LOCKHEED MARTIN

ORNL/ER-341

ENVIRONMENTAL RESTORATION PROGRAM

Program Management Plan for the Molten Salt Reactor Experiment Remediation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee

ENERGY SYSTEMS ER

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

UCN-17560 (6 8-95)

ORNL/ER-341

Energy Systems Environmental Restoration Program

Program Management Plan for the Molten Salt Reactor Experiment Remediation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee

Date Issued—September 1996

Prepared for the
U.S. Department of Energy
Office of Environmental Management
under budget and reporting code EX 20

Environmental Management Activities at the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

APPROVALS

Project Management Plan for the Molten Salt Reactor Experiment Remediation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee (ORNL/ER-341)

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PREFACE

This *Project Management Plan for the Molten Salt Reactor Experiment Remediation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-341) was prepared as part of the Oak Ridge National Laboratory Environmental Restoration Program Decontamination and Decommissioning activities. This report satisfies requirements of U.S. Department of Energy (DOE) Order 4700.1 as amended by DOE Order 430.1 dated August 1995. It was prepared under Work Breakdown Structure 1.4.12.6.2.01.05.02, Activity Data Sheet 3701, "ORNL Decontamination and Decommissioning Program."

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D.	Work Plan	Chap. 3.	Work Plan
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H.	Performance Criteria	Chap. 7.	Project Management, Performance Measurement, Planning, and Control
I.	Cost and Manpower Estimates	Chap. 2.	Objectives
J.	Project Functional Support Requirements	Chap. 6.	Management Organization and Responsibilities
K.	Project Management, Measurement, and Planning and Control Systems	Chap. 7.	Project Management, Performance Measurement, Planning, and Control
L.	Information and Reporting	Chap. 7.	Project Management, Performance Measurement, Planning, and Control
M.	Systems Engineering Management	Chap. 6. Chap. 9. Chap. 12.	Management Organization and Responsibilities Configuration Management Operational Readiness Reviews

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O.	Contingency	Chap. 2.	Objectives
P.	Quality Assurance	Chap. 11.	Quality
Q.	Utility Services		Not Applicable Addressed in other program plans
R.	Responsibility Matrix	Chap. 6.	Management Organization and Responsibilities
S.	Annexes		
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ABBREVIATIONS

ACB	auxiliary charcoal bed
ADS	Activity Data Sheet
BCP	baseline change proposal
BIO	basis for interim operation
CBC	charcoal bed cell
CCB	configuration control board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CI	configuration items
CT	MSRE Certification Team
CTD	Chemical Technology Division
D&D	decontamination and decommissioning
DMC	Document Management Center
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DOE-ORO	U.S. Department of Energy–Oak Ridge Operations
Energy Systems	Lockheed Marietta Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&HC	environmental safety and health compliance
FY	fiscal year
HAZWOPER	Hazardous Waste Operations and Emergency Response
IRM	Information Resource Management
MCIS	Management Control Information System
MOAs	memorandums of agreement
MOUs	memorandums of understanding
MSRE	Molten Salt Reactor Experiment
OQP&I	Office of Quality Programs and Inspection
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OpRR	operational readiness review
OSHA	Occupational Safety and Health Administration
PHA	preliminary hazard analysis
PMP	Program Management Plan
QA	quality assurance
RA	readiness assessment
SAR	safety analysis report
SISMP	Site Integrated Stabilization Management Plan
S&M	surveillance and maintenance
TEC	total estimated cost
TDEC	Tennessee Department of Environment and Conservation
WBS	Work Breakdown Structure
WMRAD	Waste Management and Remedial Action Division

EXECUTIVE SUMMARY

The primary mission of the Molten Salt Reactor Experiment (MSRE) Remediation Project is to effectively implement the risk-reduction strategies and technical plans to stabilize and prevent further migration of uranium within the MSRE facility, remove the uranium and fuel salts from the system, and dispose of the fuel and flush salts by storage in appropriate depositories to bring the facility to a surveillance and maintenance condition before decontamination and decommissioning. This Project Management Plan (PMP) for the MSRE Remediation Project details project purpose; technical objectives, milestones, and cost objectives; work plan; work breakdown structure (WBS); schedule; management organization and responsibilities; project management, performance measurement, planning, and control; conduct of operations; configuration management; environmental, safety, and health compliance; quality assurance; operational readiness reviews; and training.

This PMP meets the requirements of U.S. Department of Energy (DOE) Order 4700.1 and conforms to the Defense Nuclear Facilities Safety Board Recommendation 94-1. Where feasible, reference is made to data contained in other documents to minimize duplication.

The information described in this plan is current through the first quarter of fiscal year (FY) 1996. Updates to the status of the MSRE Remediation Project and the corresponding milestones, budgets, baseline data, and other pertinent information can be obtained by referring to future revisions of the Recommendation 94-1 document or the *Site Integrated Stabilization Management Plan* (SISMP).

1. INTRODUCTION

1.1 PURPOSE

U.S. Department of Energy (DOE) Order 4700.1 requires that major system acquisitions, such as the Environmental Restoration (ER) Program at the Oak Ridge Reservation (ORR), have a project management plan. In response to this requirement, the ER Division of the U.S. Department of Energy-Oak Ridge Operations (DOE-ORO) prepared the *Management Plan for the Oak Ridge Operations Environmental Restoration Program* (DOE-ORO 1991); the *Oak Ridge Reservation Site Management Plan for the Environmental Restoration Program* (DOE-ORO 1992a); and the *Project Management Plan for the DOE Field Office, Oak Ridge Major System Acquisition OR-1 Environmental Restoration Program* (DOE-ORO 1992b).

Subsequently, the Defense Nuclear Facilities Safety Board (DNFSB) examined the reduction of defense nuclear activities nationwide and the associated accumulation of excess fissile material in unsuitable long-term storage conditions which resulted in Recommendation 94-1. Within Recommendation 94-1, the DNFSB called for an integrated program plan formulated on a high priority basis to convert nuclear materials to forms or conditions suitable for safe interim storage. In response to this requirement, the Office of Environmental Restoration and Waste Management of the DOE-ORO prepared the *Site Integrated Program Plan for the Implementation of DNFSB Recommendation 94-1* (DOE-ORO 1994a, 1994b). Volumes 1 and 2 of Recommendation 94-1 were updated with Revision 1 (DOE-ORO 1995a, 1995b), referred to as the *Site Integrated Stabilization Management Plan* (SISMP).

This *Program Management Plan for the Molten Salt Reactor Experiment Remediation Project at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (ORNL/ER-341) is consistent with DOE Order 4700.1, as amended, and conforms to Recommendation 94-1. It also adheres to the guidelines described in the Program Management Plan (PMP) (ORNL/ER-167) (ORNL 1994a) for Lockheed Martin Energy Systems, Inc., [formerly Martin Marietta Energy Systems, Inc., (Energy Systems)] governing ER Program activities at the Oak Ridge National Laboratory (ORNL). This PMP delineates the major activities of the Molten Salt Reactor Experiment (MSRE) Remediation Project and defines the management system used to manage the project. Where feasible, reference is made to data contained in other plans and documents to minimize duplication.

1.2 BACKGROUND

The MSRE facility complex was a graphite-moderated, liquid-fueled reactor built to investigate the practicality of the molten salt reactor concept for commercial power applications. A very nominal amount of fuel component was actually produced during 1965 using a fuel of $^{235}UF_4$ in a mixture of lithium, beryllium, and zirconium fluoride salts. During 1968, the fuel was changed from ^{235}U to ^{233}U. Development and prototyping of the molten salt reactor concept continued during operation of the MSRE from 1965 through shutdown in 1969. Figure 1.1 denotes the buildings, structures, and vapor condensing system tanks that comprise the MSRE facility complex.

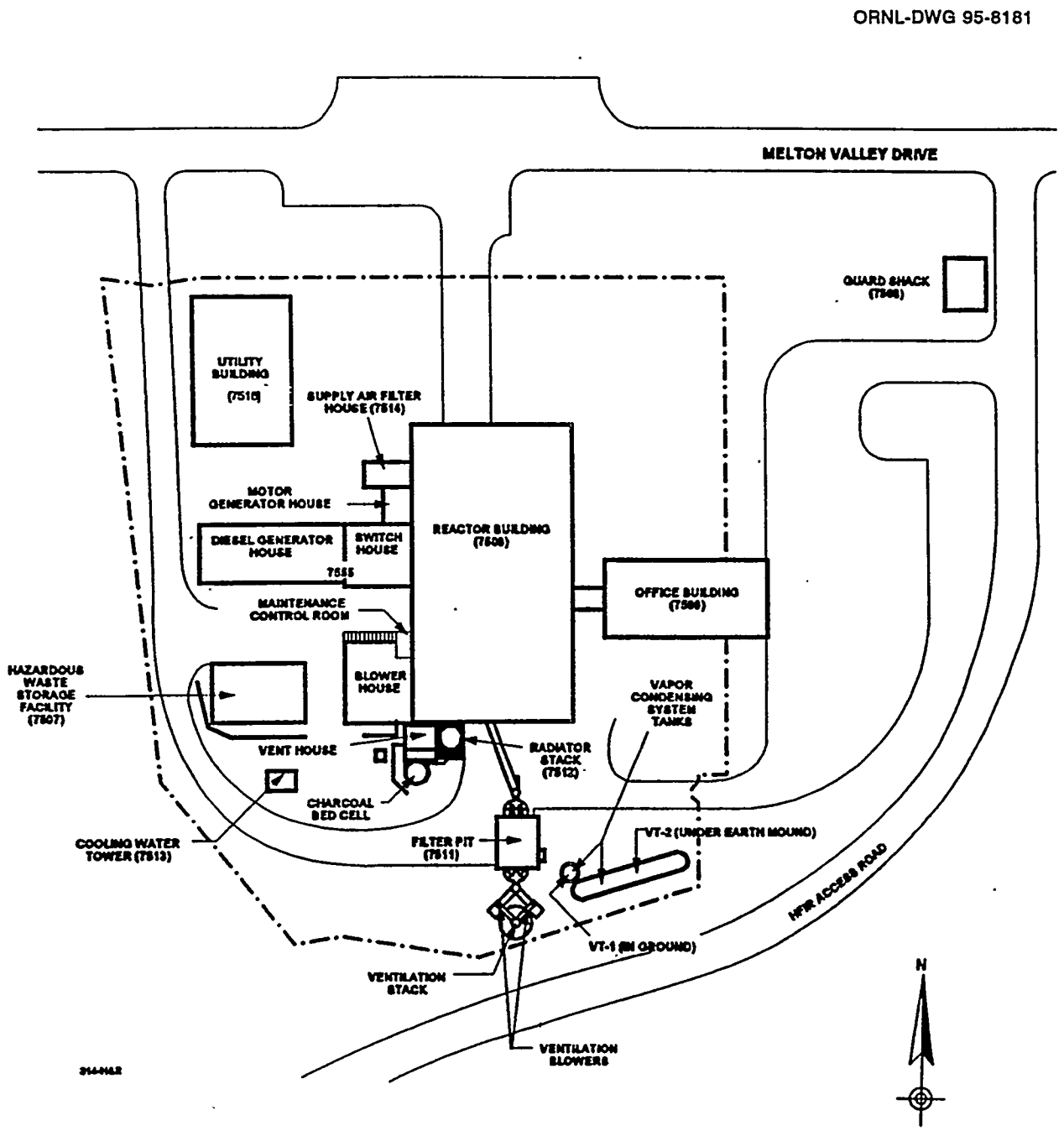


Fig. 1.1. Layout of the Molten Salt Reactor Experiment facility complex in the Melton Valley area.

When the reactor was shut down, the fuel salt was drained in approximately equal volumes into the fuel drain tanks and the flush salt was drained into the flush salt tank. The fuel and flush salts were allowed to cool and solidify in the tanks. Following a post-operation examination, the MSRE facility was placed under a Surveillance and Maintenance (S&M) Program awaiting eventual Decontamination and Decommissioning (D&D). Radiolysis of the fuel salt slowly produced fluorine gas after a latent period, and a procedure to annually anneal the salt became part of the S&M Program. Figures 1.2 and 1.3 denote the layout of the MSRE facility.

In mid-1994, the surveillance and maintenance program discovered that approximately 10% of the uranium stored in the fuel salt had migrated as uranium hexafluoride (UF_6) from the fuel storage tanks to other components in the reactor off-gas system. One uranium deposit was discovered in a 6-inch diameter charcoal absorber bed in a water-filled concrete cell. The discovery raised concerns about nuclear criticality safety, the potential for corrosion, and containment. To address the MSRE situation , an MSRE Remediation Project has been established as part of the DOE Implementation Plan for DNFSB Recommendation 94-1 on Nuclear Material Stabilization.

1.3 MISSION STATEMENT

The primary mission of the MSRE Remediation Project is to effectively implement the risk-reduction strategies and technical plans to stabilize and prevent further migration of uranium within the MSRE facility, remove the uranium and fuel salts from the system, and dispose of the fuel and flush salts. These actions will place the facility in a safe, stable, and environmentally sound condition suitable for an extended period of minimum S&M before D&D. The nuclear materials removed from the facility will be stabilized for interim storage at ORNL or packaged for transport to long-term waste depositories.

The risk reduction/containment effort involves installing, modifying, and operating the instrumentation, systems, and structures, as well as performing data gathering, investigative, and sampling activities. The remedial action activities involve opening and accessing the primary and secondary containment components, systems, and structures.

Figure 1.4 shows the continuous risk-reduction strategy for the MSRE.

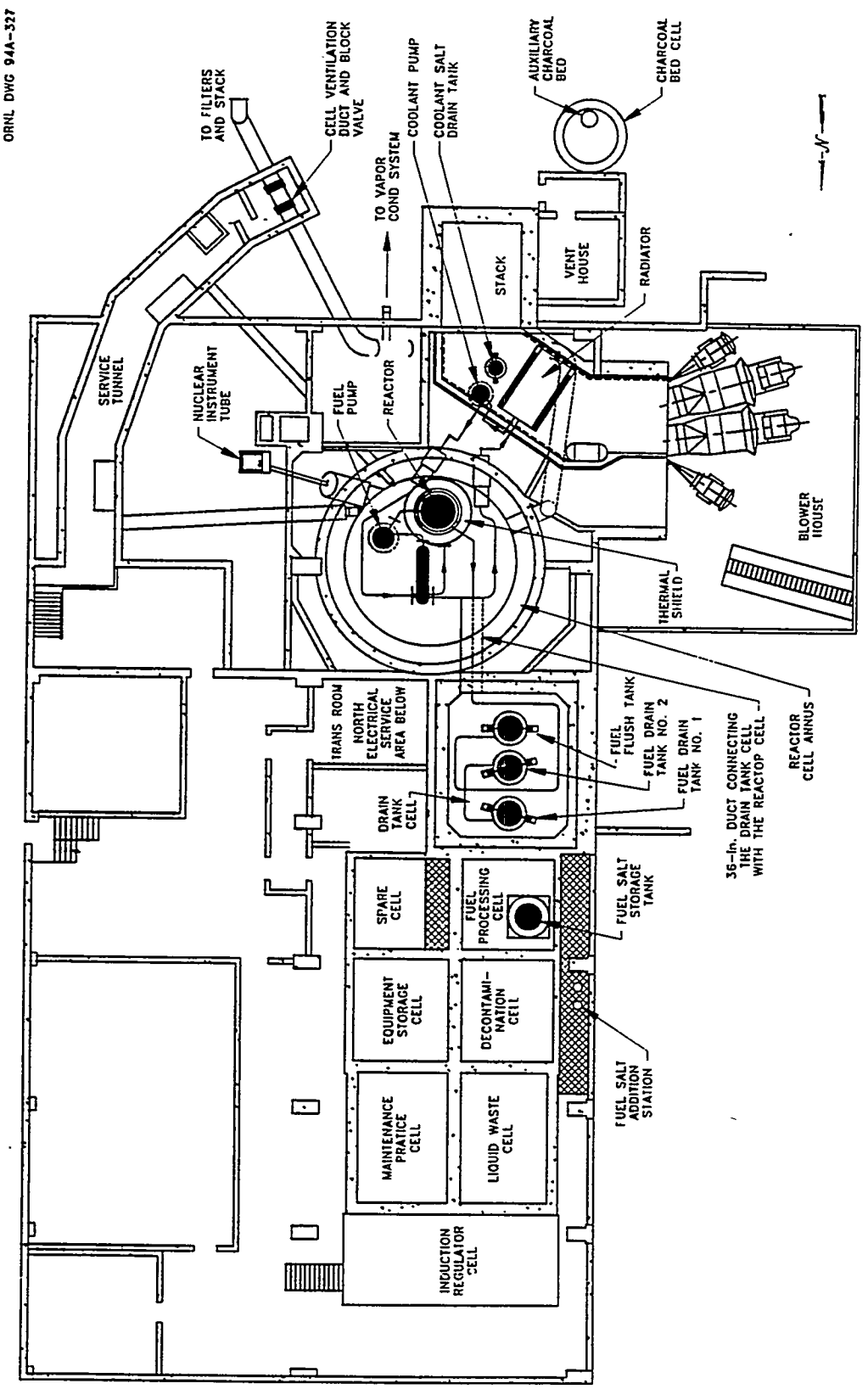


Fig. 1.2. Overhead view of the Molten Salt Reactor Experiment facility.

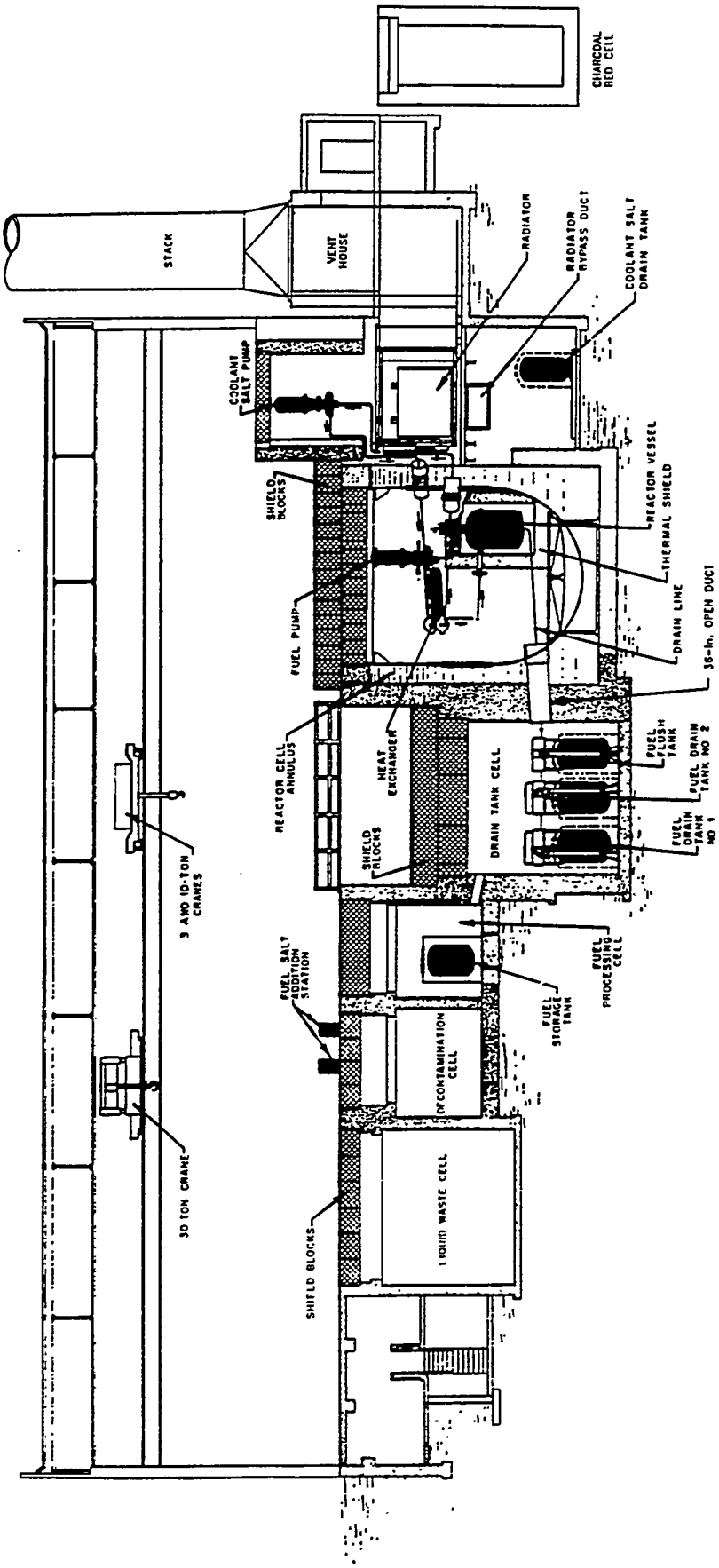


Fig. 1.3. Side view of the Molten Salt Reactor Experiment facility.

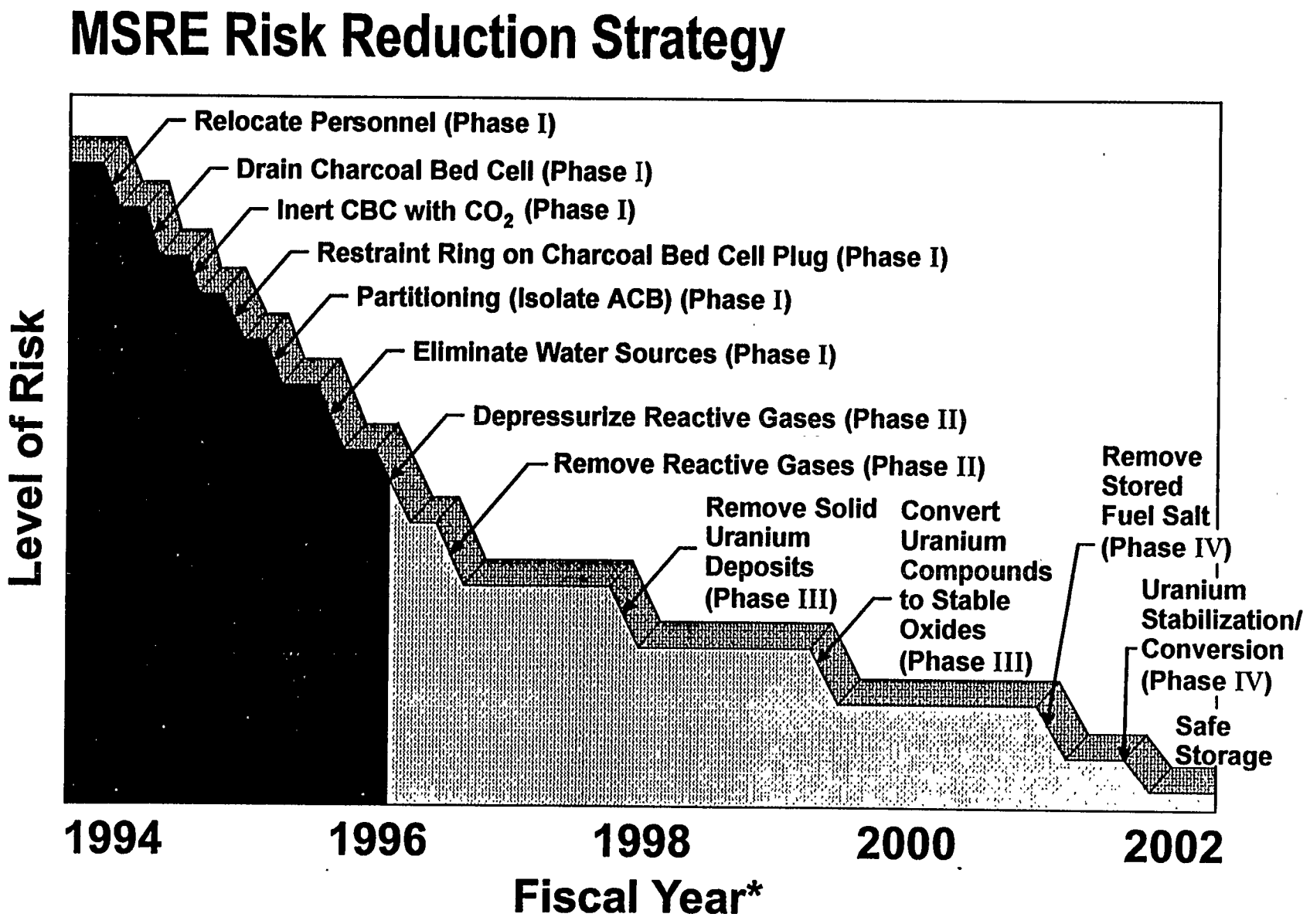


Fig. 1.4. Continuous risk reduction strategy for the Molten Salt Reactor Experiment.

2. OBJECTIVES

The generation and migration of reactive gases from the fuel salt drain tanks through piping to other MSRE facility locations have produced a condition outside the original safety authorization for storage of fuel salt. As noted in the mission statement, the primary objective of the MSRE Remediation Project is to place the MSRE facility in a safe, stable, and environmentally sound condition suitable for S&M. The technical objectives, schedule objectives, and cost objectives required to support the primary objective are discussed in this chapter.

This PMP is based on the original planning assumptions and the corresponding baseline schedule and cost objectives. It must be emphasized that the technical schedule and cost objectives of this effort are changing as the project evolves. A more detailed discussion of these assumptions, schedules, and objectives can be found in the most current version of the SISMP.

2.1 TECHNICAL OBJECTIVES

For planning purposes, it has been assumed that the MSRE fuel and flush salts will be removed as a solid; the uranium will be separated from the carrier salt and converted to oxide for safe interim storage at ORNL; and the carrier salt will be packaged for interim storage, also at ORNL. These technical assumptions form the basis for the major work strategies and technical objectives of the MSRE remediation process. These activities were originally organized into five phases which have subsequently been reduced to four; their respective technical objectives are explained in the following paragraphs.

2.2 PHASE I—INVESTIGATION

The first phase enhanced worker safety and stabilized the situation in the MSRE facility by relocating non-remediation employees to other Oak Ridge National Laboratory facilities; establishing facility access controls; draining the water from the charcoal bed cell containing the uranium deposit; installing a monitoring system to detect water in-leakage; and installing a criticality alarm system to detect a nuclear criticality. Effective control of water greatly reduced the concern for a nuclear criticality. Also, the charcoal bed cell was inerted with a gas atmosphere of carbon dioxide and a steel hold-down ring installed on the top of the cell to reduce the potential of a release of reactive, radioactive gasses during a hypothetical worst case accident. An action was also completed involving isolation of the auxiliary charcoal bed trap from the fuel drain tanks to prevent further migration of uranium and fluorine.

2.2.1 Analyses, Tests, and Evaluations

These activities (originally a separate phase) involve conducting analyses, tests, and evaluations to provide technical data and engineering details to establish the technical work plan. Technical components of this work phase include containment assessments, corrosion data compilations, confinement leakage samples, distribution mappings, dosimetry technology evaluations, systems engineering, gas measurements, and quantification analyses. At this writing, the activities of Phase I have been completed.

2.3 PHASE I—INTERIM CORRECTIVE MEASURES

2.3.1 Interim Corrective Measures

Interim Corrective Measures devolve from the information gathered by the analyses, tests and evaluations and involve the investigation and mitigation of immediate safety concerns of the MSRE. At this writing, the activities of Phase I have been completed.

2.4 PHASE II—REACTIVE GAS REMOVAL

Reactive Gas Removal involves the design, fabrication, and installation of a purge and trap system to extract the reactive gases currently present in the MSRE off-gas system. Also included in this work phase are the design, fabrication, installation, and operation of a chemical conversion and packaging system to convert the trapped UF_6 to uranium oxide, package the oxide in containers tested to meet stringent regulations, and transport the oxide to interim storage cells in the ORNL Radiochemical Development Facility. The Reactive Gas Removal process was underway as of April 1996 and is ongoing at this publication.

2.5 PHASE III—URANIUM DEPOSIT REMOVAL

Uranium Deposit Removal involves the design, fabrication, and installation of fixtures and equipment to extract the uranium deposits from locations within the MSRE that were not removed by the Reactive Gas Removal process. Uranium Deposit Removal will begin at the completion of Phase II.

2.6 PHASE IV—FUEL SALT DISPOSITION

Fuel Salt Disposition follows the recommended base case technical alternative to remove solidified fuel salt, fluorinate the salt to remove uranium, convert the salt to oxide, and package and transport processed materials to interim storage. The technology alternatives for fuel salt disposition will be re-evaluated as part of the ongoing remedial investigations, development of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) feasibility study, and formulation of the waste certification plan for the MSRE facility. These activities have not yet begun.

2.7 MILESTONES AND SCHEDULE OBJECTIVES

The MSRE Remediation Project schedule objective is to meet the criteria established in the *DOE-ORO Site Integrated Program Plan for the Implementation of DNFSB Recommendation 94-1*, DOE/OR/01-1333&V1, as updated by Revision 1 issued October 1995. Also, because the Project is regulated by CERCLA requirements, the schedule objective must meet criteria established by U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC). Table 2.1 lists the major milestones for the MSRE Remediation Project.

Table 2.1. Milestones for the Molten Salt Reactor Experiment Remediation Project

Completion date	Actual finish date	Milestone number	Milestone description[a]	Phase
			Level 1 Milestones	
11/13/95	11/29/95	IP-3.5-010	Complete interim corrective measures	I
02/28/97			Fuel salt removal feasibility study transmitted to EPA/TDEC	IV
06/16/97			Off-gas system reactive gas removal completed	II
01/22/98			Fuel salt record of decision transmitted to EPA/TDEC	IV
02/25/99		IP-3.5-005	Uranium deposits removed	III
05/31/00			Reactive gas removal and uranium deposit removal conversion completed	III
06/03/02		IP-3.5-011	Salt as a solid (base case) removed	IV
02/27/03			Oxides stored	IV
			Level 2 Milestones	
11/29/94	11/18/94		Water level in the auxiliary charcoal bed lowered	I
06/01/95	11/20/95		Off-gas system partitioned	I
07/24/95	09/27/95		Safety basis for MSRE facility revised	I
10/25/95	09/01/95		Technical approach for uranium deposits removal developed	II
11/13/95	11/29/95		Other water sources removed	I
01/18/96			UF_6 generation mechanism defined	I
01/18/96			Purge and trap operation initiated	II
02/15/96	12/30/95		Regulatory requirements evaluated	III
08/07/96			Technical approach for salt removal developed	III
09/11/96			UF_6 material balances quantified	I
01/03/97			Purge and trap operation completed	II
01/28/02			Oxides stored	IV

[a]The Level 3 project schedule for the MSRE Remediation Project is contained in Volume 2 of the most current version of the Site Integrated Stabilization Management Plan (SISMP) which has been updated to reflect the status of activities initiated to date.

2.8 COST OBJECTIVES

The cost objective established in D&D Activity Data Sheet (ADS) 3701, "DOE Environmental Restoration Program for ORNL," is to keep total project costs within the total estimated cost (TEC). The TEC for the MSRE Remediation Project, excluding contingency[1] and assuming the base case for fuel salt removal, is currently estimated at ~$120 million. The TEC is based on various assumptions and issues which are outlined in the SISMP.

DOE/OR/01-1333&V2 provides a detailed break down of the TEC by overall project elements, labor analyses, fiscal year, and contingency. The document also depicts the resource curves for each primary contractor and major Energy System division. Revision 1 to DOE/OR/01-1333&V2, issued October 1995, provides a detailed fiscal year schedule by WBS element, updated with FY1995 accomplishments.

Table 2.2 summarizes the overall budget by fiscal year based upon the latest project estimate. The estimate has been adjusted to incorporate FY1995 actual cost and proposed FY1996 spending. The dollars associated with conversion and additional uranium removal from the processing cells are listed separately.

[1]Contingency refers to a designated, unbudgeted amount of money, controlled by DOE, for possible justifiable use as the project evolves.

Table 2.2. Budget summary by fiscal year (FY)[a] for the Molten Salt Reactor Experiment Remediation Project

Work Breakdown Structure category	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	Total
5.01 Analyses, tests, and evaluations	$0.6	$0.4								$1.0
5.02 Compliance	$0.6	$1.3	$1.0	$1.0	$1.2	$1.0	$0.8	$0.8	$0.7	$8.4
5.03 Interim corrective measures	$2.3	$0.6								$2.9
5.04 Reactive gas removal	$1.8	$6.8	$3.5	$1.0	$1.0	$1.0	$1.0	$1.0		$17.1
TBD Conversion	$0.1	$0.4	$2.0	$4.0	$3.5	$1.0				$11.0
5.05 Uranium deposit removal	$0.1	$0.8	$3.0	$3.5	$2.0					$9.4
5.06 Salt removal	$0.1	$0.6	$2.0	$3.0	$8.0	$10.0	$8.0	$5.0	$4.0	$40.7
5.07 Facility management	$2.1	$2.8	$2.8	$2.7	$2.5	$2.5	$2.2	$2.0	$1.7	$21.3
5.08 Project management	$0.9	$0.9	$1.0	$1.1	$1.3	$1.1	$0.8	$0.6	$0.4	$8.1
5.08 Processing cells uranium removal		$0.2								$0.2
TOTALS	**$8.6**	**$14.8**	**$15.3**	**$16.3**	**$19.5**	**$16.6**	**$12.8**	**$9.4**	**$6.8**	**$120.1**

[a] Dollars in 000,000s.
[b] Excludes costs associated with fuel salt disposition pending technical alternative analyses in 1996.

3. WORK PLAN

This work plan addresses four identifiable work phases. To avoid duplication of information that is available in other publications and documents (DOE-ORO 1994a, 1994b, 1995a, 1995b; Green 1995), the information presented in this chapter represents a general overview of the original work plan that has been developed to meet the technical, schedule, and cost objectives. Subsequent updates or revisions to this work plan will be included in the latest version of the SISMP. Figure 3.1 is a diagram of the project's work flow.

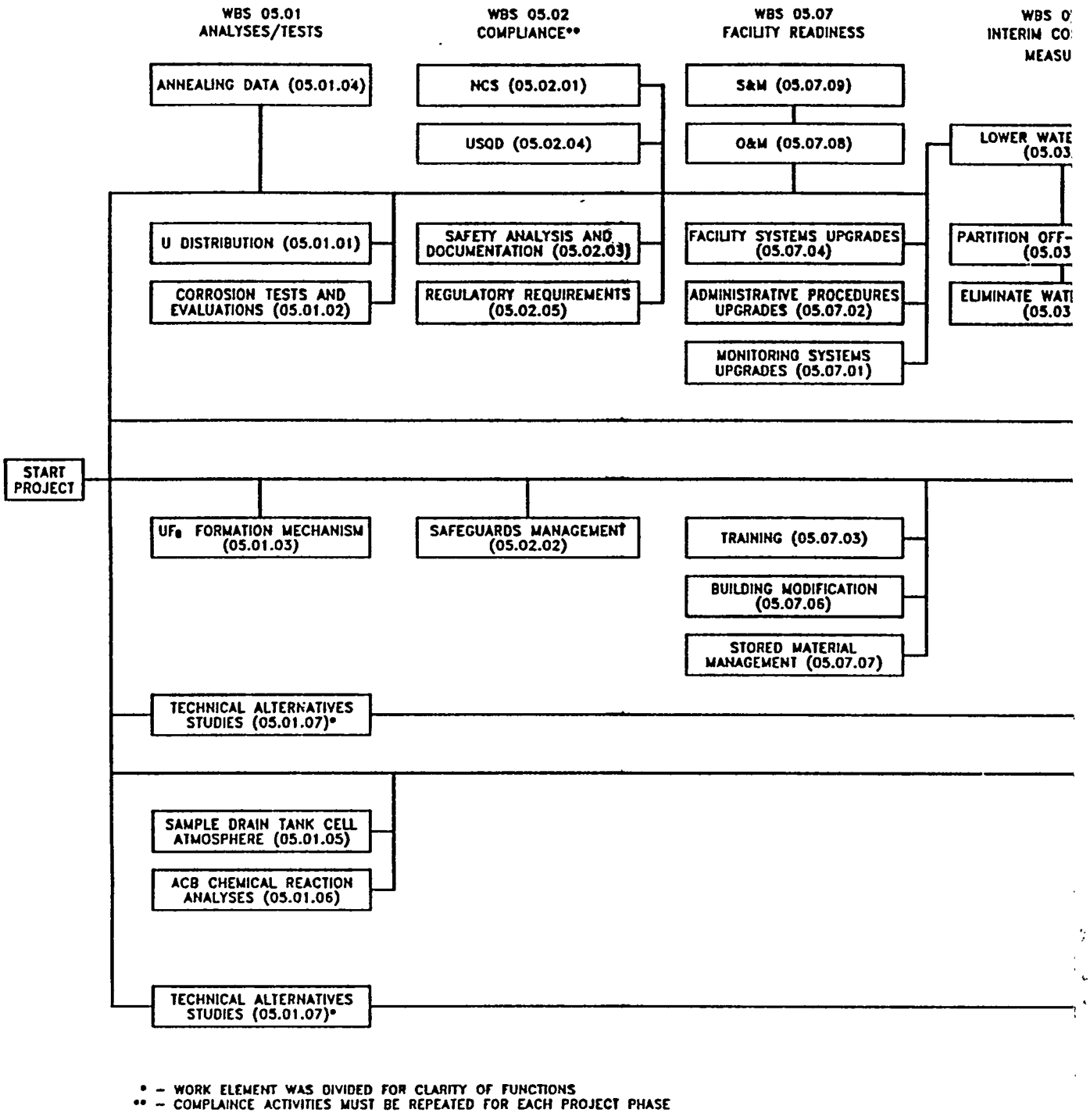
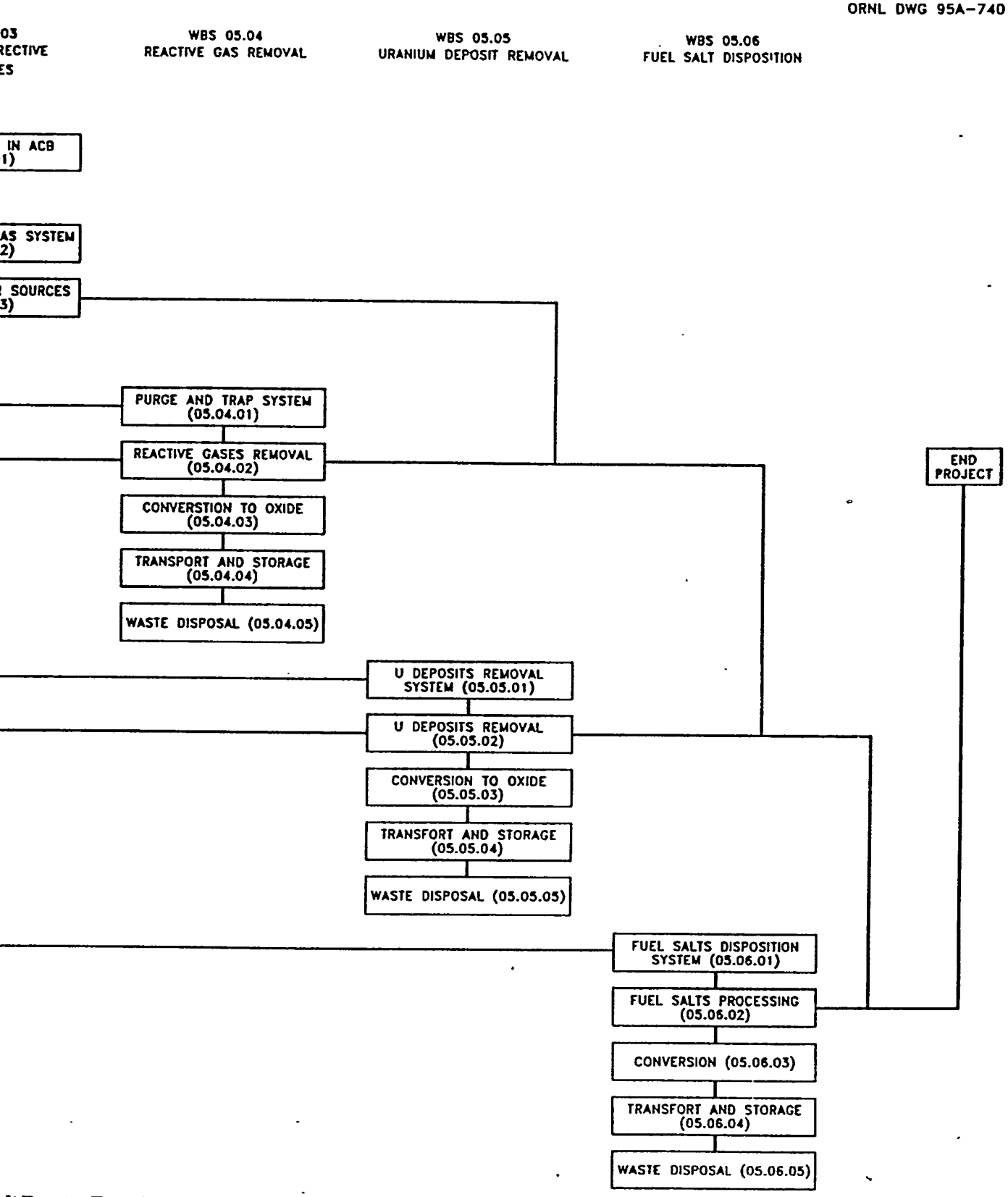


Fig. 3.1. Functional work flow diagram for the Molten

ORNL DWG 95A-740



lt Reactor Experiment Remediation Project.

3.1 PHASE I—ANALYSES AND TESTS

This task of Phase I concentrates on the tests and evaluations conducted to provide technical data and engineering details to support the resolution of technical issues associated with the uranium deposit removal and fuel salt disposition tasks. Ongoing and proposed investigations are necessary to determine the location and quantities of uranium in MSRE, to identify the potential for corrosion of the primary containment system, and to develop an improved understanding of the mechanism for the generation and transport of gases from the drain tanks.

3.2 PHASE I—INTERIM CORRECTIVE MEASURES

This task of Phase I, completed in November 1995, concentrated on the investigation and resolution of near-term technical phenomena and safety items within the MSRE. Risk-reduction tasks completed include the following:

- Charcoal bed cell (CBC) confinement enhancement to ensure containment of radionuclides that could be released by a reaction between the carbon and fluorine gas within the ACB

  —CBC pressure hazards evaluation,

  —shield plug restraint installation, and

  —water control system installation.
- Off-gas system partitioning to isolate the entire bulk gas volume of the off-gas system from the ACB

  —closure of Valve 561 precluding further transport of UF_6 and F_2.
- Elimination of water sources

  —identification of water sources,

  —formulation of water disposal strategy, and

  —reduction of the water level in the ACB.

3.3 PHASE II—REACTIVE GAS REMOVAL

The Phase II task concentrates on the removal of the reactive gases, conversion of the recovered UF_6 to oxide, and packaging and transporting the oxide for storage. It involves the design, fabrication, installation, and check-out of the reactive gas removal system. A shielded chemical trapping system with critically safe geometry has been designed to allow reactive gases to be collected. The trapping system includes NaF columns to collect UF_6 and alumina columns to collect F_2. The system is capable of evacuating process lines to promote sublimation and transport of UF_6 deposits. A readiness assessment (RA) is underway prior to operation of the system..

Initially, the system will depressurize the off-gas system to reduce the potential for accidental leakage. Then, planned batch operations will purge the reactive gas from the gas space in the MSRE through the chemical trapping system to remove all reactive gases and restore the inert atmosphere for continued safe interim storage of the fuel salt. The configuration of the MSRE primary confinement system will require multiple purges to remove all reactive gases.

A chemical conversion and packaging system will be designed, fabricated, installed, and operated to convert UF_6 trapped on NaF columns to uranium oxide and to package the oxide for storage at ORNL. Special shielded carriers have been designed and fabricated for transport of the NaF columns and existing transport casks are being evaluated for use.

3.4 PHASE III—URANIUM DEPOSIT REMOVAL

This phase concentrates on the chemical or physical removal of uranium deposits from locations that are not suitable for long-term storage of fissile uranium, conversion of the deposits removed to a stable oxide, and transport for long-term storage or disposition. It involves the design, fabrication, check-out, and installation of remote handling equipment and fixtures (i.e., CBC/ACB mock-up, ACB hot-tap, mixing tool, pipe cutter, sampling tool, support apparatus), which will be used to remove the UF_6 deposits not removed by the reactive gas system. The uranium deposit removal system will be designed to facilitate transport of the removed deposits to other ORNL facilities for conversion to oxide and to package the oxide for storage at ORNL. The technical approach has been selected from three major alternatives.

3.5 PHASE IV—FUEL SALT DISPOSITION

This phase concentrates on the design, fabrication, and installation of a system to remove or stabilize-in-place the fuel salts in the MSRE. The system will be designed to facilitate transport of the fuel salts to other facilities for conversion to a chemically stable form. Removal or stabilization of the fuel salt is necessary to ensure that the MSRE is in an acceptable condition for S&M prior to D&D. Major tasks in this phase include the development of a waste management strategy, evaluation of salt removal chemistry and technologies, and evaluation of salt processing chemistry and technologies. However, further technology development is required to support the resolution of technical issues associated with the uranium deposit removal and the fuel salt disposition. Ongoing and proposed investigations are necessary to isolate the ACB from the drain tanks, to determine the location and quantities of uranium in MSRE, to identify the potential for corrosion of the primary containment system, and to develop an improved understanding of the mechanism for the generation and transport of gases from the drain tanks.

Salt removal and processing are independent tasks but must use compatible technologies. Preliminary technology alternatives considered for fuel salt disposition as part of the development of this plan included the following:

1. Stabilize the fuel in place, with periodic operation of the reactive gas removal system.
2. Fluorinate the salt either in place or in the fuel processing cell; convert the uranium to oxide and store at Building 3019; store fluorinated salt in the drain tanks.
3. Remove the salt as a molten salt, fluorinate after removal; convert the uranium to oxide and store at Building 3019; package the salt for interim storage at ORNL.
4. Remove the salt as a solid; transport the salt to a hot cell; fluorinate the salt to remove uranium; convert the uranium to oxide; store the uranium at Building 3019; package the salt for interim storage at ORNL. For planning purposes, this alternative was chosen as the base case.

5. Remove the tanks intact with the salt; transport the salt and tanks to a hot cell; remove the salt from the tanks; fluorinate to remove the uranium; convert the uranium to oxide; store the uranium at Building 3019; package the salt for interim storage at ORNL.

For all cases in which the salt is removed, no further processing beyond fluorination is assumed, and no disposal method other than interim storage at ORNL is considered. A further evaluation of alternatives will take place during the development of the CERCLA Feasibility Study and Proposed Plan documents. During this process, an overall waste management strategy for MSRE fuel and flush salt materials will be developed. Removal technologies will include those listed above, as well as removal as an aqueous solution or slurry. Separation of uranium from the salts by fluorination or other technologies will be considered. A range of processes to separate actinides and fission products from the salt will be considered, as will technologies for converting materials separated from the salt and for converting the carrier salt itself, into generally accepted waste forms. Selection of process alternatives will be based on the need to process in order to implement the selected waste management strategy, as well as other factors such as cost; complexity; process maturity; and risks posed to workers, the public, and the environment.

4. WORK BREAKDOWN STRUCTURE

The WBS provides a standard basis for overall planning, scheduling, controlling, and reporting on the project. It is used as a management tool for identifying the scope of all work activities; planning and scheduling work; preparing resource budgets to support work; developing spending profiles; and collect technical, schedule, and cost performance data required to meet project objectives.

The WBS to support management control of the MSRE Remediation Project is established in the DOE ER Program D&D ADS 3701 for ORNL. The WBS is organized into nine major packages with 49 elements, as depicted in Fig. 4.1. A more detailed explanation of the specific WBS elements and the associated work scopes is given in Revision 1 of the SISMP, Volume 1, issued October 1995.

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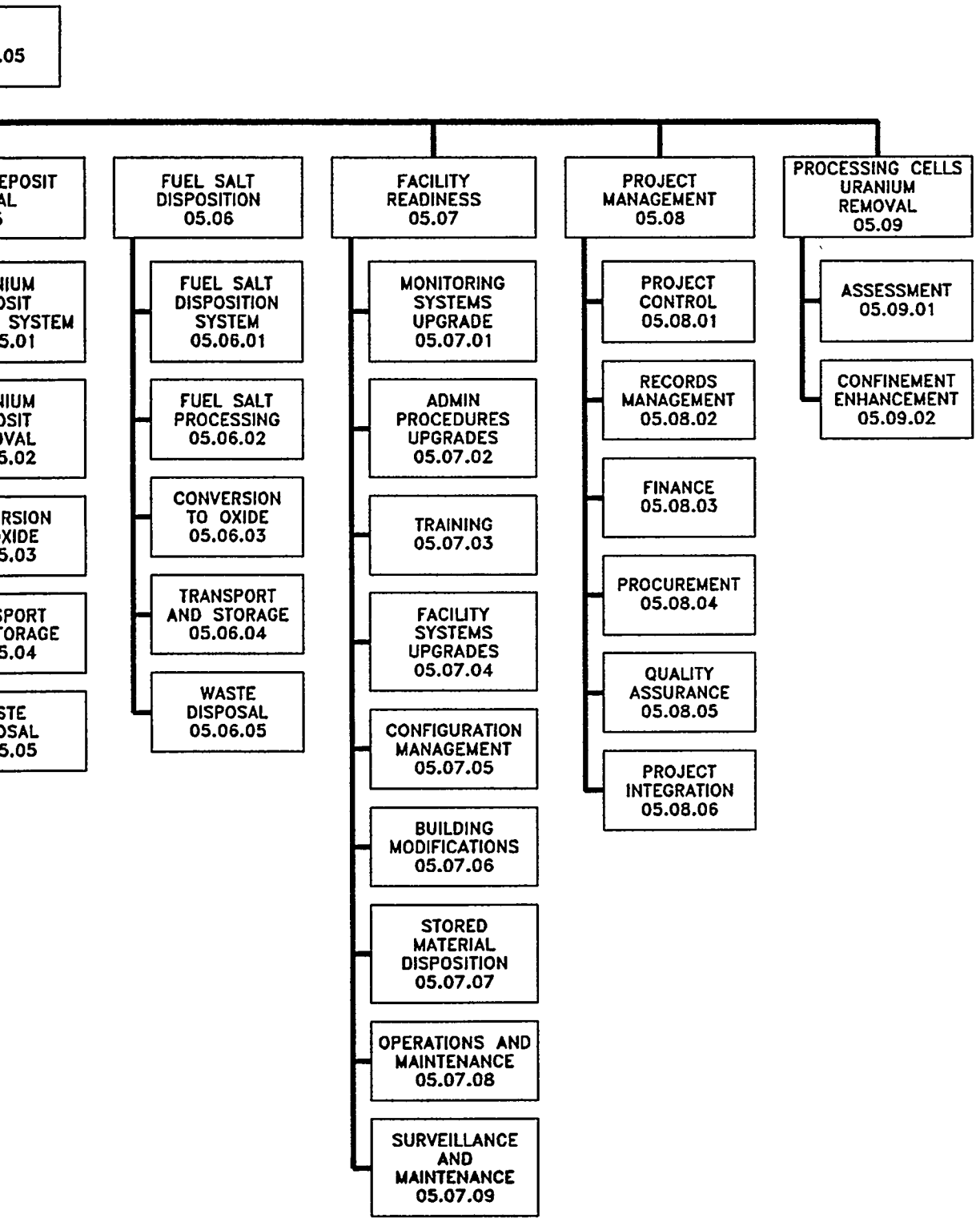

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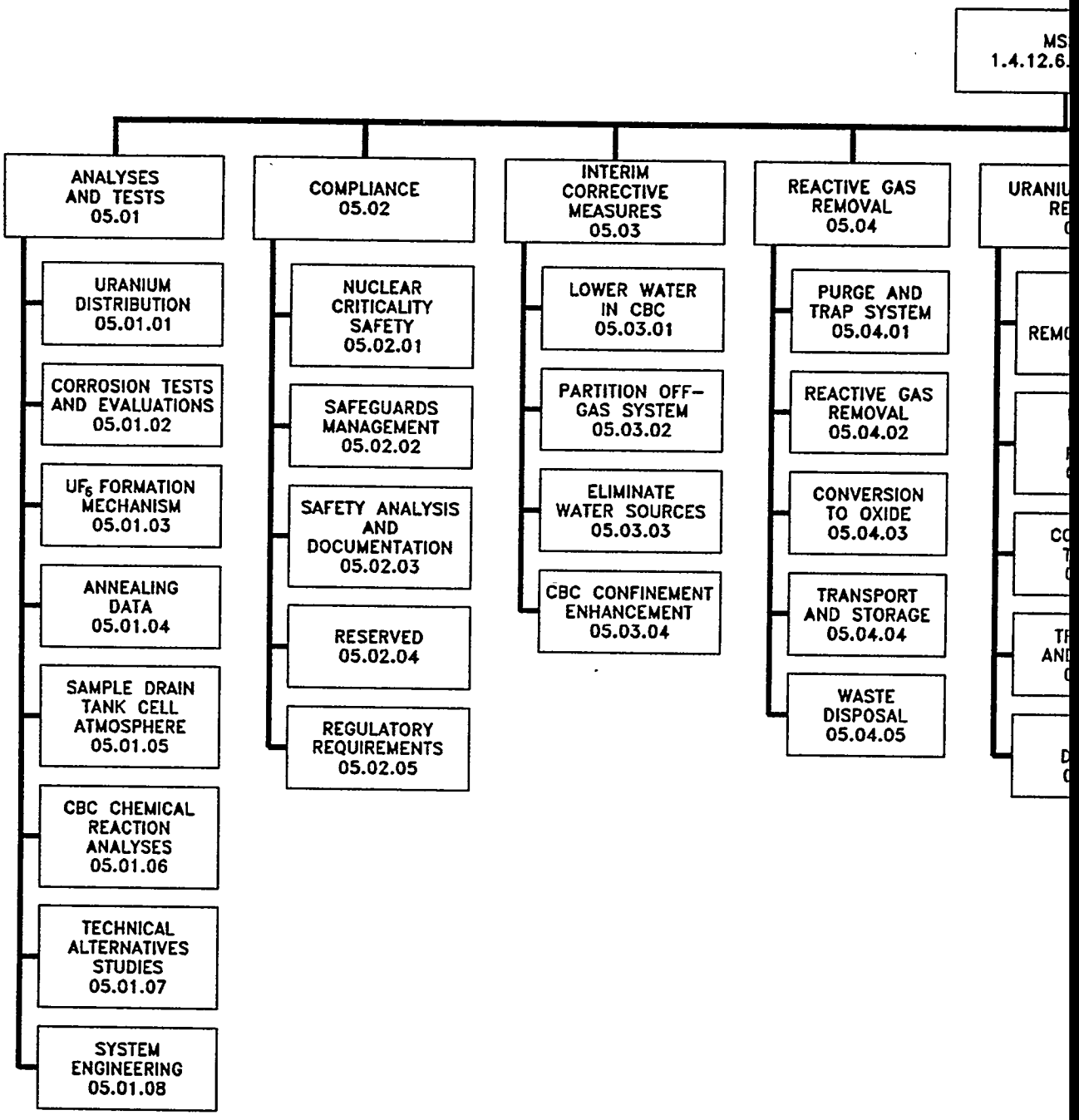

Fig. 4.1. Work Breakdown Structure for the Molte

5. PROJECT SUMMARY SCHEDULE AND TECHNICAL FLOW DIAGRAM

The project summary schedule and technical flow diagram are shown in Figs. 5.1 and 5.2, respectively. The data are based on the assumption that fuel salts will be removed and stabilized (base case). However, the critical path has allowed for re-evaluation of alternative technical assumptions. A detailed project schedule by fiscal year is presented in Revision 1, Volume 2 of the SISMP, issued October 1995.

Energy Systems program management, ORNL project management, and DOE program/project management routinely review schedule status with the MSRE Remediation Project manager during the normal reporting and communication exchange process. Any changes in the planned dates for controlled or major milestones will be approved in accordance with the DOE-ORO Baseline Control Procedure.

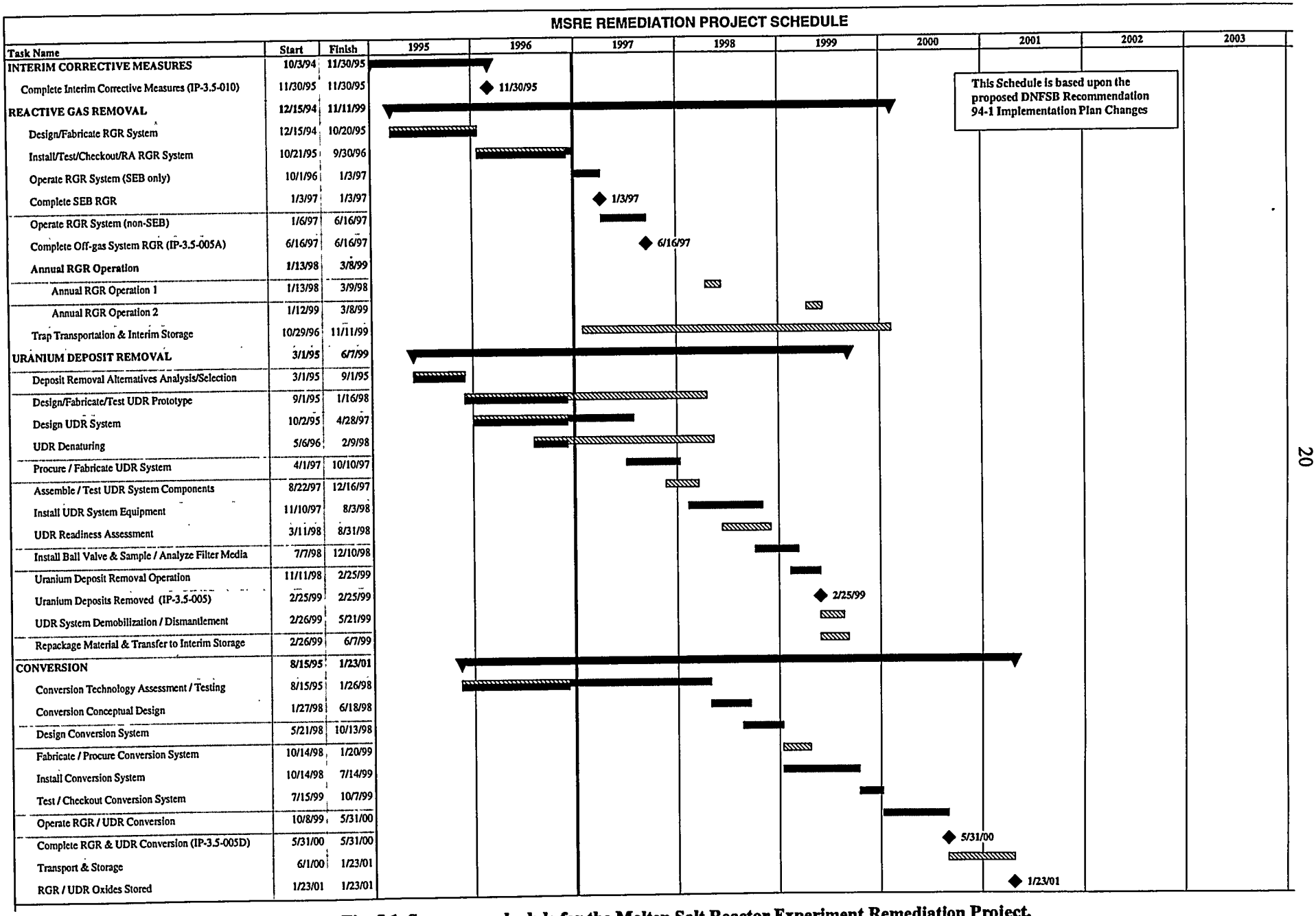

Fig. 5.1. Summary schedule for the Molten Salt Reactor Experiment Remediation Project.

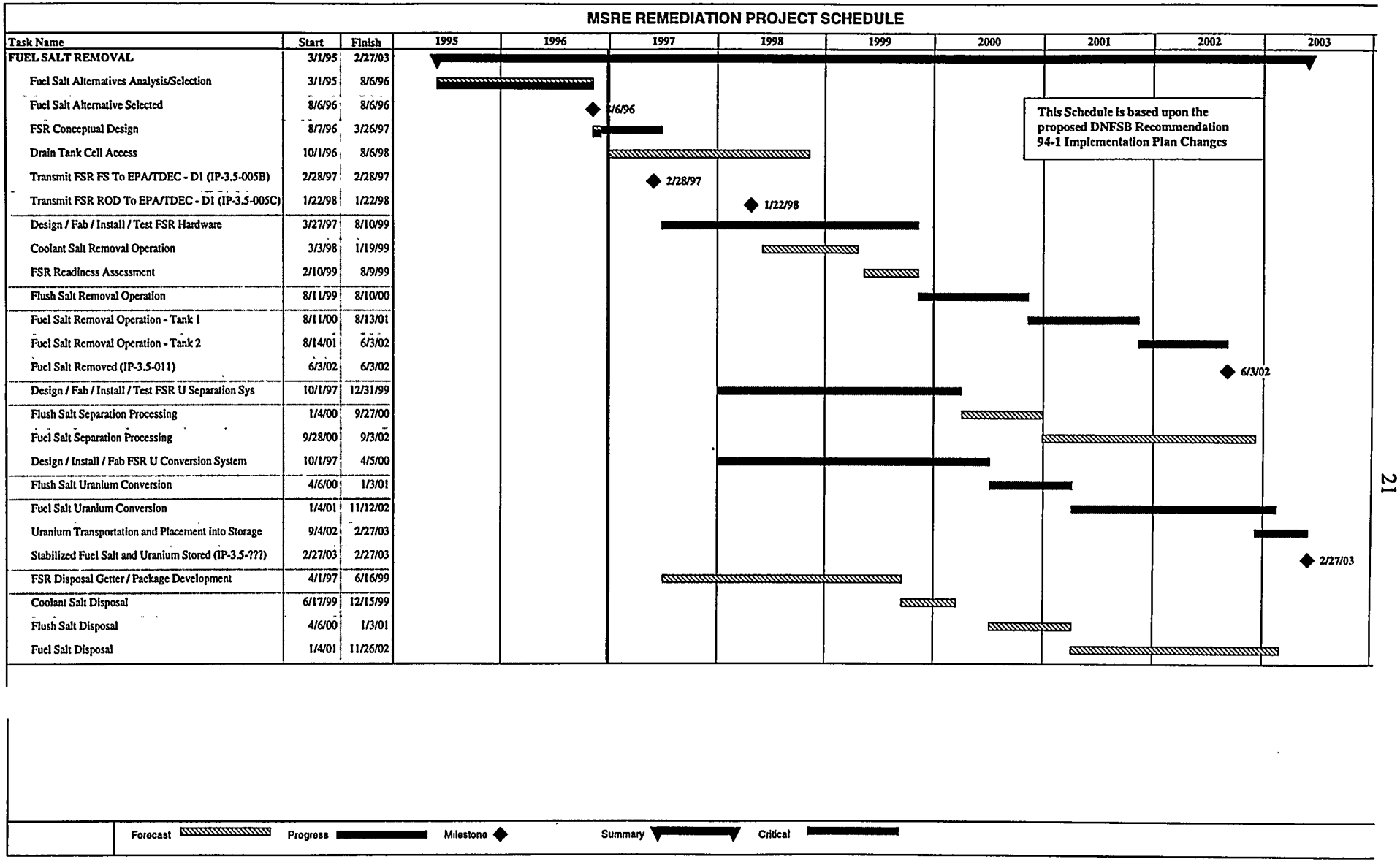

Fig. 5.1. (continued)

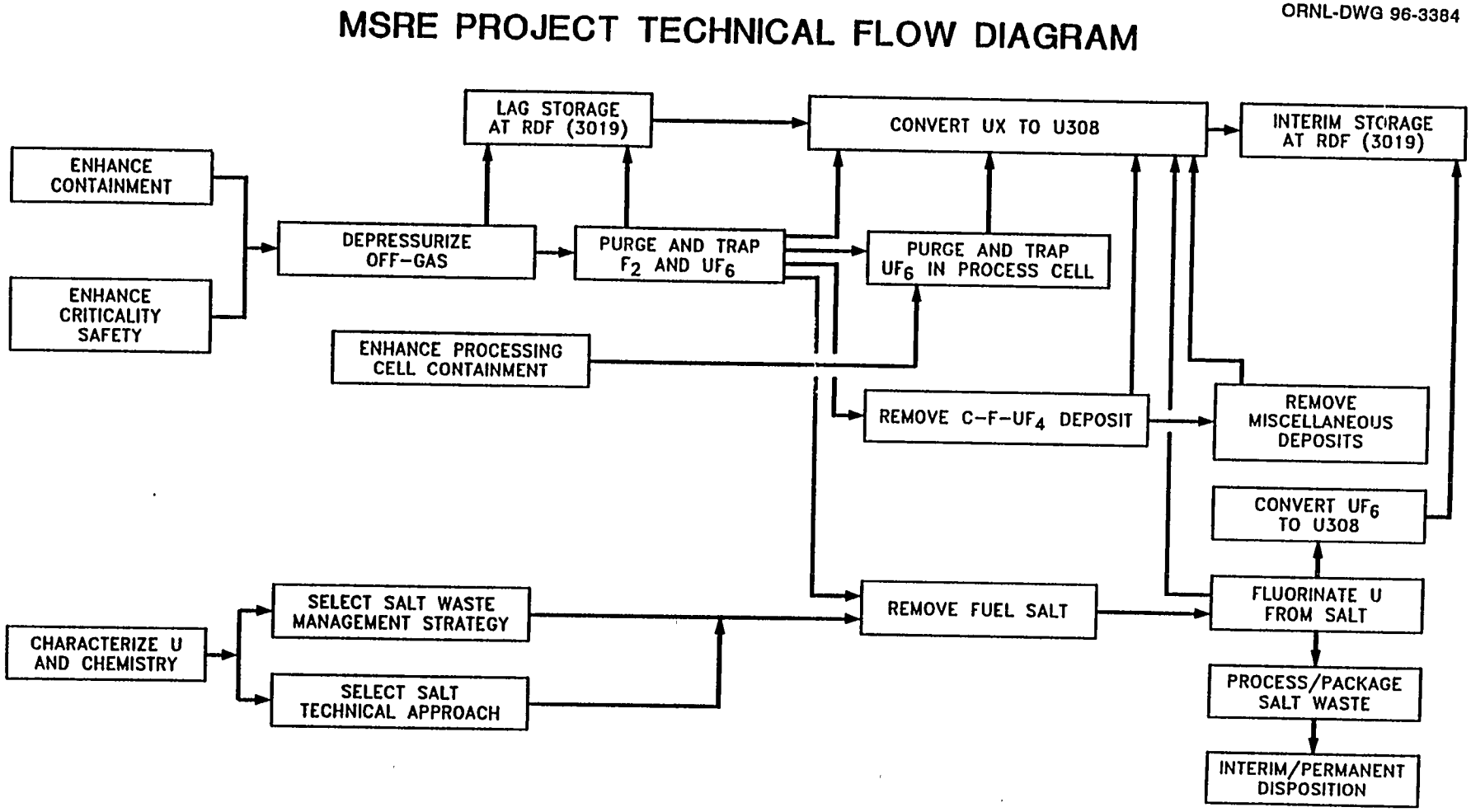

Fig. 5.2. Technial flow diagram for the Molten Salt Reactor Experiment Remediation Project.

6. MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

6.1 OVERALL PROGRAMMATIC ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

Figure 6.1 depicts the overall programmatic organizational structure and interrelationships for DOE and Energy Systems.

DOE and Energy Systems are the primary participants in the MSRE Remediation Project. Jacobs Engineering Group is the DOE prime technical support contractor.

DOE, through the ORO Office, is responsible for programmatic, construction, engineering, and technical oversight, as well as the necessary management support functions (e.g., safety reviews; quality assurance; budget guidance; procurement, security, legal, and environmental compliance reviews; coordination with the appropriate DOE office; and interface with the regulators).

As the DOE prime technical support contractor, Jacobs Engineering Group will support the CERCLA documentation requirements.

As the DOE prime management and operations contractor, Energy Systems is responsible for the integration and general management of the program. This role includes the coordination of all work performed by Energy Systems, its subcontractors, other DOE prime contractors, independent reviewers, and outside specialty assistance in the execution of the MSRE Remediation Project. In addition, Energy Systems performs the following primary functions:

- Technical investigations, test and evaluation, and technical analyses;
- Systems engineering, design, procurement, and installation/construction;
- Facility operation and maintenance;
- Interim corrective measures;
- Operation of remedial systems;
- Waste management;
- Regulatory and administrative compliance;
- Maintenance of project records;
- Surveillance and maintenance; and
- Program management and project control.

To accomplish these functions, Energy Systems has established an MSRE Remediation Project office managed by J. E. Rushton.

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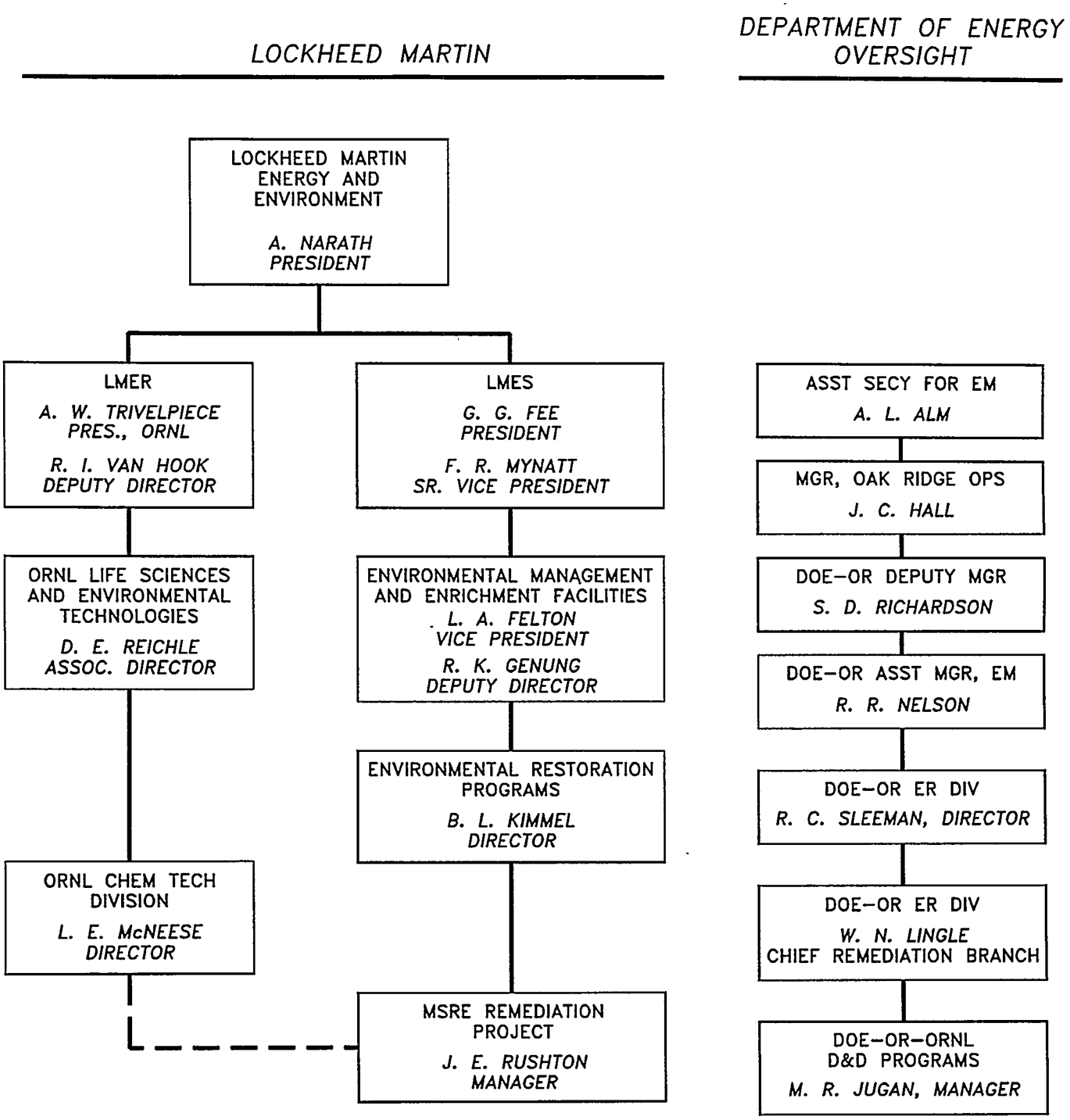

Fig. 6.1. Organizational structure of the Molten Salt Reactor Experiment Remediation Project.

6.2 SPECIFIC MSRE REMEDIATION PROJECT MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

Figure 6.2 depicts the MSRE Remediation Project organization's major interfaces and lines of authority, responsibility, accountability, and communication.

The manager, MSRE Remediation Project office, is responsible to the director of the Energy Systems ER Program for the overall successful execution of the program. Task managers report to the project manager and support completion of project objectives as required. Because of their familiarity with the complexities of the MSRE technology, coupled with the initiative for cost savings, many managers have multiple responsibilities or dual roles.

This highly matrixed project is comprised of a multitude of technical and management personnel with expertise from various Energy Systems organizations and ORNL divisions, such as Analytical Services, Central Engineering, Chemical Technology, Criticality, ER, Health and Safety, Health Sciences Research, Instrumentation and Controls, Metals and Ceramics, Plant and Equipment, Quality, Radiation Protection, Robotics and Process Systems, Safety, and Waste Management. A general description of the roles and responsibilities for the key project managers is included in the SISMP, DOE/OR/01-1333 Volume 1, Revision 1. Specific MSRE roles and responsibilities are listed in Sects. 6.2.1 through 6.2.9.

Figure 6.3 identifies the responsibility assignment matrix. Memorandums of Agreement (MOAs) or Memorandums of Understanding (MOUs) have been implemented to define the interrelationships of key personnel and major interfaces.

6.2.1 MSRE Remediation Project Manager

The MSRE Remediation Project manager is responsible directly to the Energy Systems ER Division director for the safe and successful execution of the remediation program. The project manager is responsible for technical integration and program management and planning; contract and project administration; and direction of all development, design, procurement, component fabrication, and testing activities. Programmatic guidance and funding direction are received from the ER Program director. The MSRE Remediation Project manager is an employee of the ORNL Chemical Technology Division (CTD). The MSRE Remediation Project manager receives technical and scientific guidance and direction from the director, Chemical Technology Division. This assignment is covered in a Memorandum of Agreement between MSRE and CTD.

6.2.2 MSRE Business Manager

The MSRE business manager is responsible to the project manager for project financial management necessary for project cost and schedule control, including project scheduling, cost estimating, project planning, performance measurement, and status reporting. The MSRE business manager receives financial guidance with the authority of the project manager from the ER Program Business Management Office and maintains liaison with the DOE-ORO project manager as directed for budget discussions.

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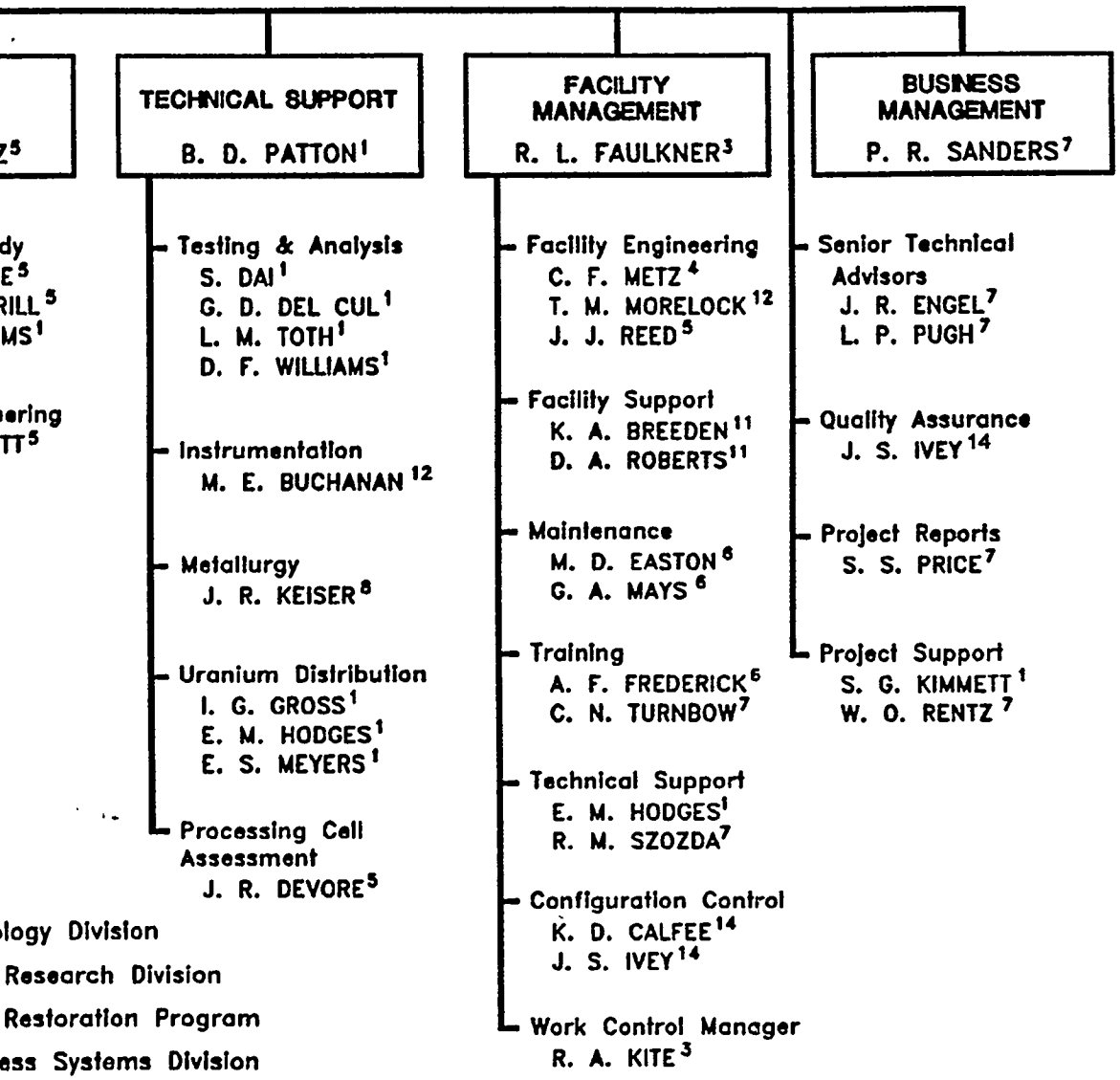

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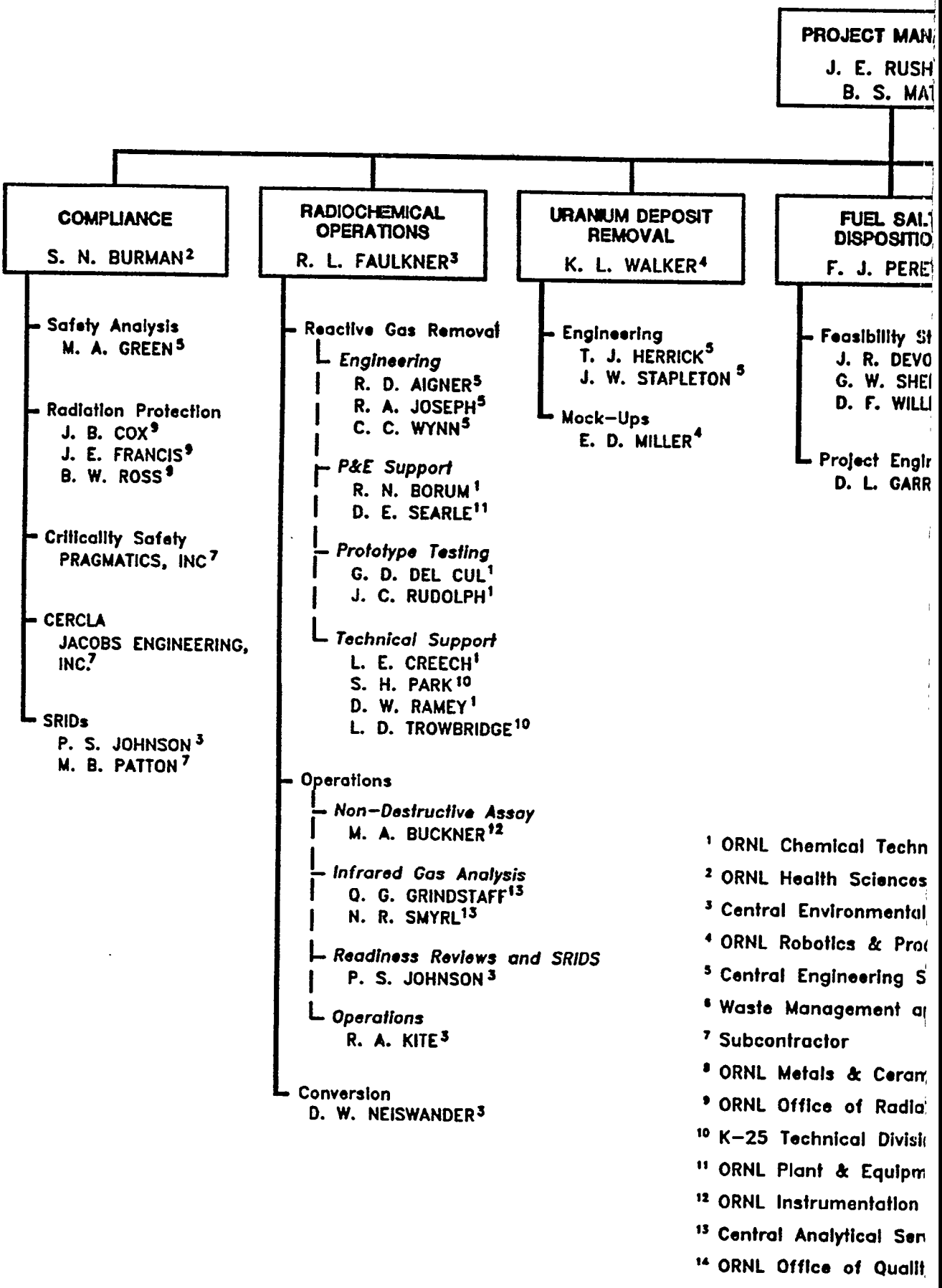

Fig. 6.2. Energy Systems organization for the Molte

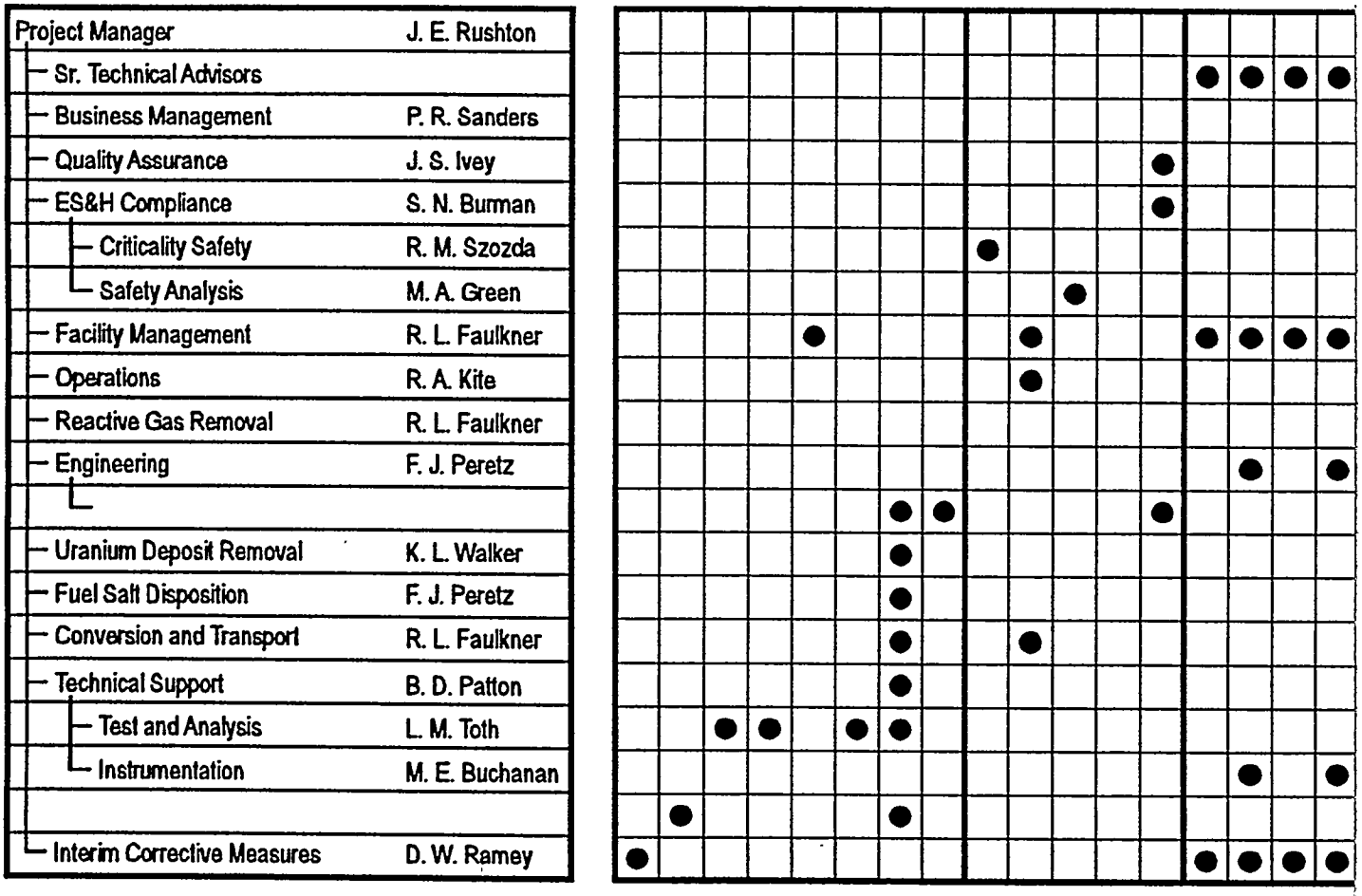

Fig. 6.3. Responsibility assignment matrix for the Molt

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Reactive Gas Removal (05.04)				Uranium Deposit Removal (05.05)					Fuel Salt Disposition (05.06)					Facility Readiness (05.07)									Project Management (05.07)					
Reactive Gas Removal (05.03.02)	Conversion to Oxide (05.04.03)	Transport & Storage (05.04.04)	Waste Disposal (05.04.05)	U Deposits Removal System (05.05.01)	U Deposits Removal (05.05.02)	Conversion to Oxide (05.05.03)	Transport & Storage (05.05.04)	Waste Disposal (05.05.05)	Fuel Salts Disposition System (05.06.01)	Fuel Salts Processing (05.06.02)	Conversion (05.06.03)	Transport & Storage (05.06.04)	Waste Disposal (05.06.05)	Monitoring Systems Upgrade (05.07.01)	Admin Procedures Upgrades (05.07.02)	Reserved (05.07.03)	Facility System Upgrades (05.07.04)	CM (05.07.05)	Building Modification (05.07.06)	Stored Material Disposition (05.07.07)	O&M (05.07.08)	S&M (05.07.09)	Project Control (05.08.01)	Records Management (05.08.02)	Finances (05.08.03)	Procurement (05.08.04)	QA (05.08.05)	Project Integration (05.08.06)
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6.2.3 MSRE Quality Assurance Manager

The MSRE quality assurance (QA) manager is responsible to the project manager for ensuring that all aspects of MSRE Remediation Project execution are accomplished in accordance with DOE rules and orders and Energy Systems requirements and practices for QA, conduct of operations, records, and management systems. The QA manager receives technical guidance and administrative authority from the ORNL Office of Quality Programs and Inspection (OQP&I) and, thereby, maintains sufficient independence from the project line organization to allow objective monitoring of project activities focused on project quality improvements. This relationship is described in a Memorandum of Agreement between MSRE and OQP&I. The organizational structure for the MSRE QA manager is shown in Fig. 6.4.

6.2.4 MSRE Environmental Safety and Health Compliance Manager

The MSRE Environmental Safety and Health Compliance (ES&HC) manager is responsible to the project manager for ensuring that project activities are accomplished in compliance with legal and administrative requirements governing the remediation of DOE nuclear facilities, including CERCLA; environmental, safety, and health; safeguards and security; and event recording. In the compliance areas of radiological protection, nuclear criticality safety, and health and safety, the ES&HC manager receives technical guidance and oversight support for project activities from the ORNL Office of Radiation Protection, the Office of Operational Readiness and Facility Safety, and the Office of Safety and Health Protection, respectively. These three organizations report to the ORNL Associate Director for Operations, Environment, Safety, and Health. In the technical area of Safety Analysis Engineering, the ES&HC manager receives technical support and guidance from Central Engineering Services. All of these areas of coordination are covered by a Memorandum of Agreement between MSRE and the respective organization. The organizational structure for the MSRE ES&HC manager is shown in Fig. 6.5.

6.2.5 MSRE Facility Manager

The MSRE facility manager is responsible to the MSRE project manager for readiness of the existing MSRE facility to safely support execution of MSRE Remediation Project activities. The facility manager will establish and maintain a configuration management program for the facility and will safely operate and maintain facility material and equipment during project execution. Although several key facility personnel are from the ORNL Waste Management Division (and some limited support is provided from Waste Management for operation of the facility) primary direction of the MSRE facility is provided by the MSRE project manager, and guidance on compliance issues is provided by the ER Division Facility Management and Operations organization. The organizational structure for the MSRE facility manager is shown in Fig. 6.6.

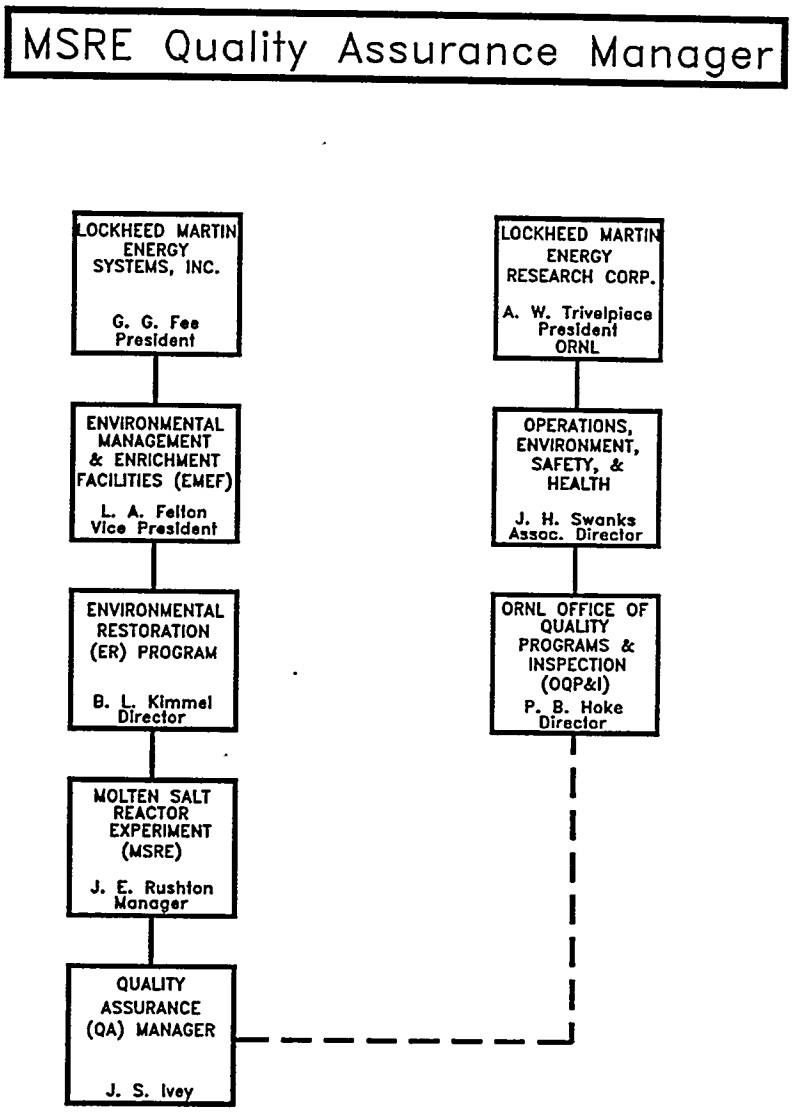

Fig. 6.4. Organizational structure for the Molten Salt Reactor Experiment quality assurance manager.

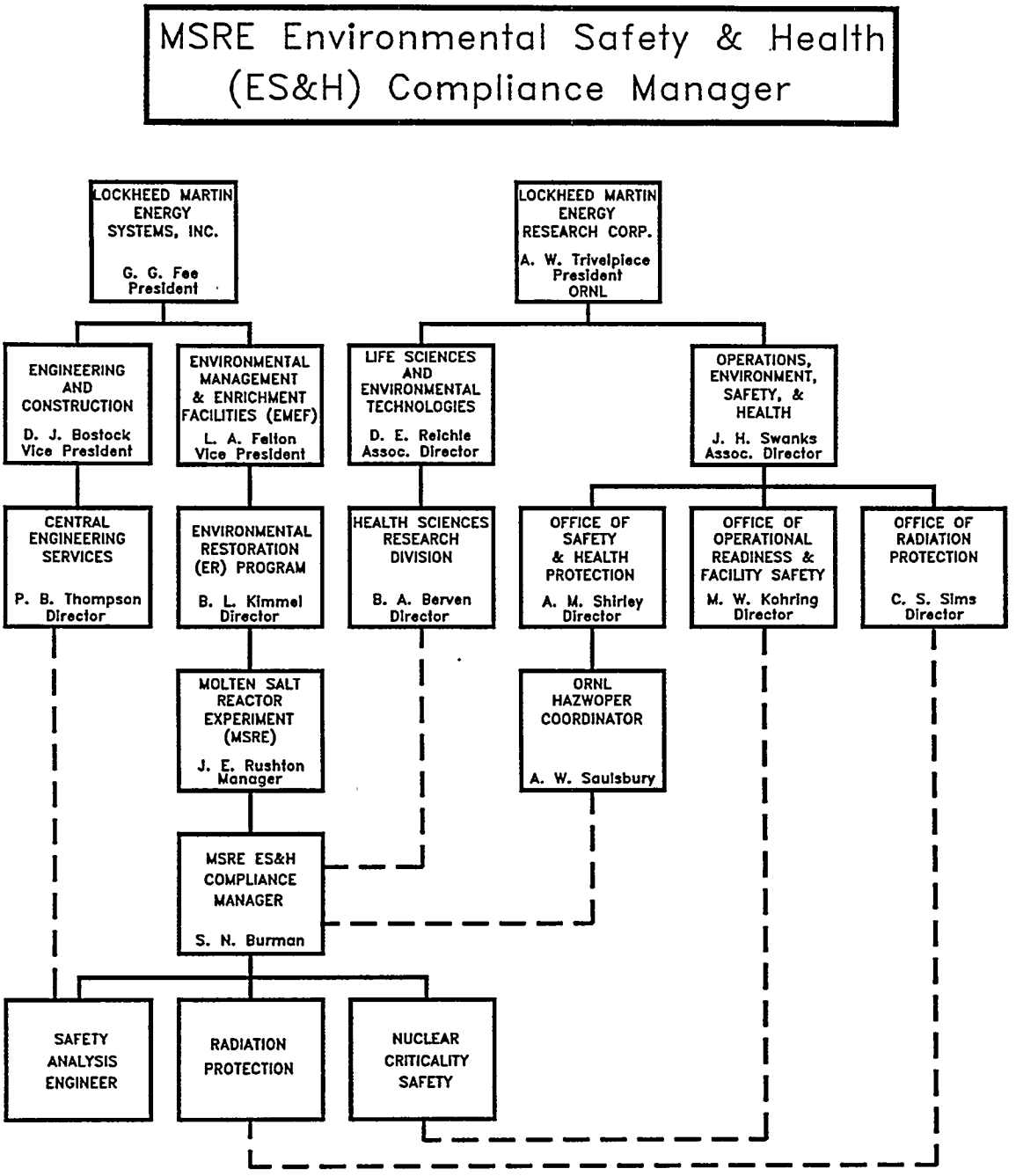

Fig. 6.5. Organizational structure for the Molten Salt Reactor Experiment environmental safety and health manager manager.

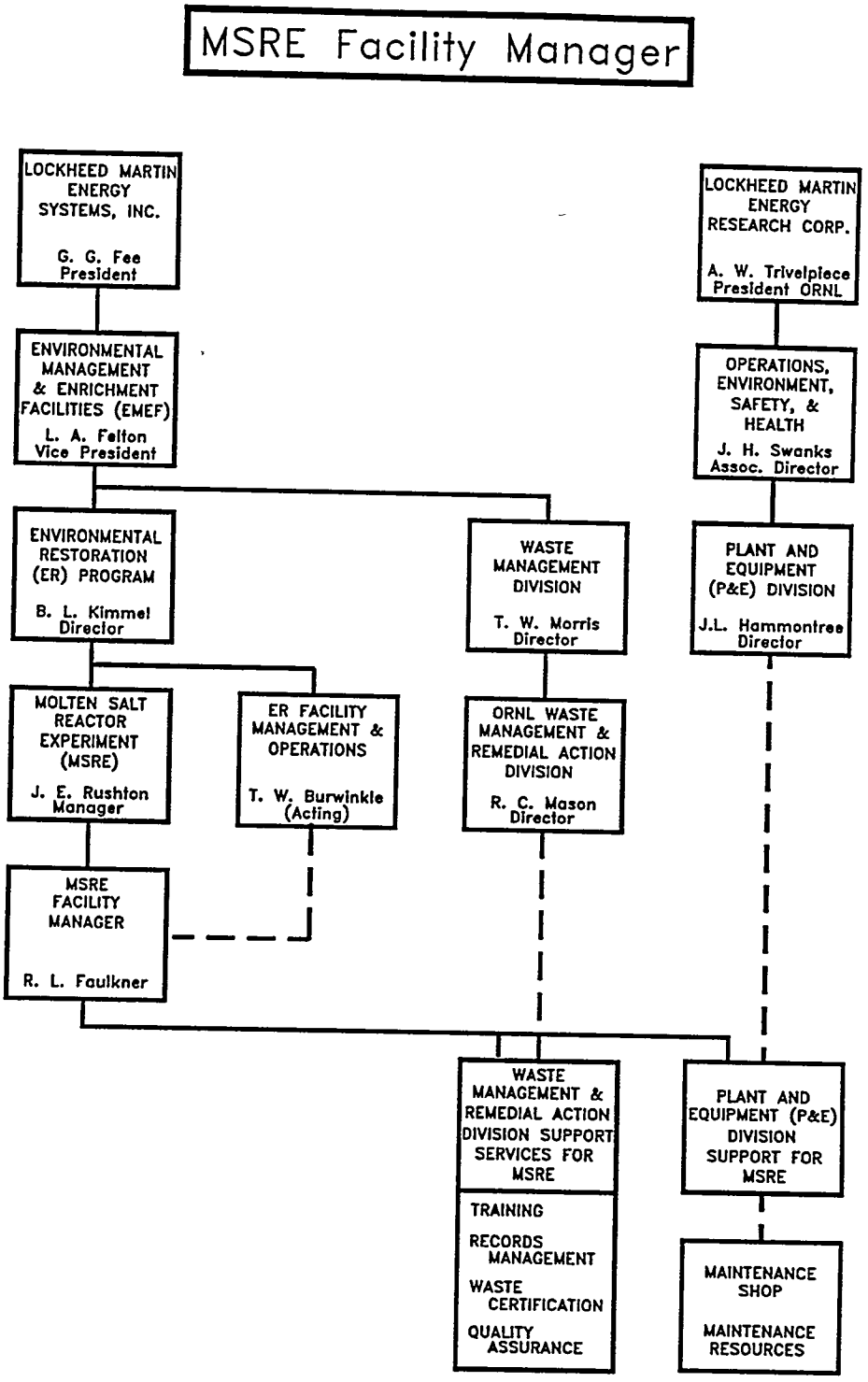

Fig. 6.6. Organizational structure for the Molten Salt Reactor Experiment facility manager.

6.2.6 MSRE Technical Support Manager

The MSRE technical support manager is responsible to the project manager for conducting tests, evaluations, and associated technical analyses to identify safe and effective technical solutions to the MSRE uranium migration phenomena. The incumbent is from the CTD, and the majority of test and analysis efforts are performed under CTD auspices. In the metallurgical area, technical guidance and support are derived from the ORNL Metals and Ceramics Division. The ORNL Instrumentation and Controls Division also provides technical support in that area of expertise. Memoranda of Agreement between MSRE and the respective organizations are in place to effect the cooperation needed to support these activities. The organizational structure for the MSRE technical support manager is shown in Fig. 6.7.

6.2.7 MSRE Engineering Manager

The MSRE engineering manager is responsible to the project manager for all engineering aspects of the MSRE Remediation Project. The engineering manager represents Central Engineering Services and is responsible for the economical design, fabrication, procurement, and installation of the technical systems necessary to remediate the uranium migration concerns. The MSRE engineering manager receives technical guidance and resource support from the Director of Central Engineering Services. Coordination and cooperation are covered by a Memorandum of Agreement between MSRE and Central Engineering Services. The engineering manager also serves as the fuel salt disposition project manager, an interim remedial action under CERCLA. As such, the MSRE engineering manager reports to the MSRE project manager for meeting DNFSB Recommendation 94-1 milestones and CERCLA milestones. These milestones include evaluating alternatives for fuel salt removal and for fuel salt processing as well as designing, installing, and operating equipment for removal, processing, and eventual storage or disposal of the salts. The engineering manager will draw upon the technical, engineering, and support organizations necessary to complete the MSRE tasks. The organizational structure for the MSRE engineering manager is shown in Fig. 6.8.

6.2.8 MSRE Radiochemical Operations Manager

The MSRE radiochemical operations manager is responsible to the MSRE project manager for all aspects of radiochemical operations, such as interim vent, purge, and trap of radioactive gases, and conversion of these trapped gases to more stable products. The radiochemical operations manager is responsible for the design, start-up, operation, support, and maintenance of the technical systems installed to remediate the uranium migration concerns. The radiochemical operations manager, in order to ensure readiness for radiochemical operations, draws on necessary technical and scientific support from other appropriate organizations. The incumbent also serves as the reactive gas removal project manager and the conversion, transport, and storage project manager. The organizational structure for the MSRE operations manager is shown in Fig. 6.9.

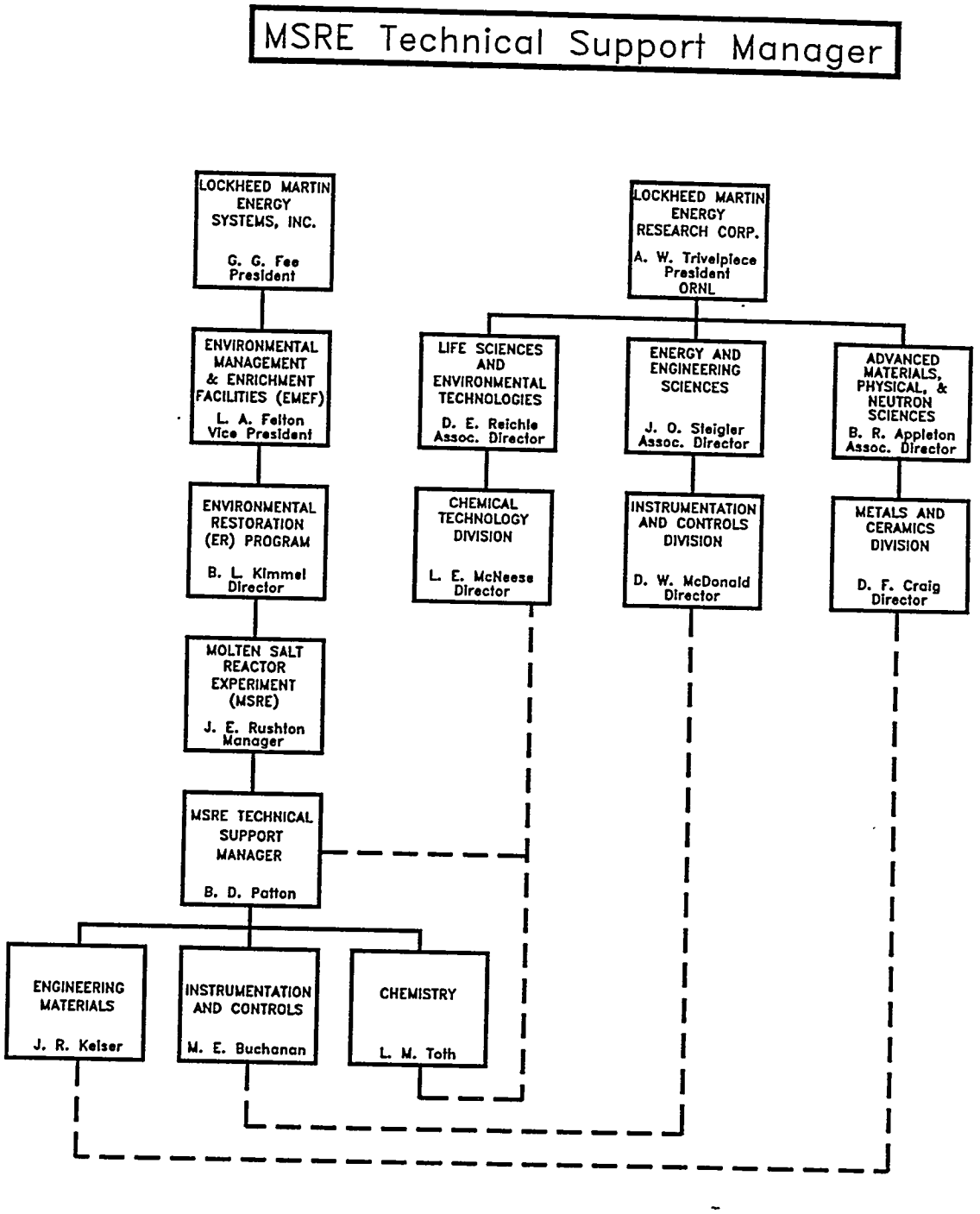

Fig. 6.7. Organizational structure for the Molten Salt Reactor Experiment technical support manager.

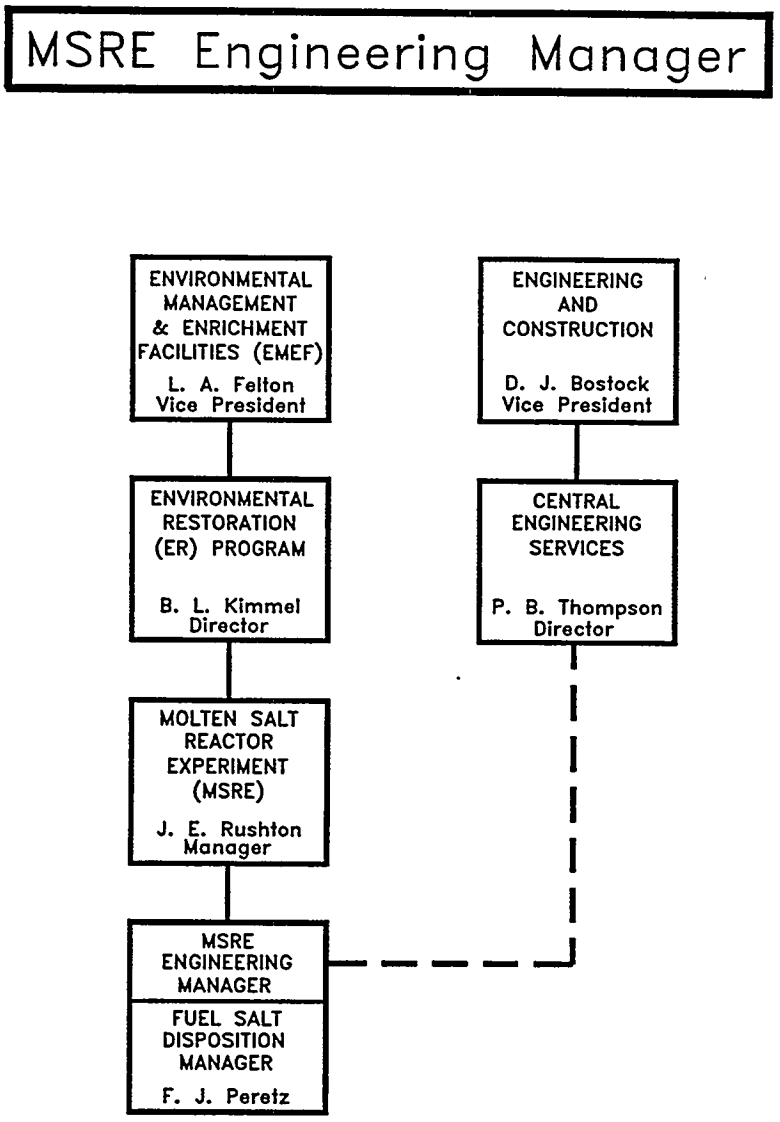

Fig. 6.8. Organizational structure for the Molten Salt Reactor Experiment engineering manager.

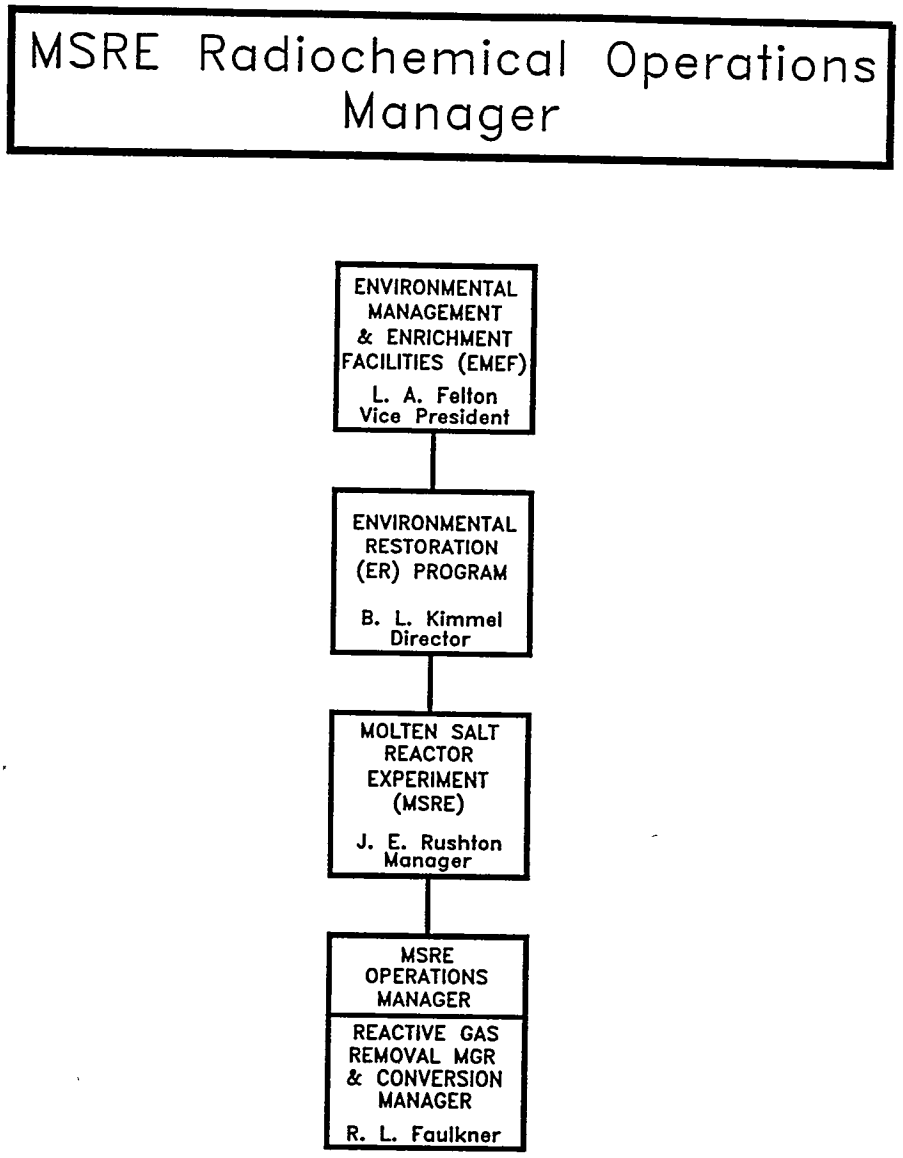

Fig. 6.9. Organizational structure for the Molten Salt Reactor Experiment radiochemical operations manager.

6.2.9 MSRE Interim Corrective Measures Manager

The MSRE interim corrective measures manager reports to the MSRE project manager for the successful execution of the initiatives formulated to promptly reduce the immediate risks associated with the uranium migration. The initiatives include lowering water in the ACB, partitioning the off-gas system, eliminating water sources, and enhancing the charcoal bed cell confinement. The MSRE interim corrective measures manager is responsible for directing the resources for project control and systems engineering activities, as well as coordinating the activities of the respective technical, analytical, and support organizations involved in these initiatives. The incumbent is a member of the ORNL Chemical Technology Division.

6.2.10 MSRE Reactive Gas Removal Manager

See Sect. 6.2.8.

6.2.11 MSRE Uranium Deposit Removal Manager

The MSRE uranium deposit removal manager reports to the MSRE project manager for all aspects of the removal operation, which is being conducted as a non-time critical removal action under CERCLA (EPA). The uranium deposit removal manager is in charge of evaluating and selecting alternatives for removing the uranium deposit from the ACB. Once selected, this phase will develop and test the equipment, systems, and methods selected, including a secondary containment system for the ACB. The MSRE uranium deposit removal manager is a member of the ORNL Robotics and Process Systems Division. Due to the hazardous nature of the deposits, particularly from a criticality and radiological standpoint, the MSRE uranium deposit removal manager draws upon the technical expertise of the Remote Systems Development section of the RPSD. A Memorandum of Agreement is in place to effect the cooperation between the MSRE project and the Robotics and Process Systems Division. The organizational structure for the MSRE uranium deposit removal manager is shown in Fig. 6.10.

6.2.12 MSRE Fuel Salt Disposition Manager

See Sect. 6.2.7.

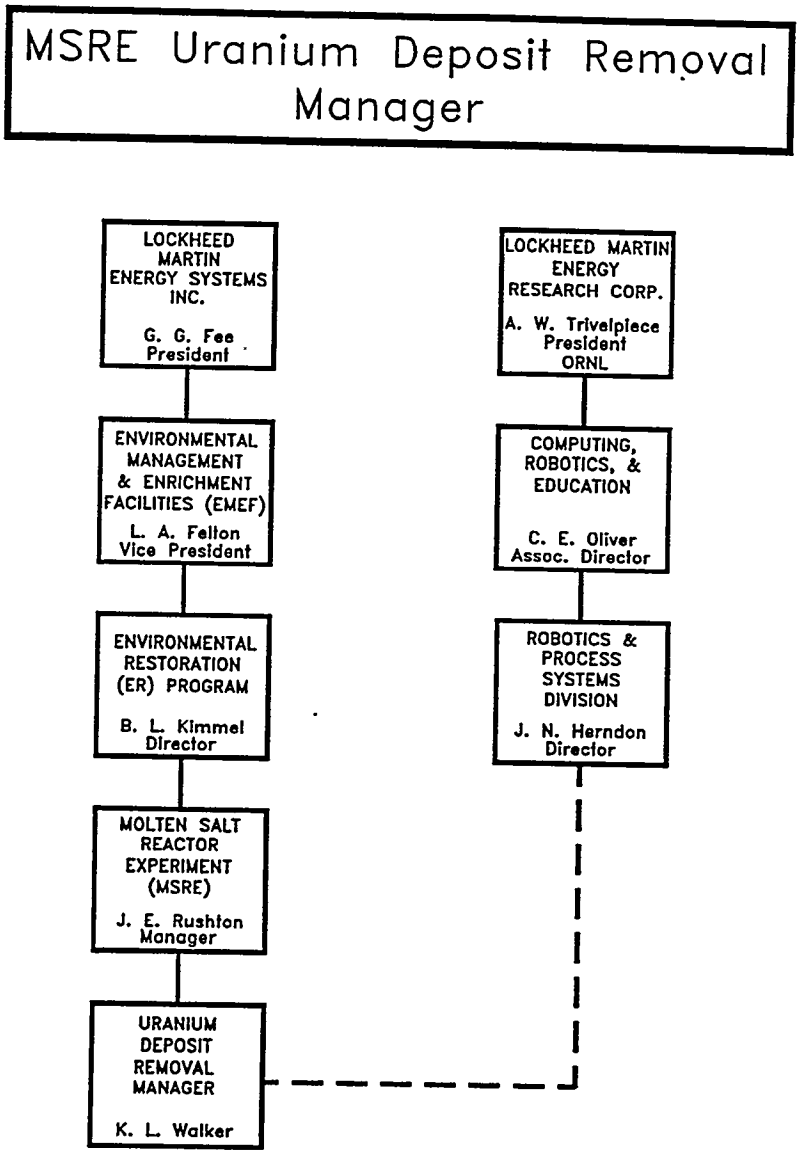

Fig. 6.10. Organizational structure for the Molten Salt Reactor Experiment uranium deposit removal manager.

7. PROJECT MANAGEMENT, PERFORMANCE MEASUREMENT, PLANNING, AND CONTROL

This chapter describes the management systems used by the MSRE Remediation Project to provide for planning and budgeting, tracking of funds and associated costs, scheduling, and performance measurement.

DOE-ORO is responsible for overall project coordination. Energy Systems and ORNL are responsible for controlling costs and schedules within the baseline estimates and for reporting project status and performance against their respective baselines. Integrated DOE-ORO, Energy Systems, and ORNL cost accounting and engineering manpower systems are used to manage the cost, manpower, schedule, and technical performance of the project.

A Management Control Information System (MCIS) is described in the PMP for the Energy Systems ER Program activities at ORNL (ER-167) and is used by project team members for decision making and reporting activities. The primary goal of the MCIS is to ensure planning and execution of each project in a manner that is technically sound, timely, and cost-effective. It has an upward flow of integrated, summarized information to assist in timely management decision-making by the project team.

In addition to the management systems and technical baseline requirements for the project, there are other essential requirements that must be satisfied, including environmental, safety, and health compliance; quality; configuration control; readiness reviews; and training. These areas are described in subsequent chapters of this plan.

7.1 WORK DEFINITION AND PROGRAM PLANS

The WBS provides the common framework used by all project participants to facilitate planning and assigning management and technical responsibilities, as well as controlling and reporting progress, status, resource allocations, cost estimates, expenditures, and project-related actions. In turn, specific technical tasks and the corresponding scope of work are described in the project's work package system. For further definition, reference SISMP, Volume 1, Revision 1, issued October 1995.

The MSRE Remediation Project management team has developed and implemented essential oversight program plans in response to federal regulations, DOE Orders, corporate policies, industry standards, and sound business practices. These program plans serve as an active reference and guidance mechanism, which supplement the work tasks to establish the applicable program plan objectives, define line management responsibilities, and detail the administrative requirements. Examples of current program plans used by the project include the following documents.

- Site Integrated Stabilization Management Plan,
- Project Management Plan,
- Quality Assurance Plan,
- Health and Safety Plan,
- Training Program Plan,
- Facility Excellence Program Plan,

- Basis for Interim Operation Document,
- Configuration Control Board Charter, and
- Readiness Review Process Plan.

7.2 PROGRESS REPORTS

Progress, accomplishments, special events, problems, impacts, and corrective actions for the MSRE Remediation Project are reported as required by agreement between Energy Systems and DOE. The following are examples of the periodic status reports that are provided to Energy Systems management and DOE:

- Weekly Highlights for the ER Program;
- Weekly Highlights for the MSRE Remediation Project (frequency changed to monthly effective May 1996);
- Monthly DNFSB Recommendation 94-1 Implementation Plan Progress Reports;
- Monthly Program Manager's Summaries of Project Accomplishments;
- Monthly Events Reports (as part of the ER Program Report);
- Monthly DOE Performance Measurement Summary Reports;
- Monthly budget, cost, and schedule reports;
- Quarterly DNFSB Recommendation 94-1 Performance Reports; and
- Quarterly Federal Facilities Agreement Project Progress Reports.

7.3 PROJECT REVIEWS, STATUS MEETINGS, AND OVERSIGHT GROUPS

To facilitate the effective and timely exchange of information between project participants, the project manager schedules periodic coordination and review meetings. These oversight meetings are intended to provide a medium for exchanging test or experimental data, reviewing and identifying action items, reporting project status, and communicating specific technical or other project-relevant information. The following are examples of project reviews, oversight meetings, and self-analysis:

- daily calendars and commitments tracking;
- weekly project technical tasks status reviews;
- weekly readiness review meetings;
- weekly project manager's status reviews with DOE-ORO;
- weekly facility and test operations status and planning sessions;
- biweekly MSRE performance measurement team assessments;
- project priorities listing reviews;
- monthly project technical status meetings;

- monthly presentations to the ORNL environment, safety, health compliance and quality committees; and
- monthly budget and cost status reviews, held separately with ER program management, Energy Systems management, and DOE-ORO program management.

Performance measurement is also conducted via other important exchanges such as technical review sessions, change control meetings, lessons learned, and project assessments which are scheduled on an as-needed basis. The following are examples of these internal and external oversight groups:

- the DOE/Energy Systems senior management team;
- an ad hoc MSRE operational readiness review certification team;
- an Energy Systems RA management review group;
- a quarterly performance measurement assessment team;
- a semi-annual senior review board;
- an Energy Systems technical review team;
- an annual joint DOE/ER and Energy Systems budget and schedule justification review team;
- a periodic independent technical review panel;
- various DOE, state, and local government or agency regulatory forums, including the EPA and the Tennessee Department of Environment and Conservation (TDEC); and
- groups participating in public forums and workshops to answer stakeholder questions on technical issues.

7.4 DOCUMENT CONTROL AND RECORDS MANAGEMENT

The ER Technical Integration Information Resource Management (IRM) program provides the project with compliant implementation of the following records management functional elements: creation, receipt, identification, distribution, indexing, turnover, transfer, storage, preservation, protection, inventory, retrieval, and disposition in accordance with the following procedures:

- ERWM/ER-P1110, "Environmental Restoration Records Management," Rev. 1;
- ERWM/ER-P1113, "Environmental Restoration Controlled Document Management," Rev.1; and
- ERWM/ER-P1103, "Preparation, Division Approval, and Clearance of ER Program Documents."

However, project members may chose to continue to use their "home division's" editing, release, and distribution system depending on the subject matter and purpose for the document or report issuance. In these cases, documentation should be maintained as close as possible to the above referenced procedures, with specific emphasis to submit a Record Copy or file copy to the ER Document Management Center (DMC).

It is also anticipated that project members will maintain working files in which nonrecord project documentation will be retained. In these cases, the working files shall be maintained until project completion.

8. CONDUCT OF OPERATIONS

The Conduct of Operations Program ensures that operations at DOE facilities are managed, organized, and conducted in a manner that will ensure an acceptable level of safety. DOE requirements for Conduct of Operations are included in DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. The Conduct of Operations Program at the MSRE Facility has been implemented with Energy Systems guidance and ORNL site procedures to ensure:

1. Facility operators have procedures in place to control the conduct of their operations;
2. Line organizations review existing and planned programs important to safe and reliable facility operations; and
3. Line organizations assess the effectiveness of appropriate directives, plans, or procedures at locations for which they are responsible.

This program incorporates several areas that overlap, including surveillance, testing, maintenance, criticality safety, radiation protection, hazardous materials, and safety management.

9. CONFIGURATION MANAGEMENT

A configuration control board (CCB) solely dedicated to the MSRE Remediation Project has been established. The CCB is a part of the overall MSRE configuration control program designed to meet the requirements of DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

The purpose of the CCB is to ensure that all changes to MSRE configuration items (CIs) receive multi-disciplined technical and management reviews in a timely manner. CIs could include structures, systems, and components; instrumentation and alarm systems; communication networks; instructions and procedures; and other designated physical or administrative boundaries, with particular attention to primary and secondary containment, nuclear criticality safety approval requirements, and safety authorization basis documents.

The CCB is currently chaired by the MSRE Quality Assurance specialist and consists of approximately four members whose work experience covers research and development, facility maintenance and safety, mechanical and instrumentation engineering and operations, and nuclear criticality.

A planning and internal control mechanism is in place for initiating, approving, and documenting the performance of physical work and tests at the MSRE Facility/site during the remediation project. Procedure WMRA-ERPS-502, MSRE Work Package Preparation, provides guidance on the project's approach to work control and configuration management. All individuals or organizations performing work at the MSRE complex must comply with this procedure. The procedure establishes a formal process for initiating MSRE work packages; ensuring MSRE work packages receive appropriate reviews, assessments, and approvals; tracking work packages in a system that is readily retrievable; providing for configuration management of MSRE structures, systems, and components in conformance with approved requirements; ensuring the work is performed by appropriately trained personnel in a safe and efficient manner; and ensuring work does not compromise the established safety basis.

Project-associated work and tests not physically performed at the MSRE complex should comply with the applicable procedures and instructions of the performing organization.

The MSRE configuration management is illustrated in Fig. 9.1.

ORNL DWG 95A-72R

MSRE Configuration Management

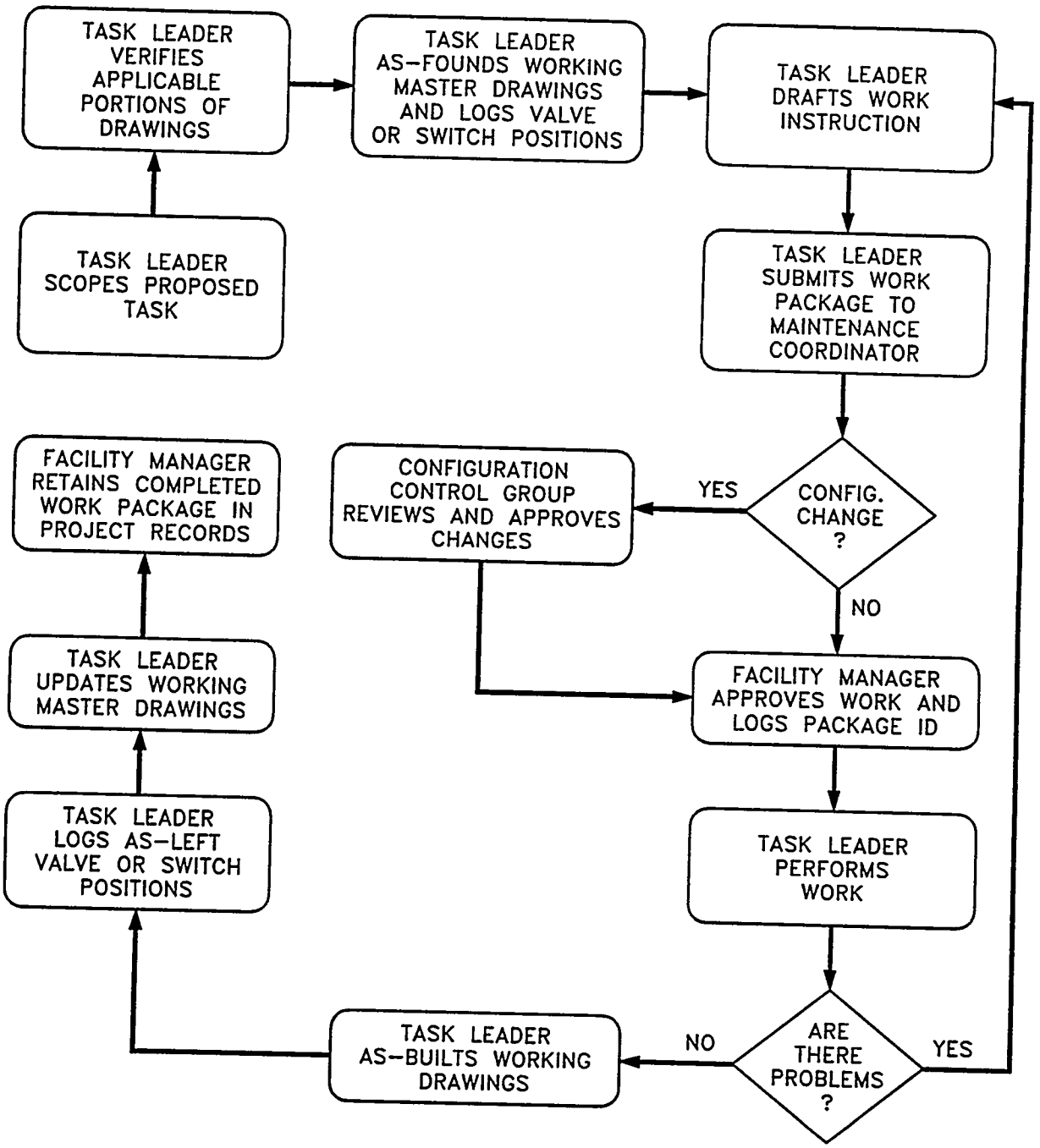

Fig. 9.1. Configuration management for the Molten Salt Reactor Experiment Remediation Project.

10. ENVIRONMENTAL, SAFETY, AND HEALTH PROTECTION

There are environmental, safety, and health concerns associated with the MSRE Facility and Remediation Project. The facility is an old building built in the mid-1940s that has housed many functions. The facility itself is under a facility readiness program which evaluates the condition of the building and defines deficiencies that need attention. Some of these concerns are safety related. The MSRE remediation activities have been reviewed for both environmental and project-task-related issues. Health and safety concerns are addressed on a task-by-task basis. Controls are put into place to protect the workers as well as the environment from the identified hazards. Numerous documents have been generated that address safety and health issues. Some of these documents are listed below.

- ***Basis for Interim Operation: Molten Salt Reactor Experiment Facility* (Green 1995).** The basis for interim operation (BIO) serves as the facility safety analysis report (SAR). The preliminary hazard analysis (PHA) is a part of the BIO and specifies the safety precautions in place for the protection of the workers and the general public.

- ***Request for Nuclear Safety Review and Approval, MSRE Fuel and Flush Salt Storage* (in preparation).** This report addresses the nuclear criticality safety of the MSRE facility on the basis of the known facility conditions and a modification of this document addresses the migration of the uranium-fluorine throughout the system.

- ***Health and Safety Plan for the Molten Salt Reactor Experiment Project at Oak Ridge National Laboratory.*** The plan was written to address the safety of personnel and the environment for efforts related to operations conducted at the MSRE facility. The plan complies with the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910.120 *Hazardous Waste Operations and Emergency Response* (HAZWOPER), for investigations and cleanup at hazardous sites.

- ***Hazard Screening.*** Hazard screening identifies hazards and classifies them according to threshold quantities outlined in DOE-STD-1027-92. Screening and identification of hazards were performed in accordance with ES/CSET-2/R1 and DOE-STD-1027-92. The comparison resulted in a classification of Category 2 facility. This classification was based on the nuclear inventory within the MSRE facility.

In addition, the project adheres to the applicable ER Program policies and procedures pertaining to environmental, safety, and health protection. However, since the project is not classified as an environmental characterization project, normal activities do not involve collection and measurement of environment data. The related documentation, validation criteria, and data management requirements do not apply to the MSRE Remediation project.

11. QUALITY

A rigorous Quality Assurance Program has been implemented by the project to meet facility and customer needs. The project's quality assurance requirements are contained in ORNL/ER-336, *Quality Assurance Plan for the Molten Salt Reactor Experiment Remediation Project, Phase I–Interim Corrective Measures and Phase II–Purge and Trap Reactive Gases*. The project's Quality Assurance Plan Defines the quality program elements for project activities and describes how conformance with these requirements will be ensured for remediation, structures, systems, components, and their operation.

The project's quality assurance plan is responsive to the following Energy Systems documents: Y/QD-15, Revision 2, *Lockheed Martin Energy Systems Quality Program Description* and Y/QD-21, Revision 2, *Quality Program Description Implementation Plan for Lockheed Martin Energy Systems, Inc.* Y/QD-15 describes the overall quality program for Energy Systems and is applicable to all Energy Systems activities and facilities. Y/QD-15 contains the 50 quality requirement commitments that were adopted as part of Energy Systems response to the Price-Anderson Amendment Act. Y/QD-15 was developed on the premise that the rigor of application should be based on a graded approach to quality commensurate with the identified risk associated with the failure of items, processes, or services as related to the safety of employees or the public, protection of the environment, and achievement of programmatic missions.

Project and support line management are responsible for ensuring that the requirements of ORNL/ER-336 are appropriately implemented during conduct of activities and the requirements are communicated and understood by appropriate personnel. The project's quality assurance manager is responsible for assisting the MSRE project manager and the MSRE line management in assuring that all aspects of the project activities are accomplished in accordance with customer requirements. The ORNL Office of Quality Programs & Inspections provides technical guidance and administrative authority to the MSRE QA manager in such a manner that this position maintains sufficient independence from the project and facility line management to allow objective monitoring of project activities focused on quality improvements.

12. OPERATIONAL READINESS REVIEWS

DOE Order 5480.31, *Startup and Restart of Nuclear Facilities*, establishes the requirement to conduct operational readiness reviews (OpRRs) or readiness assessments (RAs) prior to restart of an existing nuclear facility, startup of a new nuclear facility, or restart or startup of a nonreactor nuclear facility in which activities or operations involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. The DOE order also establishes the responsibilities and authorities of the responsible contractor and DOE elements in the process leading to a new start or restart. The OpRR review scope is based on the specifics of the facility and the reason for the shutdown or restart as related to a minimum set of core requirements. A graded approach will be used in defining the depth of the OpRR based on established core requirements.

Readiness assessments are conducted to determine a facility's readiness to start up or restart when an OpRR is not required. Readiness review is a disciplined, systematic, documented, performance-based examination of facilities, equipment, personnel, procedures, and management control systems to ensure that a facility will be operated safely within its approved safety envelope as defined by the facility safety basis.

For either an OpRR or an RA, a line management certification team (CT) is chartered to provide on-going management reviews for each of the consequential tasks related to the primary process containment for the MSRE. the CT will work with appropriate task leaders, as well as review fabrication, installation, and operations packages to ensure that personnel are ready, that documentation is complete, and that the facility and equipment are ready before the task is initiated. The CT reviews will include documentation review, walk-down of selected fabrication packages, and work packages, and walk- down of the system.

13. TRAINING

A Training Program Plan has been developed for the MSRE Remediation Project in compliance with the requirements set forth in DOE Order 5480.20A, *Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities*. The Training Program Plan for the project also complies with state and federal laws and regulations, Energy Systems policies and procedures, site requirements, and operational procedure requirements.

The Training Program Plan establishes a comprehensive, job-performance-based training program with the following objectives: to promote the safety of personnel at the MSRE complex; to ensure that all applicable training programs are provided to qualify personnel at the MSRE complex for their designed responsibilities and duties; to ensure that personnel are aware of their responsibilities while at the MSRE complex; to expand personnel understanding of the MSRE facility process and corresponding equipment; and to provide a formalized, auditable training program that satisfies DOE orders and other regulatory requirements.

The Waste Management and Remedial Action Division Training Department (WMRAD) located at ORNL is responsible for guidance, monitoring, record keeping, and general oversight of current and evolving training needs for the MSRE Remediation Project.

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