (202)586-4879.

Sincerely,

SIR
We are trying hard to set a clear, accountable path to technical success -- thanks for your board help!

Thomas F. Gioconda

THOMAS F. GIOCONDA
Brigadier General, USAF
Acting Deputy Administrator
for Defense Programs

Enclosures

cc w/enclosures:
G. Leah Dever, OR
M. Whitaker, S-3.1

PROJECT MANAGEMENT SYSTEM CORRECTIVE ACTION PLAN

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface ( ) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	Section I. Project Management Program Description and Implementing Procedures			
1.	Develop and issue a Y-12 project management program description that incorporates lessons learned from other DOE projects and best commercial practices and the recommendations of the outside expert team (Y-12 Modernization Project Advisory Team) as appropriate			
	A. Align/integrate DOE and contractor Project Management Program Procedures and define interfaces/points of contact between DOE and the contractor (DOE/LMES 1-1, DOE/LMES 1-2) to accomplish: • DOE issue Construction Project Management Plan (CPMP) to define roles and responsibilities and interfaces for project. • Incorporate CPMP roles and responsibilities and interfaces into LMES Project Management Program Description. • Identify and review other DOE procedures to ensure requirement reflected in LMES Project Management Program Description (DOE 2).	6/1/00	Morris/ Ooten	
	B. Develop a Project Management Program Description Document that is based on DOE Order 430.1A, (LCAM), DOE Construction Project Management Plan (draft), existing Y-12 project management procedures, fundamentals of ISM DOE Policy 450.4, and best practices of DOE and commercial projects. The Program description will include but is not limited to: (LMES 7; ORO PM 1, 2) Line management is responsible for safety: • Define the Project Management ISM Roles and Responsibilities of Line Management, Engineering, Design Authority, Project Management, Facility/Criticality Safety, Quality Assurance, etc. (LMES 1, 5; ORO Vendor Quality 1-4; HF Recommendation 1)	3/31/00	Burdett/ Crociata	

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- Identify ownership of Project Management Procedure Process

- Define the project-specific Senior Management Team (General Manager, responsible Line Manager, Technical Operations Director, and others as required) to interface with the individual Project Management. (LMES 5)

- Define the LMES Senior Management [Executive Steering Group (ESG)] Roles and Responsibilities for projects. (LMES 6)

Clear roles and responsibilities must be articulated:

- Define the project team core members, basic roles, responsibilities, and authority. (LMES 1, 2)

Competence must be commensurate with responsibilities assigned:

- Identify the process for development of baseline training and qualification requirements for Project Management Personnel and project team members. (HF Recommendation 2)

Balanced priorities must be set:
Hazards controls must be tailored to the work performed:
Operations must be authorized:

- Identify the Project Plan as an implementation blueprint for project execution, organization, and administrative strategy. The tailoring of Project Plan requirements will be based on cost, risk safety, and schedule, etc.

- Define the process for selecting, tailoring, approving, training, and change control for project-specific procedures

- Identify the process and responsibilities that will be utilized to track and resolve technical and administrative issues (LMES 4)

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	Safety standards and requirements must be identified: • Define a clear description of the hierarchy of project policies, procedures, and plans that would include the relationships to institutional procedures and plans (LMES/DOE interfaces plans and procedures, PEP, CPMP) • Identify minimum requirements (contractual, legal, SRIDs, etc.) • Define Program description change process. • Summarize the execution of the ISM Core Functions Wheel during the completion of the five critical decision phases of project execution. (Develop the requirements, Plan the work, Endorse the project, Execute the work, Transition and closeout)			
2.	Project Plans will be prepared for each specific project. The sections of the Project Plan are addressed in Y13-XXX INS. The Y13-XXX INS series will also contain project management procedures covering project execution processes and requirements and provides guidance for tailoring the project plan to the specific project. A checklist will be used to identify the required elements of the project plan. Where project cost, schedule, risks, safety, etc. do not require a specific element, "NA" shall be entered and justification provided in the remarks section of the checklist for each NA prior to approval of the Project Plan. The following Project Plan sections will be addressed: A. Mission need justification B. Project description summary of technical and functional performance objectives for the project, as well as Project Baselines (technical, cost and schedule) (ORO PM 1) C. Specific training of project team members for the associated project (LMES 3) D. Systems Engineering requirements.	4/15/00	Morris	

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	E. Project Management Team approach and specific system to be used including: (LMES 2) • Detailed organization structure, • Roles and responsibilities and authorities, including decision authority from Headquarters and DOE Field Element program, and • Project Management Team support functions (expanded team) such as health physics, safety, NEPA, etc. F. Engineering trade-off studies G. System Design Description Process H. Resource Plan including a short description of funding and expenditure plans to include the total project cost profile, budget by funding category, and total project cost plan. I. Identification of project-specific procedures and plans. J. Project controls system and reporting. (LMES 8) K. A Work Breakdown Structure to working level 3 elements L. A schedule listing of major events, with a discernible critical path, major milestones, Critical Decision points, and their anticipated approval dates. M. Line Management develop as appropriate a list of required Process Descriptions and the scheduled completion dates. N. The process for PSAR/SAR development and approval. (HF SA 1, 2) O. Identification and documentation of Criticality Safety evaluations, requirements, and inspections/test (HF CS 3, 4) P. Identification and documentation of SSCs in the PHA, Design Specifications, and QA Surveillance Plans (HF SA 3, 4)			

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	Q. QA Plan (HF CM 4)			
	R. Risk Assessment and Risk Management Plan			
	S. Configuration Management Plan			
	T. Acquisition Strategy			
	U. The approval/signature requirements for all members of the project team.			
	V. Use of contingencies			
	W. References to applicable Department of Energy Orders and Standards (HF SA 1)			
	X. Earned value measuring tools to be used to evaluate project controls.			
	Y. Testing and acceptance criteria (HF CM 3)			
	Z. Technical Baseline Requirements			
	AA. Transition Plan (HF OP 1)			
	BB. Operations Readiness Requirements for operation of equipment or facilities			
	CC. Change Control Process (HF CM 1)			
	DD. Identify the methodology to resolve technical and administrative issues (LMES 4; HF CM 5)			
	EE. Waste Management Plan			
	FF. Security Plan			

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3.	Develop site-wide procedures, Y13-XXX INS, to address: Line Item Projects, Capital Equipment Projects/General Plant Projects, and Expense Projects specifically addressing the requirements of the tailoring for project plans. A. Line Item Projects (Y13-XXXINS) issued. • PEP identified as subset of Project Plan. B. Capital Equipment Projects/General Plant Projects (Y13-XXXINS) issued. C. Expense projects (Y13-XXXINS) issued.	4/15/00	Morris	
	Section II. Organization-Specific Project Management Corrective Actions			
*4.	Technical Operations, with support from Duke Engineering, is developing and implementing a Y-12 Conduct of Engineering Improvement Project to improve Y-12 Conduct of Engineering based on best commercial nuclear practices and Y-12 mission needs (HF Recommendation 3): A. Compare the current state engineering functions at Y-12 with best practice organization(s) and develop recommendations for improvement that is based on: • Interview key personnel across Y-12 • Develop current state functional matrix and current state functional organization chart • Develop best practice functional matrix and best practice functional organization chart • Analyze differences and develop recommendations to use as input to Company restructuring initiatives and assignment of Design Authority	11/10/99	Craig	Complete/Report, "Y-12 Engineering Functional Analysis, Rev. 1"

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	B. Develop and issue a Company policy that clearly assigns Design Authority at Y-12 by: (LMES 1) • Develop draft Design Authority Policy assigning Design Authority to Engineering • LMES President approves Policy	12/6/99	Craig	Complete/LMES Policy Y12-020, *Policy on Design Authority*
	C. Identify and analyze gaps between current state critical Conduct of Engineering processes and procedures and those of best practice organization(s) and develop recommendations for improvement by: • Identify critical processes and procedures. This includes, but is not limited to: – Y17-001, Engineering, Design, and Construction Process – Y17-69-401, Engineering Process Interface for Projects – Y17-69-402, Minor Modifications – Y17-69-403, Minor Construction Modifications – Y17-69-404, Drawing Control Interface – Y15-187, Integrated Safety and Change Control Process – Y10-37-036, Configuration Management – Change Control Process – Y10-153, Temporary Modification Control – Y15-001INS, Grading Criteria for Y-12 Facility and Systems – Y74-809, Unreviewed Safety Question Determinations – EP-C-02, Squad Check for Design Drawing – EP-C-20, Design Analysis and Calculations – EP-C-22, Equipment Specifications • Perform functional decomposition of current state processes and procedures and ensure all quality procedures and processes are addressed	1/14/00	Craig	Complete/Report, "Y-12 Conduct of Engineering and Command Media Analysis"

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	• Perform best practice functional decomposition • Identify gaps, analyze and prioritize differences • Generate procedure revision schedule based on prioritization			
D.	Develop draft Implementation Plan that addresses the realignment of functions, assignment of Design Authority and recommendations for improvements in processes and procedures based on best practice organization(s).	2/1/00	Craig	Complete/Report, "Y-12 Design Authority Implementation Plan," draft 1/29/00
E.	Finalize the Implementation Plan to improve Conduct of Engineering at Y-12 by: • A Proposed Plan that will: – Define, establish, and communicate functional roles, responsibilities, and interfaces for implementing the new Design Authority Policy and improving Conduct of Engineering consistent with the revised LMES organizational structure. – Upgrade Engineering work processes and procedures to implement Design Authority and improve Conduct of Engineering by specifically addressing areas such as SSC grading, initiation of changes and change control, configuration management, design output for procurement and construction, technical oversight, non-conformances, and documentation and records. – Identify knowledge gaps, address qualifications and skills, and conduct training to address new and revised roles and responsibilities, processes, and procedures. – Establish a performance measurement system to monitor, analyze, and trend Engineering work process performance to provide feedback for performance improvement. – Develop an integrated schedule and estimate resources for implementing the Plan.	3/1/00	Craig	Complete

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	F. Present plan to senior management for acceptance and resource commitment	3/1/00	Craig	Complete
	G. Incorporate Implementation Plan into this corrective action plan	3/31/00	Craig	
	H. Welding			
	• Address MK-Ferguson concerns identified in 1998 Assessment of HF Supply Line Welding (HF SW-5)	6/24/99	Craig	Complete/Evidence Package, D. J. Etzler
5.	Configuration Management (CM) Program Review			
	A. Determine ownership of the configuration management process	11/30/99	Morrow	Complete
	B. Develop and submit to senior management for approval a Y-12 Configuration Management Program Description (Y/ES-110) that incorporates a lifecycle approach so that design, procurement, construction, and transition to Operations are integrated in the program. (ORO CM 1-7; HF Recommendation 6)	3/31/00	Craig/ assisted by Reed	
	C. Conduct a review of key CM implementing procedures/processes and identify modifications needed to meet requirements of the CM Program Description.	4/20/00	Craig/ assisted by Reed	
	D. Upgrade Y15-001INS, "Grading Criteria for Y-12 Facilities and Systems." The upgraded procedure shall incorporate: (a) Technical Operations ownership of the design basis documentation, (b) documentation of the SSC grading in a calculation format, (c) requirements to grade all new SSCs, including non-nuclear hazardous SSCs to new criteria. (HF CM 1, 3; HF CS-1)	5/31/00	Craig/ assisted by Crowley	
	E. Provide input to the engineering procedures and work processes that need revision or improvement to meet the CM requirements.	3/31/00	Reed	

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	F. Revise/develop and issue CM implementing procedures as necessary to meet the CM Program Description to extend the CM Program to design, procurement, construction, and turnover and to incorporate the design authority role. This includes but is not limited the following procedures: (LMES 7) • Y15-187, "Integrated Safety and Change Control process" • Y15-002, "Configuration Control of Equipment Data Sheets" • Y15-003, "Equivalency Evaluation" • Y60-705, "Acquisition, Control, and Traceability of Procured Safety SSCs" • EP-E-02, "Configuration Management" • EP-C-21, "Turnover Plans"	5/31/00	Craig/ assisted by Reed	
*6.	Quality Program Review.			
	A. Conduct independent assessment of LMES Quality Program, addressing the recommendations from the independent assessment of HF	10/31/99	Butz	Complete
	B. Develop an upgraded Quality Program based on the Quality Program Independent Assessment results and propose a structure and clear responsibilities for the Quality Assurance organization within Y-12 such that it meets ISM principles and expectations. Ensure the following are addressed as a minimum: (HF Recommendation 4, HF VQ-1, 2) • Roles and Responsibilities for Quality Assurance Supervisor with respect to the Project Team Charter and the PEP. • Roles and Responsibilities of personnel performing QA roles at vendor sites. • The prioritization of Field Quality Representative activities in QA surveillance plans	4/28/00	Butz	

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	• Project QA requirements to perform independent surveillances and audits as appropriate.			
	C. Develop a resource-loaded implementation schedule for the identified upgrades.	5/15/00	Butz	
	D. Obtain Senior Management approval of the upgraded LMES Quality Program.	6/01/00	Butz	
7.	Line Management Project responsibilities are clearly established. (LMES 1)			
	A. President of LMES will implement actions to:			
	• Clearly reiterate management expectations for procedural compliance throughout Y-12. (ORO-2; HF PR-3; HF CM 1, 2, 4; HF OP-1, 3)	10/28/99	Van Hook	Complete
	• Reorganize to establish a Technical Operations to focus on a consolidated and clarified Design Authority role and a Modernization organization to focus on the Project Management Process	1/17/00	Van Hook	Complete
	• Establish Senior Management lead for corrective action plan	11/30/99	Van Hook	Complete
	• Provide weekly reports on the status of the Project Management Corrective Action Plan to LMES President.	On-going	Crociata	
	• Conduct monthly review meetings with senior line managers on Project Management Corrective Action Plan status	On-going	Crociata	
	• Bring on a Senior Advisory Team of recognized Project Management experts to mentor DOE and LMES on project oversight and execution	11/99	Van Hook	Complete
	• Bring on experienced outside contractor to mentor EUO process-based restart	11/99	Van Hook	Complete
	B. Revise the Executive Steering Group (ESG) Charter to define the designated senior management steering groups for projects. The assignment of ESG designated personnel and their required reviews will be tailored to the project size, safety, complexity, and risks of the specific projects. (LMES 6, ORO PM-1; HF Rec 7)	4/30/00	Cochran	

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	C. Perform independent assessments of procedural compliance in selected Operations and Non-Operations organizations. (LMES 8)	4/7/00	Stalnaker	
	Section III. Review and Feedback of Y-12 Project Management Execution			
8.	Designate an outside expert team, Y-12 Modernization Project Advisory Team (Paul Rice, Chairman) and have them evaluate the capability of the current Y-12 Project Management Structure and processes. The evaluation will include review of issues identified in the HF independent assessment. (HF Recommendation 14)	Began 12/31/99	Morris	Complete (Rice/Bishop/O'Connor/ Wilmont/Stanley)
	A. Y-12 Modernization Project Advisory Team second review scheduled for 24 Jan visit.	1/24/00	Morris	Complete
	B. Y-12 Modernization Project Advisory Team conduct reviews of the institutional organizations that are crucial in project support and are applying significant corrective actions as the result of the assessment of the HF Project. These include Engineering, QA, Procurement, and Operations.	3/31/00	Morris	
	C. Based on the results of the Project Advisory Team members reviews, update this Corrective Action Plan as appropriate.	On-going	Crociata	
9.	HEU Storage Facility Project Management Review by the Y-12 Modernization Projects Advisory Team Recommended Actions/Path Forward for HEU Facility			
	A. Develop a short-term (6-moonth) schedule, including the specific resource loading requirements for accomplishment. This schedule must include all actions necessary to achieve high-quality project baselines, a satisfactory completion of work necessary to request customer approval of CD2, and all actions required ensuring high-quality RFP documents.	2/25/00	Herron	Complete
	B. Develop near-term actions that define and formalize the interfaces and roles and responsibilities of all project participants including the project execution team, senior Y-12 contractor and DOE management, and DP-20 key sponsors.	3/31/00	Herron/ Ooten	

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	C. Develop Functional and Operational Requirements in a manner that results in a clear picture of the fundamental basis for safety evaluation, design specifications, or the preparation of a design-build RFP.	4/28/00	Herron	
	D. Prepare and issue Project Procedures (See item 2, 3)	4/28/00	Herron	
	E. Complete facility systems identification and process descriptions			
	F. Upgrade current project organization charts, formal organization descriptions, and definitions of roles and responsibilities to establish a clear understanding of the "Project Team" definition and senior management sponsorship. (See item 1)	2/25/00	Herron	Complete
	G. Upgrade the Project Execution Plan (PEP) for the Highly Enriched Uranium Materials Facility project to meet basic PEP objectives. The following areas are to be addressed: • Define core project team members • Define the Senior Management interface for the HEU project • Identify project planning and scheduling resources to support ongoing project reporting, tracking and change control activities. • Review and upgrade the project technical and schedule baselines. • Incorporate a contemporary quantitative cost/schedule risk assessment to fully identify major risk areas, quantify the impact of these risks, and provide the needed input for risk management and risk mitigation plans.	3/31/00	Herron	

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10.	Enriched Uranium Operations (EUO) Startup Project Management Review by Paul Ricc/Leo Sain	11/11/99	Morris	Complete
	A. Recommended actions/Path Sequence for EUO Startup Project:	3/31/00	Conner	
	• Form the EUO Startup Project Core Team			
	• Immediately obtain additional Project/Scheduling resources.			
	• Develop 60-day Rolling Schedule with some near-term milestones.			
	• Develop a *simple* set of Project Procedures.			
	• Identify remaining scope and integrate into the schedule baseline.			
	• Estimate and resource load all work identified.			
	• Conduct a Quantitative Risk Assessment and Contingency Determination.			
	• Senior Project Management conduct a quality/completeness review of new baselines.			
	• Obtain formal signup/commitment to scope, schedule, and baselines.			
11.	Conduct independent assessments of selected non-Modernization ongoing projects and recently completed projects, specifically reviewing weaknesses identified during the HF Independent Assessment. (HF Recommendation 12, 13)	5/15/00	Altman	Independent Advisory Group will review results
	A. Lithium Process Replacement	9/99	Muenzer	Line Mgt. and PEG review complete
	• Crusher/Grinder	12/99		Line Mgt. and PEG review complete
	• Generators	12/99		Line Mgt. and PEG review complete
	• Kerf Collectors	1/00		Line Mgt. and PEG review complete
	• Machine Dust Dumping	2/00		
	• Deuterium Plant	4/00		
	• Reactors	5/00		
	• Evaporation/Neutralization			

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	B. Enriched Uranium Operations			
	• 9212 HP Vacuum Pump	3/00	Stone	
	• 9212 NFPA E-Wing Upgrade	3/00		
	C. Line Item Projects			
	• 3500-Ton Press	12/99	Altman	Complete
	• SMRI Upgrades	3/00		
	SECTION IV. Project Management Training Program and Lessons Learned			
12.	Train appropriate line managers on the results of the HFSS Independent Assessment. (IIF Recommendation 8)	10/29/99	Crociata	Complete
13.	A. Complete a review of the HFSS Independent Assessment and recommend appropriate training improvements or additions to the Y-12 training program. These are as follows: (LMES 8, DOE 1; HF Recommendation 9)	11/19/99	Ruth	
	B. Conduct Operations Training for appropriate personnel in Operations and Engineering, Procurement, and QA, and ET&I on: (HF CM-2; HF VQ 1, 2; HF Rec. 3, 5)	05/00	Ruth	
	• Chapter 1 Section IV.C and D: Organization Interface, Authorization Basis Maintenance			
	• Chapter 2.1 Section IV.C: Taking and Recording Data			
	• Chapter 8 Section IV.A and B: Designation of SSCs Requiring Control, Deficiency			
	• Chapter 10, Independent Verification			
	• Chapter 16, Procedure Use and Compliance (HF PR 1-3; HF TW 3; HF OP 1)			

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	• Configuration Management Process			
	• Non-Conformance Reports, Temporary Modification and Field Change Notice requirements (HF OP 2, 3, 4)			
	C. Conduct training as appropriate after approval of new Project Management Program Description, project procedures, and other LMES procedure changes (LMES 3)	05/00	Ruth	
	• Engineering and Project Teams (HF CS 2)			
	– Project Management Program and Process for management and project members			
	– Design Authority roles and responsibilities			
	– Role of originator, checker, and approver as applied to design drawings, specifications, and calculations			
	– Technical Baseline Training			
	– Change Control Process			
	– Acquisition, Control, and Traceability of procured Safety SSCs			
	– Engineering training on welding (HF TW 1)			
	➢ Implementation of ASME B31.3 inspection and nondestructive testing requirements (HF SW 3)			
	➢ Ensuring welder performance testing was adequate for the application (IIF SW 2)			
	➢ Implementation of ASME B31.3 inspecting and nondestructive testing requirements (HF SW 3)			
	➢ Implementation of ASME B31.3 record criteria for welds. (HF SW 4)			

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	• Procurement (HF PR 1, 2, 3)			Completed for HEU facility
	– Roles and Responsibilities			
	– Acquisition, Control, and Traceability of procured safety SSCs			
	• Quality Assurance			Completed for HEU facility
	– Roles and Responsibilities			
	– Audit and Surveillance performance training			
	• ET&I			
	– Roles and Responsibilities			
	– Audit and Surveillance performance training			
	D. Develop process to identify project-specific training for project core team members as identified in each PMP. (LMES 3)	6/1/00	Morris	Complete for HEU Project for Review of DOE Order 420.1, *Facility Safety*; Competitive Procurement Proposal Evaluation; DOE-STD-3024-98, *Systems Design Document*; UCNI Computing Overview; and Design Build Proposal Preparation
	E. Evaluate the incorporation into the corporate Lessons Learned program a process to identify problems with specific vendors and the procurement of services and equipment. (HF PR 4)	6/1/00	Morris	
	Section V. HF System Corrective Actions			
14.	EUO shall incorporate the specific findings and recommendations of the HF Independent Assessment into the overall EUO/PBR HFSS schedule of milestone events. (HF Rec 10; HF TW-1-3; HF SA 2-4; HF VQ-1, 2; HF CM-1, 2, 4, 5; HF OP-1-4; HF CS-1-4)	6/1/01	Conner	

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15.	Complete independent verification of technical baseline of the HF System prior to the system ORR. (HF Rec 11)	≈3/29/00	Stalnaker	

Notes:

- For the HF Independent Assessment findings, corrective action #11 in this plan indicates where the corrective action is identified in the EUO/PBR corrective action plan.
- The individual corrective actions are associated with the corresponding corrective action from the HF Independent Assessment, Y/MA-7534, DOE letter to the DNFSB, ORO Independent review of DP Projects, and HF Recommendation letter to DOE.
  - (LMES/DOE-X) reference is to root causes identified in DOE Letter to DNFSB
  - (ORO–X) reference is to findings identified in the ORO Independent Review of DP Projects
  - (HF Rec) reference is recommendations made in result of the HF investigation.
  - (HF XX-X) reference to the HF Investigation Report

Y-12 Modernization Projects Advisory Team Charter

February 25, 2000

Purpose

Ensure successful management of the planning and execution of major modernization, infrastructure, and expense projects at the Y-12 plant.

Goal

Review and evaluate major modernization construction projects. Review the Lockheed Martin Energy Systems and DOE-ORO DP organizations, procedures, and interfaces that are in place to support and execute major modernization, infrastructure and expense projects. Focus on planning, execution, programmatic interfaces (external and internal), DOE requirements, training, and support systems. Make recommendations to the President, Lockheed Martin Energy Systems, and the Manager, DOE-ORO.

Objectives

- Review planning processes, particularly integration of scope, deliverables, integrated safety management, milestones, and budget, to support programmatic needs and requirements.
- Review major projects from the perspective of evaluating strengths and weaknesses in the current project management approach and institutional support and identify potential systemic improvements, as appropriate.
- Examine management, organization, roles and responsibilities, and interfaces as they impact the planning and execution of major projects.
- Review the adequacy of policies, procedures, control systems, self-assessments, and underlying processes and support systems required for good project management.
- Assist Lockheed Martin Energy Systems and DOE-ORO DP in their development of contemporary project management tools and practices.

Guidelines

- The Modernization Projects Advisory Team reports to Robert Van Hook, President, Lockheed Martin Energy Systems and Leah Dever, Manager, DOE Oak Ridge Operations.
- Planned initial start of these activities is in December 1999, with follow up reviews conducted as necessary and appropriate.
- A report and recommendations will be delivered to the President, Lockheed Martin Energy Systems and the Manager, DOE-ORO upon the completion of each team review.
- From time to time, the President, Lockheed Martin Energy Systems or the Manager, DOE-ORO may request the assistance of individual advisory team members to provide input and advice targeted at specific project management improvement initiatives.

Advisory Team Members

Paul Rice, Project Management Consultant (Chair)
Bill Bishop, Project Management Consultant
Kevin O'Connor, Lockheed Martin Representative
Gary Stanley, Bechtel Savannah River
Ed Wilmot, DOE Representative

Panel Support

Mr. Tom Morris (Lockheed Martin Energy Systems)
Mr. Ron Ooten (DOE-ORO DP)
Mr. Joe Crociata (Lockheed Martin Energy Systems)

Leah Dever, Manager, DOE-ORO

Robert Van Hook, President, LMES

Lockheed Martin Energy Systems
Post Office Box 2009 Oak Ridge, TN 37831-8001
Telephone 423-574-3620 Facsimile 423-576-3806
E-mail: rvh@ornl.gov

LOCKHEED MARTIN

Robert I. Van Hook
President

March 3, 2000

Mr. Corey A. Cruz
Acting Assistant Manager for Defense Programs
Department of Energy, Oak Ridge Operations
Post Office Box 2001
Oak Ridge, Tennessee 37831

Dear Mr. Cruz:

Contract DE-AC05-84OR21400, Response to Project Planning and Execution Issues

In response to the Defense Nuclear Facilities Safety Board (DNFSB) concerns with Y-12 Plant project management, Lockheed Martin Energy Systems (LMES) submitted a letter on December 2, 1999, to your office identifying the contractor's root causes for these project management problems and a commitment to submit a Y-12 Project Management Corrective Action Plan (CAP). The enclosed LMES Project Management CAP (Enclosure 1) has been coordinated with members of your staff. Paul Rice has continued to provide advice and assistance related to the CAP to both LMES and the Department of Energy, Oak Ridge Operations Office (DOE-ORO).

In analyzing the Y-12 project issues that led to the sequence of events resulting in inadequate safety management and insufficient attention to technical safety issues, the underlying root causes were determined to be systemic. The results of the Hydrogen Fluoride Supply System (HFSS) Independent Assessment, a Y-12 Engineering Functional Analysis conducted by Duke Engineering and Services, and a review of the Y-12 Quality Program conducted by Lockheed Martin Corporation, identified findings that encompassed all aspects of project management. However, these reviews did share a common set of underlying root causes, including the failure to establish the fundamental guiding principles of Integrated Safety Management in the existing project management infrastructure and the need to expand project management corrective actions beyond the specific issues indicated by the HFSS project failures. Therefore, in developing the LMES Project Management CAP, we address not only the findings of the different assessments but specifically identify corrective actions that will significantly strengthen project management programs and make safety management an integral part of Project Management.

The Project Management CAP is focused on rebuilding and reinforcing the fundamental infrastructure of project processes and procedures, establishing unambiguous and appropriate interfaces between LMES and DOE, clearly defining and assigning project management roles and responsibilities, establishing senior management's leadership roles and responsibilities, developing and conducting required training and reviewing ongoing projects to ensure appropriate incorporation of planned corrective actions. Throughout the development and execution of the Project Management CAP, we will continue to use the assistance of a team of outside experts, including the Y-12 Modernization Project Advisory Team.

The Y-12 Modernization Project Advisory Team has been retained to advise and assist the DOE and LMES in their development of contemporary project management systems to ensure proper execution of major modernization and expense projects. The advisory team provides reviews and recommendations in critical project management areas including planning processes, execution, programmatic interfaces, DOE requirements, training, support systems, and proper incorporation of integrated safety management principles. Paul Rice chairs this advisory team. The team has met twice and provided reports with recommendations that have been shared with the DNFSB staff. In addition, Mr. Rice has provided individual assistance to the DOE and the contractor related to the development of the enclosed CAP. He has provided inputs related to the overall project management development strategy, the extent of corrective action plan coverage, priorities of corrective actions, and roles and responsibilities. The next advisory team review is scheduled for the week of March 13, 2000, and will focus on the progress and effectiveness of corrective actions to strengthen project management performance in engineering, quality assurance, procurement and operations.

For Leah Dever's review and approval, enclosed is the charter for the Modernization Project Advisory Team (Enclosure 2).

The LMES Project Management System CAP (Enclosure 1) is expected to be a working plan that will be revised and updated as we proceed with its execution. The specific corrective actions have been prioritized and resource loaded to focus on the critical items we need to get in place to support the execution of the Modernization Project and Enriched Uranium Restart.

If you have any questions on the details of the enclosures, please contact Joe Crociata at 574-3793, who is leading the development, implementation, and execution of the Project Management CAP.

Sincerely,

R. I. Van Hook

Robert I. Van Hook

RIVH:jvq

Enclosures: As Stated

c: E. J. Bergin
T. R. Butz
W. L. Clements
H. T. Conner, Jr.
D. F. Craig
T. W. Morris
M. K. Morrow
R. I. Van Hook
P. R. Wasilko

c/enc: J. P. Crociata – RC

PROJECT MANAGEMENT SYSTEM CORRECTIVE ACTION PLAN

SUMMARY

Section I. Project Management Program Description and Implementing Procedures

1. Project Management Program Description

   - Blueprint of desired end state
   - Project Management Process Incorporation of ISM: addressing ISM Guiding Principles and Core Functions
   - Management roles and responsibilities identified
   - Identify owner of Project Management Procedure Process
   - Project Team concept
   - Roles and responsibilities of Project Team
   - Core project members
   - Project Plan Process
   - Project Plan requirements tailored to Project
   - Addresses DOE requirements

2. Project Management "Project Plan Procedure"

   - Graded process; tailored based on project cost, schedule, risk, safety, etc.
   - Justification for "NA" required
   - Tailoring Process identified in applicable Project Procedures covering
     - Line Item Projects,
     - Capital/General Projects, and
     - Expense Projects
   - Meets DOE requirement

3. Project Management Specific Project Type Procedures

   - Address these project types:
     - Line Item Projects
     - Capital/General Projects
     - Expense Project
   - Tailoring process for project plans identified in project procedure

Section II. Organization-Specific Project Management Corrective Actions

4. Y-12 Conduct of Engineering Improvement Plan

   - Developed by Technical Operations in coordination with Duke Engineering
   - Based on best commercial nuclear practices and Y-12 mission needs compared with current engineering practices
   - Issue Company Policy on assignment of Design Authority
   - Gap Analysis based on comparison of best practices to current state used to develop recommendation to change key engineering procedures
   - Develop draft implementation plan to address realigning of functions, assignment of Design Authority, and improvements to processes and procedures
   - Implement Plan

5. Configuration Management

   - Assign ownership
   - Revise Y-12 Operational Configuration Management Plan to integrate project management configuration management requirements into program
   - Modify key Configuration Management Procedures to address project management configuration management

6. Quality Program

   - Conduct independent assessment
   - Based on independent assessment, propose structure and clear responsibilities for Quality Assurance
   - Develop implementation plan for identified changes

7. Line Management Responsibilities Clearly Identified

   - Reorganization established Technical Operations and Modernization Divisions
   - Senior Management lead for Project Management Corrective Action Plan
   - Revise Executive Steering Group charter to define Senior Management role in project planning and execution
   - Perform independent assessment of procedural compliance

Section III. Review and Feedback of Y-12 Project Management Execution

8. Designate Outside Expert Team, Y-12 Modernization Project Advisory Team

   - Evaluate capability of the current Y-12 Project Management structure and processes
   - Conduct reviews of organizational corrective actions to address HF Independent Assessment
   - Provide on-going results of review as an input for update to Corrective Action Plan

9. HEU Storage Facility Project Management Review (Y-12 Modernization Project Advisory Team)

   - Provide recommended actions/path forward

10. EUO Startup Project Management Review

    - Provide recommended actions/path forward for EUO Startup Project

11. Independent assessment of selected ongoing projects and recently completed projects

    - Basis is the weaknesses identified during HF Assessment
    - Results correlated and provide potential inputs to Corrective Action Plan

Section IV. Project Management Training Program and Lessons Learned

12. Train appropriate line managers on HF Independent Assessment results

13. Identify Project Management training for LMES

    - Based on HF Independent Assessment results, review current Y-12 Training Program and recommend improvements as appropriate
    - Conduct Conduct of Operations (CONOPS) training for Operations, Engineering, Procurement, Quality Assurance, and ET&I personnel
    - Conduct training on new Project Management process and procedures as appropriate
    - Develop process to identify project-specific training for project teams
    - Evaluate the incorporation into the corporate Lessons Learned program a process to identify problems with specific vendors and the procurement of services and equipment. (HF PR-4)

Section V. HF System Corrective Actions

14. EUO addresses specific findings and recommendations of HF Independent Assessment

15. Complete independent verification of Technical Baseline of HF system

Cross-Reference Root Causes with Corrective Action Plan

Root Causes	Corrective Action Plan Location
Contractor Root Causes	
1. Roles and responsibilities were not established to effectively execute projects. Design Authority is split among different organizations. (Defining work)	1.B(bullet 1), 2.E, 4.B, 6, 7.A and B
2. Project management authority was not commensurate with responsibilities. (Affects all Integrated Safety Management functions)	1.B(bullets 1, 5), 2.E, 6
3. Project management training and experience was not sufficient for the complexity and importance of projects. (Affects all Integrated Safety Management functions)	1.B(bullet 6), 2.C, 8, 9, 10, 11, 13
4. Issue resolution organization did not provide timely/dedicated support for decision making. (Feedback)	1.B(bullets 9, 13), 2.DD
5. Integration of project management with line function was not effective. (Affects all Integrated Safety Management functions)	1.B(bullets 1, 5)
6. A lack of senior management attention and focus existed. (Affects all integrated safety management functions)	1.B(bullets 3, 4), 7.B
7. There was a lack of control of program and functional requirements during project execution. (Defining work, analyzing hazards, establishing controls)	1.B (bullet 8), 2.S and U, 3, 5.D, 6
8. A lack of training and execution to established processes and procedures existed. (Establishing controls)	1.B(bullet 6), 2.C, 7.C, 8, 12, 13
Interface Between DOE and the Contractor	
1. DOE and contractor procedures were not effectively aligned/integrated. (All Integrated Safety Management functions affected.)	1.A
2. Interfaces/points of contact between DOE and the contractor were not well defined. (All Integrated Safety Management functions affected.)	1.A, 1.B(bullet 1), 2.E

PROJECT MANAGEMENT SYSTEM CORRECTIVE ACTION PLAN

NO.	ISSUE DESCRIPTION * Indication of Y-12 institutional issue being addressed on project interface (*) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	Section I. Project Management Program Description and Implementing Procedures			
1.	Develop and issue a Y-12 project management program description that incorporates lessons learned from other DOE projects and best commercial practices and the recommendations of the outside expert team (Y-12 Modernization Project Advisory Team) as appropriate			
	A. Align/integrate DOE and contractor Project Management Program Procedures and define interfaces/points of contact between DOE and the contractor (DOE/LMES I-1, DOE/LMES 1-2) to accomplish: • DOE issue Construction Project Management Plan (CPMP) to define roles and responsibilities and interfaces for project. • Incorporate CPMP roles and responsibilities and interfaces into LMES Project Management Program Description. • Identify and review other DOE procedures to ensure requirement reflected in LMES Project Management Program Description (DOE 2).	6/1/00	Morris/ Ooten	
	B. Develop a Project Management Program Description Document that is based on DOE Order 430.1A, (LCAM), DOE Construction Project Management Plan (draft), existing Y-12 project management procedures, fundamentals of ISM DOE Policy 450.4, and best practices of DOE and commercial projects. The Program description will include but is not limited to: (LMES 7; ORO PM 1, 2) Line management is responsible for safety: • Define the Project Management ISM Roles and Responsibilities of Line Management, Engineering, Design Authority, Project Management, Facility/Criticality Safety, Quality Assurance, etc. (LMES 1, 5; ORO Vendor Quality 1-4; HF Recommendation 1)	3/31/00	Burdett/ Crociata	

NO.	ISSUE DESCRIPTION Indication of Y-12 institutional issue being addressed on project interface (*) Indicates cross-walk of Root Causes, findings and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion

- Identify ownership of Project Management Procedure Process

- Define the project-specific Senior Management Team (General Manager, responsible Line Manager, Technical Operations Director, and others as required) to interface with the individual Project Management. (LMES 5)

- Define the LMES Senior Management [Executive Steering Group (ESG)] Roles and Responsibilities for projects. (LMES 6)

Clear roles and responsibilities must be articulated:

- Define the project team core members, basic roles, responsibilities, and authority. (LMES 1, 2)

Competence must be commensurate with responsibilities assigned:

- Identify the process for development of baseline training and qualification requirements for Project Management Personnel and project team members. (HF Recommendation 2)

Balanced priorities must be set:
Hazards controls must be tailored to the work performed:
Operations must be authorized:

- Identify the Project Plan as an implementation blueprint for project execution, organization, and administrative strategy. The tailoring of Project Plan requirements will be based on cost, risk safety, and schedule, etc.

- Define the process for selecting, tailoring, approving, training, and change control for project-specific procedures

- Identify the process and responsibilities that will be utilized to track and resolve technical and administrative issues (LMES 4)

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface ( ) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	Safety standards and requirements must be identified: • Define a clear description of the hierarchy of project policies, procedures, and plans that would include the relationships to institutional procedures and plans (LMES/DOE interfaces plans and procedures, PEP, CPMP) • Identify minimum requirements (contractual, legal, SRIDs, etc.) • Define Program description change process. • Summarize the execution of the ISM Core Functions Wheel during the completion of the five critical decision phases of project execution. (Develop the requirements, Plan the work, Endorse the project, Execute the work, Transition and closeout)			
2.	Project Plans will be prepared for each specific project. The sections of the Project Plan are addressed in Y13-XXX INS. The Y13-XXX INS series will also contain project management procedures covering project execution processes and requirements and provides guidance for tailoring the project plan to the specific project. A checklist will be used to identify the required elements of the project plan. Where project cost, schedule, risks, safety, etc. do not require a specific element, "NA" shall be entered and justification provided in the remarks section of the checklist for each NA prior to approval of the Project Plan. The following Project Plan sections will be addressed: A. Mission need justification B. Project description summary of technical and functional performance objectives for the project, as well as Project Baselines (technical, cost and schedule) (ORO PM 1) C. Specific training of project team members for the associated project (LMES 3) D. Systems Engineering requirements.	4/15/00	Morris	

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface (*) Indicates cross-walk of Root Causes, findings and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	E. Project Management Team approach and specific system to be used including: (LMES 2) • Detailed organization structure, • Roles and responsibilities and authorities, including decision authority from Headquarters and DOE Field Element program, and • Project Management Team support functions (expanded team) such as health physics, safety, NEPA, etc. F. Engineering trade-off studies G. System Design Description Process H. Resource Plan including a short description of funding and expenditure plans to include the total project cost profile, budget by funding category, and total project cost plan. I. Identification of project-specific procedures and plans. J. Project controls system and reporting. (LMES 8) K. A Work Breakdown Structure to working level 3 elements L. A schedule listing of major events, with a discernible critical path, major milestones, Critical Decision points, and their anticipated approval dates. M. Line Management develop as appropriate a list of required Process Descriptions and the scheduled completion dates. N. The process for PSAR/SAR development and approval. (HF SA 1, 2) O. Identification and documentation of Criticality Safety evaluations, requirements, and inspections/test (HF CS 3, 4) P. Identification and documentation of SSCs in the PHA, Design Specifications, and QA Surveillance Plans (HF SA 3, 4)			

NO.	ISSUE DESCRIPTION * Indication of Y-12 institutional issue being addressed on project interface ( ) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	Q. QA Plan (HF CM 4)			
	R. Risk Assessment and Risk Management Plan			
	S. Configuration Management Plan			
	T. Acquisition Strategy			
	U. The approval/signature requirements for all members of the project team.			
	V. Use of contingencies			
	W. References to applicable Department of Energy Orders and Standards (HF SA 1)			
	X. Earned value measuring tools to be used to evaluate project controls.			
	Y. Testing and acceptance criteria (HF CM 3)			
	Z. Technical Baseline Requirements			
	AA. Transition Plan (HF OP 1)			
	BB. Operations Readiness Requirements for operation of equipment or facilities			
	CC. Change Control Process (HF CM 1)			
	DD. Identify the methodology to resolve technical and administrative issues (LMES 4; HF CM 5)			
	EE. Waste Management Plan			
	FF. Security Plan			

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface (0) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
3.	Develop site-wide procedures, Y13-XXX INS, to address: Line Item Projects, Capital Equipment Projects/General Plant Projects, and Expense Projects specifically addressing the requirements of the tailoring for project plans. A. Line Item Projects (Y13-XXXINS) issued. • PEP identified as subset of Project Plan. B. Capital Equipment Projects/General Plant Projects (Y13-XXXINS) issued. C. Expense projects (Y13-XXXINS) issued.	4/15/00	Morris	
	Section II. Organization-Specific Project Management Corrective Actions			
*4.	Technical Operations, with support from Duke Engineering, is developing and implementing a Y-12 Conduct of Engineering Improvement Project to improve Y-12 Conduct of Engineering based on best commercial nuclear practices and Y-12 mission needs (HF Recommendation 3): A. Compare the current state engineering functions at Y-12 with best practice organization(s) and develop recommendations for improvement that is based on: • Interview key personnel across Y-12 • Develop current state functional matrix and current state functional organization chart • Develop best practice functional matrix and best practice functional organization chart • Analyze differences and develop recommendations to use as input to Company restructuring initiatives and assignment of Design Authority	11/10/99	Craig	Complete/Report, "Y-12 Engineering Functional Analysis, Rev. 1"

NO.	ISSUE DESCRIPTION Indication of Y-12 institutional issue being addressed on project interface (•) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	B. Develop and issue a Company policy that clearly assigns Design Authority at Y-12 by: (LMES 1) • Develop draft Design Authority Policy assigning Design Authority to Engineering • LMES President approves Policy	12/6/99	Craig	Complete/LMES Policy Y12-020, *Policy on Design Authority*
	C. Identify and analyze gaps between current state critical Conduct of Engineering processes and procedures and those of best practice organization(s) and develop recommendations for improvement by: • Identify critical processes and procedures. This includes, but is not limited to: – Y17-001, Engineering, Design, and Construction Process – Y17-69-401, Engineering Process Interface for Projects – Y17-69-402, Minor Modifications – Y17-69-403, Minor Construction Modifications – Y17-69-404, Drawing Control Interface – Y15-187, Integrated Safety and Change Control Process – Y10-37-036, Configuration Management – Change Control Process – Y10-153, Temporary Modification Control – Y15-001INS, Grading Criteria for Y-12 Facility and Systems – Y74-809, Unreviewed Safety Question Determinations – EP-C-02, Squad Check for Design Drawing – EP-C-20, Design Analysis and Calculations – EP-C-22, Equipment Specifications • Perform functional decomposition of current state processes and procedures and ensure all quality procedures and processes are addressed	1/14/00	Craig	Complete/Report, "Y-12 Conduct of Engineering and Command Media Analysis"

NO.	ISSUE DESCRIPTION * Indication of Y-12 institutional issue being addressed on project interface. (#) Indicates cross-walk of Root Causes, findings, and recommendations (see note 1)	Date Due	Manager	Status/Evidence of Completion
	• Perform best practice functional decomposition • Identify gaps, analyze and prioritize differences • Generate procedure revision schedule based on prioritization			
D.	Develop draft Implementation Plan that addresses the realignment of functions, assignment of Design Authority and recommendations for improvements in processes and procedures based on best practice organization(s).	2/1/00	Craig	Complete/Report, "Y-12 Design Authority Implementation Plan," draft 1/29/00
E.	Finalize the Implementation Plan to improve Conduct of Engineering at Y-12 by: • A Proposed Plan that will: – Define, establish, and communicate functional roles, responsibilities, and interfaces for implementing the new Design Authority Policy and improving Conduct of Engineering consistent with the revised LMES organizational structure. – Upgrade Engineering work processes and procedures to implement Design Authority and improve Conduct of Engineering by specifically addressing areas such as SSC grading, initiation of changes and change control, configuration management, design output for procurement and construction, technical oversight, non-conformances, and documentation and records. – Identify knowledge gaps, address qualifications and skills, and conduct training to address new and revised roles and responsibilities, processes, and procedures. – Establish a performance measurement system to monitor, analyze, and trend Engineering work process performance to provide feedback for performance improvement. – Develop an integrated schedule and estimate resources for implementing the Plan.	3/1/00	Craig	Complete

NO.	ISSUE DESCRIPTION (*) Indication of Y-12 institutional issue being addressed on project interface (#) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1.	Date Due	Manager	Status/Evidence of Completion
	F. Present plan to senior management for acceptance and resource commitment	3/1/00	Craig	Complete
	G. Incorporate Implementation Plan into this corrective action plan	3/31/00	Craig	
	H. Welding			
	• Address MK-Ferguson concerns identified in 1998 Assessment of HF Supply Line Welding (HF SW-5)	6/24/99	Craig	Complete/Evidence Package, D. J. Etzler
5.	Configuration Management (CM) Program Review			
	A. Determine ownership of the configuration management process	11/30/99	Morrow	Complete
	B. Develop and submit to senior management for approval a Y-12 Configuration Management Program Description (Y/ES-110) that incorporates a lifecycle approach so that design, procurement, construction, and transition to Operations are integrated in the program. (ORO CM 1-7; HF Recommendation 6)	3/31/00	Craig/ assisted by Reed	
	C. Conduct a review of key CM implementing procedures/processes and identify modifications needed to meet requirements of the CM Program Description.	4/20/00	Craig/ assisted by Reed	
	D. Upgrade Y15-001INS, "Grading Criteria for Y-12 Facilities and Systems." The upgraded procedure shall incorporate: (a) Technical Operations ownership of the design basis documentation, (b) documentation of the SSC grading in a calculation format, (c) requirements to grade all new SSCs, including non-nuclear hazardous SSCs to new criteria. (HF CM 1, 3; HF CS-1)	5/31/00	Craig/ assisted by Crowley	
	E. Provide input to the engineering procedures and work processes that need revision or improvement to meet the CM requirements.	3/31/00	Reed	

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface (#) Indicates cross-walk of Root Causes, findings, and recommendations; see note 1	Date Due	Manager	Status/Evidence of Completion
	F. Revise/develop and issue CM implementing procedures as necessary to meet the CM Program Description to extend the CM Program to design, procurement, construction, and turnover and to incorporate the design authority role. This includes but is not limited the following procedures: (LMES 7) • Y15-187, "Integrated Safety and Change Control process" • Y15-002, "Configuration Control of Equipment Data Sheets" • Y15-003, "Equivalency Evaluation" • Y60-705, "Acquisition, Control, and Traceability of Procured Safety SSCs" • EP-E-02, "Configuration Management" • EP-C-21, "Turnover Plans"	5/31/00	Craig/ assisted by Reed	
*6.	Quality Program Review.			
	A. Conduct independent assessment of LMES Quality Program, addressing the recommendations from the independent assessment of HF	10/31/99	Butz	Complete
	B. Develop an upgraded Quality Program based on the Quality Program Independent Assessment results and propose a structure and clear responsibilities for the Quality Assurance organization within Y-12 such that it meets ISM principles and expectations. Ensure the following are addressed as a minimum: (HF Recommendation 4, HF VQ-1, 2) • Roles and Responsibilities for Quality Assurance Supervisor with respect to the Project Team Charter and the PEP. • Roles and Responsibilities of personnel performing QA roles at vendor sites. • The prioritization of Field Quality Representative activities in QA surveillance plans	4/28/00	Butz	

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface ( ) Indicates cross-walk of Root Causes, findings, and recommendations; see note 1	Date Due	Manager	Status/Evidence of Completion
	• Project QA requirements to perform independent surveillances and audits as appropriate.			
	C. Develop a resource-loaded implementation schedule for the identified upgrades.	5/15/00	Butz	
	D. Obtain Senior Management approval of the upgraded LMES Quality Program.	6/01/00	Butz	
7.	Line Management Project responsibilities are clearly established. (LMES 1)			
	A. President of LMES will implement actions to:			
	• Clearly reiterate management expectations for procedural compliance throughout Y-12. (ORO-2; HF PR-3; HF CM 1, 2, 4; HF OP-1, 3)	10/28/99	Van Hook	Complete
	• Reorganize to establish a Technical Operations to focus on a consolidated and clarified Design Authority role and a Modernization organization to focus on the Project Management Process	1/17/00	Van Hook	Complete
	• Establish Senior Management lead for corrective action plan	11/30/99	Van Hook	Complete
	• Provide weekly reports on the status of the Project Management Corrective Action Plan to LMES President.	On-going	Crociata	
	• Conduct monthly review meetings with senior line managers on Project Management Corrective Action Plan status	On-going	Crociata	
	• Bring on a Senior Advisory Team of recognized Project Management experts to mentor DOE and LMES on project oversight and execution	11/99	Van Hook	Complete
	• Bring on experienced outside contractor to mentor EUO process-based restart	11/99	Van Hook	Complete
	B. Revise the Executive Steering Group (ESG) Charter to define the designated senior management steering groups for projects. The assignment of ESG designated personnel and their required reviews will be tailored to the project size, safety, complexity, and risks of the specific projects. (LMES 6, ORO PM-1; HF Rec 7)	4/30/00	Cochran	

NO.	ISSUE DESCRIPTION (*) Indication of Y-12 institutional issue being addressed on project interface (#) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1.	Date Due	Manager	Status/Evidence of Completion
	C. Perform independent assessments of procedural compliance in selected Operations and Non-Operations organizations. (LMES 8)	4/7/00	Stalnaker	
	Section III. Review and Feedback of Y-12 Project Management Execution			
8.	Designate an outside expert team, Y-12 Modernization Project Advisory Team (Paul Rice, Chairman) and have them evaluate the capability of the current Y-12 Project Management Structure and processes. The evaluation will include review of issues identified in the HF independent assessment. (HF Recommendation 14)	Began 12/31/99	Morris	Complete (Rice/Bishop/O'Connor/ Wilmont/Stanley)
	A. Y-12 Modernization Project Advisory Team second review scheduled for 24 Jan visit.	1/24/00	Morris	Complete
	B. Y-12 Modernization Project Advisory Team conduct reviews of the institutional organizations that are crucial in project support and are applying significant corrective actions as the result of the assessment of the HF Project. These include Engineering, QA, Procurement, and Operations.	3/31/00	Morris	
	C. Based on the results of the Project Advisory Team members reviews, update this Corrective Action Plan as appropriate.	On-going	Crociata	
9.	HEU Storage Facility Project Management Review by the Y-12 Modernization Projects Advisory Team Recommended Actions/Path Forward for HEU Facility			
	A. Develop a short-term (6-moonth) schedule, including the specific resource loading requirements for accomplishment. This schedule must include all actions necessary to achieve high-quality project baselines, a satisfactory completion of work necessary to request customer approval of CD2, and all actions required ensuring high-quality RFP documents.	2/25/00	Herron	Complete
	B. Develop near-term actions that define and formalize the interfaces and roles and responsibilities of all project participants including the project execution team, senior Y-12 contractor and DOE management, and DP-20 key sponsors.	3/31/00	Herron/ Ooten	

NO.	ISSUE DESCRIPTION (*) Indication of Y-12 institutional issue being addressed on project interface (#) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1.	Date Due	Manager	Status/Evidence of Completion
	C. Develop Functional and Operational Requirements in a manner that results in a clear picture of the fundamental basis for safety evaluation, design specifications, or the preparation of a design-build RFP.	4/28/00	Herron	
	D. Prepare and issue Project Procedures (See item 2, 3)	4/28/00	Herron	
	E. Complete facility systems identification and process descriptions			
	F. Upgrade current project organization charts, formal organization descriptions, and definitions of roles and responsibilities to establish a clear understanding of the "Project Team" definition and senior management sponsorship. (See item 1)	2/25/00	Herron	Complete
	G. Upgrade the Project Execution Plan (PEP) for the Highly Enriched Uranium Materials Facility project to meet basic PEP objectives. The following areas are to be addressed: • Define core project team members • Define the Senior Management interface for the HEU project • Identify project planning and scheduling resources to support ongoing project reporting, tracking and change control activities. • Review and upgrade the project technical and schedule baselines. • Incorporate a contemporary quantitative cost/schedule risk assessment to fully identify major risk areas, quantify the impact of these risks, and provide the needed input for risk management and risk mitigation plans.	3/31/00	Herron	

NO.	ISSUE DESCRIPTION (*)Indication of Y-12 institutional issue being addressed on project interface (§)Indicates cross-walk of Root Causes, findings, and recommendations; see note 1	Date Due	Manager	Status/Evidence of Completion
10.	Enriched Uranium Operations (EUO) Startup Project Management Review by Paul Rice/Leo Sain	11/11/99	Morris	Complete
	A. Recommended actions/Path Sequence for EUO Startup Project:	3/31/00	Conner	
	• Form the EUO Startup Project Core Team			
	• Immediately obtain additional Project/Scheduling resources.			
	• Develop 60-day Rolling Schedule with some near-term milestones.			
	• Develop a *simple* set of Project Procedures.			
	• Identify remaining scope and integrate into the schedule baseline.			
	• Estimate and resource load all work identified.			
	• Conduct a Quantitative Risk Assessment and Contingency Determination.			
	• Senior Project Management conduct a quality/completeness review of new baselines.			
	• Obtain formal signup/commitment to scope, schedule, and baselines.			
11.	Conduct independent assessments of selected non-Modernization ongoing projects and recently completed projects, specifically reviewing weaknesses identified during the HF Independent Assessment. (HF Recommendation 12, 13)	5/15/00	Altman	Independent Advisory Group will review results
	A. Lithium Process Replacement	9/99	Muenzer	Line Mgt. and PEG review complete
	• Crusher/Grinder	12/99		Line Mgt. and PEG review complete
	• Generators	12/99		Line Mgt. and PEG review complete
	• Kerf Collectors	1/00		Line Mgt. and PEG review complete
	• Machine Dust Dumping	2/00		
	• Deuterium Plant	4/00		
	• Reactors	5/00		
	• Evaporation/Neutralization			

NO.	ISSUE DESCRIPTION Indication of Y-12 institutional issue being addressed on project interface ( ) Indicates cross-walk of Root Causes, findings, and recommendations; see note 1	Date Due	Manager	Status/Evidence of Completion
	B. Enriched Uranium Operations			
	• 9212 HP Vacuum Pump • 9212 NFPA E-Wing Upgrade	3/00 3/00	Stone	
	C. Line Item Projects			
	• 3500-Ton Press • SMRI Upgrades	12/99 3/00	Altman	Complete
	SECTION IV. Project Management Training Program and Lessons Learned			
12.	Train appropriate line managers on the results of the HFSS Independent Assessment. (HF Recommendation 8)	10/29/99	Crociata	Complete
13.	A. Complete a review of the HFSS Independent Assessment and recommend appropriate training improvements or additions to the Y-12 training program. These are as follows: (LMES 8, DOE 1; HF Recommendation 9)	11/19/99	Ruth	
	B. Conduct Operations Training for appropriate personnel in Operations and Engineering, Procurement, and QA, and ET&I on: (HF CM-2; HF VQ 1, 2; HF Rec. 3, 5)	05/00	Ruth	
	• Chapter 1 Section IV.C and D: Organization Interface, Authorization Basis Maintenance			
	• Chapter 2.1 Section IV.C: Taking and Recording Data			
	• Chapter 8 Section IV.A and B: Designation of SSCs Requiring Control, Deficiency			
	• Chapter 10, Independent Verification			
	• Chapter 16, Procedure Use and Compliance (HF PR 1-3; HF TW 3; HF OP 1)			

NO.	[redacted] ISSUE DESCRIPTION Indication of Y-12 institutional issue being addressed on project interface (-) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1.	Date Due	Manager	Status/Evidence of Completion
	• Configuration Management Process			
	• Non-Conformance Reports, Temporary Modification and Field Change Notice requirements (HF OP 2, 3, 4)			
C.	Conduct training as appropriate after approval of new Project Management Program Description, project procedures, and other LMES procedure changes (LMES 3)	05/00	Ruth	
	• Engineering and Project Teams (HF CS 2)			
	– Project Management Program and Process for management and project members			
	– Design Authority roles and responsibilities			
	– Role of originator, checker, and approver as applied to design drawings, specifications, and calculations			
	– Technical Baseline Training			
	– Change Control Process			
	– Acquisition, Control, and Traceability of procured Safety SSCs			
	– Engineering training on welding (HF TW 1)			
	➢ Implementation of ASME B31.3 inspection and nondestructive testing requirements (HF SW 3)			
	➢ Ensuring welder performance testing was adequate for the application (HF SW 2)			
	➢ Implementation of ASME B31.3 inspecting and nondestructive testing requirements (HF SW 3)			
	➢ Implementation of ASME B31.3 record criteria for welds. (HF SW 4)			

NO.	ISSUE DESCRIPTION *Indication of Y-12 institutional issue being addressed on project interface. (.) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
	• Procurement (HF PR 1, 2, 3)			Completed for HEU facility
	– Roles and Responsibilities			
	– Acquisition, Control, and Traceability of procured safety SSCs			
	• Quality Assurance			Completed for HEU facility
	– Roles and Responsibilities			
	– Audit and Surveillance performance training			
	• ET&I			
	– Roles and Responsibilities			
	– Audit and Surveillance performance training			
	D. Develop process to identify project-specific training for project core team members as identified in each PMP. (LMES 3)	6/1/00	Morris	Complete for HEU Project for Review of DOE Order 420.1, *Facility Safety*; Competitive Procurement Proposal Evaluation; DOE-STD-3024-98, *Systems Design Document*; UCNI Computing Overview; and Design Build Proposal Preparation
	E. Evaluate the incorporation into the corporate Lessons Learned program a process to identify problems with specific vendors and the procurement of services and equipment. (HF PR 4)	6/1/00	Morris	
	Section V. HF System Corrective Actions			
14.	EUO shall incorporate the specific findings and recommendations of the HF Independent Assessment into the overall EUO/PBR HFSS schedule of milestone events. (HF Rec 10; HF TW-1-3; HF SA 2-4; HF VQ-1, 2; HF CM-1, 2, 4, 5; HF OP-1-4; HF CS-1-4)	6/1/01	Conner	

NO.	ISSUE DESCRIPTION Indication of Y-12 institutional issue being addressed on project interface (#) Indicates cross-walk of Root Causes, findings, and recommendations, see note 1	Date Due	Manager	Status/Evidence of Completion
15.	Complete independent verification of technical baseline of the HF System prior to the system ORR. (HF Rec 11)	≈3/29/00	Stalnaker	

Notes:

- For the HF Independent Assessment findings, corrective action #11 in this plan indicates where the corrective action is identified in the EUO/PBR corrective action plan.
- The individual corrective actions are associated with the corresponding corrective action from the HF Independent Assessment, Y/MA-7534, DOE letter to the DNFSB, ORO Independent review of DP Projects, and HF Recommendation letter to DOE.
  - (LMES/DOE-X) reference is to root causes identified in DOE Letter to DNFSB
  - (ORO–X) reference is to findings identified in the ORO Independent Review of DP Projects
  - (HF Rec) reference is recommendations made in result of the HF investigation.
  - (HF XX-X) reference to the HF Investigation Report

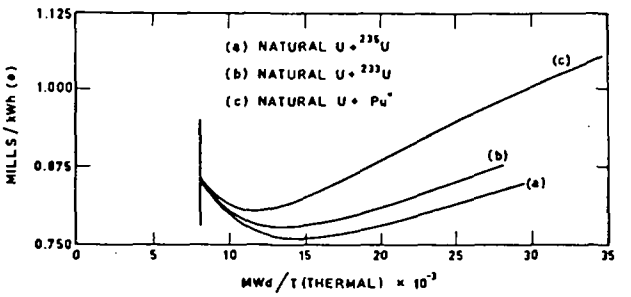

FIG. 9. Natural uranium with various fissile materials

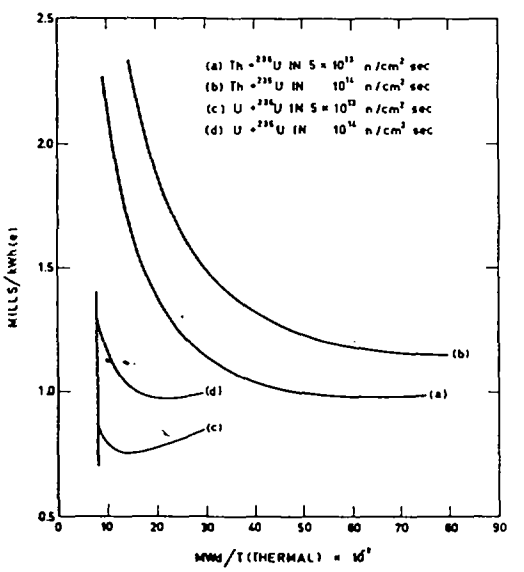

FIG. 10. Effect of flux

for ^{238}U and ^{232}Th using ^{235}U as the fissile material. Clearly, inventory charges and spent fuel credit are major contributors to the total fuel cost for ^{232}Th.

Use of various fissile materials

For the purposes of this general survey it has been assumed that any fissile material introduced will be irradiated in the same spectrum and for the same length of time as the fertile material. For ^{235}U and ^{233}U used as enrichment with thorium, this is probably a reasonable assumption to make since these fissile materials would very likely be intimately mixed with

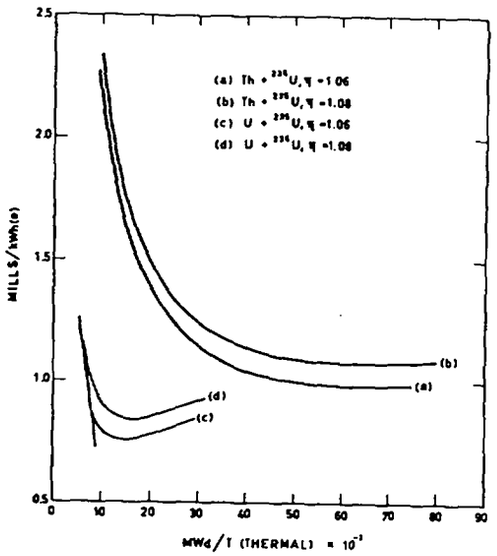

FIG. 11. Effect of flux without rating dependence

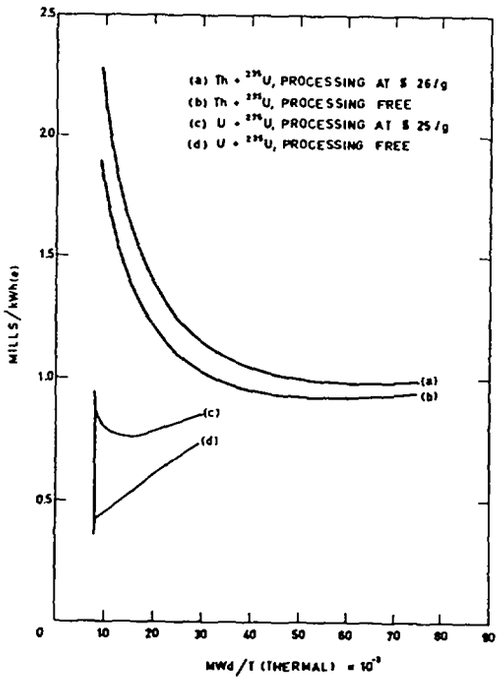

FIG. 12. Processing costs

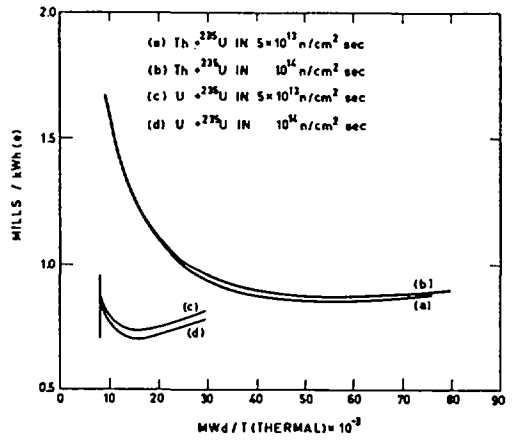

FIG. 13. Neutron economy

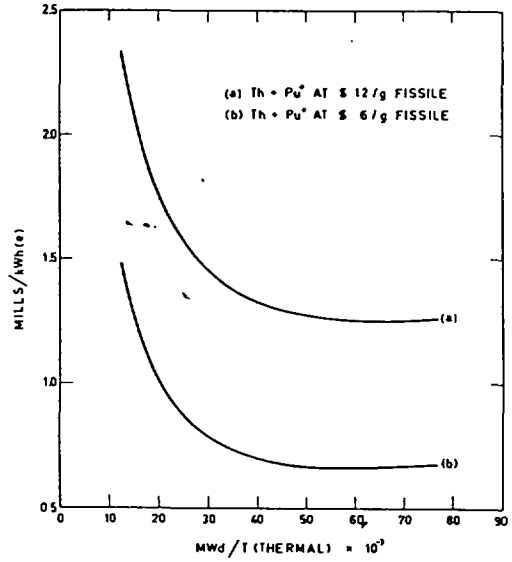

FIG. 14. Plutonium price

thorium. The $\bar{\eta}$-values for ^{235}U and ^{233}U fall to 1.06 after about 4.0 and 4.7 n/kb respectively and so would have received about their optimum irradiation when the thorium fuel was removed for processing. Plutonium (or Pu* as it will be called, being plutonium which has been extracted from natural uranium at a burn-up of about 8400 MWd/t) has an $\bar{\eta}$-value of 1.06 at 1.7 n/kb so it would be unreasonable to irradiate it much further since it

Total fuel costs for thorium with different fissile materials are plotted in Fig. 8 as a function of burn-up. Curves (a) and (b) with ^{235}U and ^{233}U as enrichment show similar costs. The Pu* curve (c) shows the consequences of using Pu* as a uniform enrichment where even at lower burn-ups (where $\bar{\eta}$ (Pu*) > 1.06) the cost is high compared with ^{235}U enrichment. This is due partly to the higher fabrication costs necessitated by the high fission cross-section of ^{239}Pu and partly to the difference in price at which plutonium is bought and allowed for as a credit in spent fuel. At higher irradiations parasitic absorption in fission products becomes more important. While there is also a difference in cost and credit value of ^{233}U this is compensated by a better $\bar{\eta}$-value of ^{233}U so that the fuel costs are very similar for ^{233}U and ^{235}U.

Results for natural uranium enriched with fissile material are shown in Fig. 9. The behaviour is basically the same as with thorium but on a different scale. Natural uranium contains sufficient 'free' ^{235}U for burn-ups of the order of 9000 MWd/t to be possible without further enrichment, so we do not have the problem of providing large quantities of enrichment to start up a reactor. Inventory charges are thus low and the total fuel costs are lower than those in Fig. 8. However, plutonium is not so good a fissile material as ^{233}U, so that with ^{238}U instead of ^{232}Th as the fertile material minimum fuel costs are obtained at much lower burn-ups (~ 14 000 MWd/t). ^{235}U compares favourably with ^{233}U when used to enrich natural uranium. This is primarily owing to the low cost of ^{235}U for these low enrichments (Fig. 2).

Variation of flux

Figure 10 shows the dependence of the fuel cost on flux for thorium and natural uranium enriched with ^{235}U. Several factors contribute to this variation.

(a) Xenon absorption increases with flux, reducing the effective $\bar{\eta}$ of the fuel. This is a small effect.

(b) For the same reason ^{239}Np hold-up in ^{238}U and ^{233}Pa hold-up in ^{232}Th become more important as the flux is raised. The ^{239}Np effect is relatively small because of its short half-life (2.35 d compared to 27 d for ^{233}Pa).

(c) In a high flux less fuel will be required to produce a given power output, although it will of course need to be changed more often. Therefore interest charges on the fuel inventory will be lower. In a thorium reactor containing very expensive fuel the inventory charges contribute a bigger percentage to the total fuel cost than is the case with uranium so there may be a greater incentive to go to higher fluxes even at the expense of increased absorption in ^{233}Pa.

(d) The simplified formulation adopted for the fuel fabrication costs in this report is such that the advantage of increasing the flux to lower the inventory charges is outweighed by the extra fabrication cost incurred. If the flux is doubled to halve the inventory charges the heat rating of the fuel must also be doubled. This calls for very thin fuel pencils with a consequent high fabrication cost. Even with a flux of 5×10^{13} n/cm^2 s as in the Douglas Point reactor, the heat rating with a thorium fuel would be at least double that for uranium and a 37-element rod design would probably be required.

Processing costs

At present in Canada no fuel processing is carried out on a commercial scale and processing costs in the United States are high enough so that it is barely worthwhile to process spent natural uranium. At \$25/kg the cost of extraction of Pu* at 4 g/kg is \$6.25/g. The fissile content is 69% so the cost of extraction is about \$9/g of fissile material compared to the value of \$10/g which we have assigned to it. In the thorium fuel cases 14 g/kg of fuel of ^{233}U are obtained for a processing charge of \$26/kg. The extraction cost of ^{233}U is thus only \$2/g compared to the value of \$12/g we have assigned to it. Thus processing will be an essential part of any thorium fuel cycle with the cost of processing contributing only a small fraction to the total fuel costs. Since the processing costs represent a much higher fraction of the cost of a uranium-plutonium fuel cycle, a reduction in the cost of processing could give the uranium-plutonium fuel cycle a big advantage. Figure 12 indicates the limiting size of this effect by showing fuel costs for thorium and natural uranium enriched with ^{235}U. Separate curves compare results when the processing costs \$26/kg and \$25/kg are assumed, and when these costs are zero. For natural uranium this represents a saving of ~ 50%, whereas for thorium irradiated to 40 000 MWd/t the saving is about 10%. As more reactors come into operation and the quantity of fuel to be processed increases, the processing cost will decrease significantly [4]. Spent fuel will be rejected from the Douglas Point reactor at a rate of 1 t/12 d and the \$25/kg cost is based on a throughput of 1 t/d. It is not likely therefore that a processing plant operating at 80% utilization would be built in Canada until the installed capacity of nuclear reactors is at least ten times that of CANDU, or 7000 MW(th).

Other input parameters

(a) Interest rate

A rate of 5% has been used throughout. This could be rather low and if so would bias the results in favour of the thorium fuel. An increase from 5% to 7% in interest rate increases the fuel cost for natural uranium by 0.028 mill/kWh but a similar increase with thorium fuel adds 0.073 mill/kWh.

(b) Station efficiency

A net station efficiency of 30% has been assumed. This is a typical value for the conversion of thermal to electric power in a large station. Any variation from 30% would merely introduce the same proportionality factor into both uranium and thorium fuel costs.

(c) Plant utilization

A station has been assumed to be on power for 7000 h/yr (80%). The effect of this is to increase the effective interest rate from 5% to $6\frac{1}{4}$ %. It is therefore more important for a thorium reactor than for a uranium reactor to operate for the maximum possible number of full power days in any given period.

(d) Neutron economy

A higher $\bar{\eta}$ value indicates a reactor of poorer neutron economy. The value 1.06 which has been used throughout this study is a reasonable number