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ENVIRONMENTAL RESTORATION

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PROJECT MANAGEMENT PLAN FOR THE OAK RIDGE NATIONAL LABORATORY REMEDIAL INVESTIGATION/FEASIBILITY STUDY

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ACRONYMS

AA	Alternatives Assessment
ACWP	Actual Cost of Work Performed
ALARA	As Low As Reasonably Achievable
ARARs	Applicable or Relevant and Appropriate Requirements
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BGIS	Bechtel Geographic Information Systems
BNI	Bechtel National, Inc.
CADD	Computer Aided Design and Drafting
CCB	Change Control Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH-TRU	Contact-Handled Transuranic
CV	Cost Variance
DOE	Department of Energy
EPA	Environmental Protection Agency
ESH	Environmental Safety and Health
FSSM	Field Services and Support Manager
HEPA	High Efficiency Particle
HRE	Homogeneous Reactor Experiment
HSWA	Hazardous and Solid Waste Amendments
LLW	Low Level Waste
MVST	Melton Valley Storage Tanks
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NHF	New Hydrofracture Facility
NPDES	National Permitted Discharge Elimination System
NRC	Nuclear Regulatory Commission
OHF	Old Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
OSHA	Occupational Safety and Health Administration

ACRONYMS
(continued)

PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PW	Process Waste
PWTP	Process Waste Treatment Plant
QAPP	Quality Assurance Project Plan
RAM	Responsibility Assignment Matrix
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facilities Assessment
RFI	RCRA Facility Investigation
RH-TRU	Remote-Handled Transuranic
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RTL	Review Team Leader
SARA	Superfund Amendments and Reauthorization Act
SAS	Statistical Analysis Systems
SV	Schedule Variance
SWMU	Solid Waste Management Unit
SWSA	Solid Waste Storage Area
TLD	Thermoluminescent Dosimeter
TRU	Transuranic
USRAD	Ultrasonic Ranging and Data
VAR	Variance Analysis Report
WA	Work Authorization
WAG	Waste Area Grouping
WBS	Work Breakdown Structure
WOC	White Oak Creek
WOD	White Oak Dam
WOL	White Oak Lake

ABBREVIATIONS

cfs	cubic feet per second
Ci	Curie
ft	foot, feet
ft^3	cubic feet
g	gram
gal	gallon
in.	inch(es)
mrad/h	millirad per hour
mrem/h	millirem per hour
nCi/g	nanocuries per gram
yr	year

1.0 INTRODUCTION

1.1 PURPOSE

This document sets forth the objectives, organizational responsibilities, project management techniques, and major project activities for a Remedial Investigation/Feasibility Study (RI/FS) for several areas at the Oak Ridge National Laboratory (ORNL). This Project Management Plan has been prepared for Martin Marietta Energy Systems (Energy Systems) in response to Phase I, Task 1 of the RI/FS, as outlined in Proposal No. 20097-30, dated August 7, 1987, and Subcontract No. 30B-99053V, dated June 1, 1987.

1.2 SCOPE

This Project Management Plan is intended as an overview document. It provides a summary discussion of relevant background information on the ORNL complex and describes current conditions and their relationship to the RI/FS efforts. It includes a discussion of management and technical objectives, a description of the technical approach to the work, a discussion of critical support activities, identification of responsible organizations and interfaces, and a discussion of the project management systems to be applied for cost and schedule control and monitoring.

2.0 OBJECTIVES

2.1 MANAGEMENT AND TECHNICAL OBJECTIVES

The objective of the ORNL RI/FS project is to provide a Remedial Investigation/Feasibility Study for several areas of ORNL that are contaminated primarily with radioactive materials and, to a lesser extent, with hazardous chemicals. At least 13 Waste Area Groupings (WAGs), each containing one or more contaminated Solid Waste Management Units (SWMUs), will be included in the RI/FS. Additional areas may be identified by, or assigned, to ORNL as areas requiring an RI/FS during the course of this project.

For each WAG, a Remedial Investigation Plan will be developed and implemented. Analytical results of the remedial investigation will be documented and incorporated into an assessment of remedial action alternatives for each WAG that addresses each SWMU individually or collectively. The Alternatives Assessments (AAs) for all WAGs will be incorporated into a single Feasibility Study, providing a comprehensive assessment of the need, extent, priority, timing, cost and environmental implications of future remedial actions. The RI/FS process will be meshed with NEPA so that the requirements of both are met and so that the final product serves as a functional equivalent of an EIS as well as documentation of the results of the RI/FS.

The WAGs presently identified as part of the RI/FS project are shown in Table 2-1, which also includes a brief description of each WAG. During Phase II of the project, each WAG will be the subject of an extensive investigative effort during the remedial investigation phase of the project.

The objectives of each remedial investigation are to collect sufficient data from a WAG to adequately characterize the nature and extent of contamination and to obtain sufficient engineering data to evaluate potential remedies for each SWMU or collection of SWMUs. A

TABLE 2-1

ORNL WASTE AREA GROUPINGS
INCLUDED IN THE RI/FS PROJECT

WASTE AREA GROUPING	DESCRIPTION
WAG No. 1 - Main Plant Area	The ORNL Main Plant Area contains about one-half (99) of the Solid Waste Management Units (SWMUs) identified to date. Most of the SWMUs are sites used to collect and store low level waste; the SWMUs also include spill and leak sites detected over the past 20 to 35 years.
WAG No. 2 - White Oak Creek/ White Oak Lake (WOC/WOL)	WOC/WOL and its tributaries represent the major drainage system for ORNL and the surrounding facilities. This WAG contains two SWMUs: the stream channels of WOC and Melton Branch, and WOL, White Oak Dam, and the embayment.
WAG No. 3 - Solid Waste Storage Area 3 (SWSA 3)	WAG 3 is located in Bethel Valley and is composed of three SWMUs: SWSA 3; a closed scrap metal area; and a contractor's landfill.
WAG No. 4 - Solid Waste Storage Area 4 (SWSA 4)	WAG 4 consists of three SWMUs: the Liquid Low Level Waste (LLLW) pipeline north of Lagoon Road; pilot LLLW seepage pits 1 and 2; and SWSA 4.
WAG No. 5 - Solid Waste Storage Area 5 (SWSA 5)	This WAG contains 22 SWMUs including 13 LLLW storage tanks, surface facilities for the Old and New Hydrofracture facilities, SWSA 5, the Transuranic (TRU) Waste Storage Area, LLLW leak/spill sites, an impoundment used to dewater sludge, and a radioactively contaminated waste-oil storage tank.
WAG No. 6 - Solid Waste Storage Area 6 (SWSA 6)	WAG 6 consists of three SWMUs: an emergency waste basin; SWSA 6; and an explosives detonation trench.
WAG No. 7 - Pits and Trenches	WAG 7 contains 10 SWMUs including: 7 seepage pits and trenches; a decontamination facility; three LLLW pipeline leak sites; a storage area; and 7 fuel wells containing the acid solutions containing enriched uranium (primarily) from the Homogeneous Reactor Experiment (HRE) fuel.

Table 2-1
(continued)

WASTE AREA GROUPING	DESCRIPTION
WAG No. 8 - Melton Valley	The Molten Salt Reactor Experiment facility and the High Flux Isotope Reactor are located within WAG 8. WAG No. 8 contains 20 SWMUs including: waste collection basins; LLLW pipeline and leak sites; a hazardous waste storage facility; LLLW collection and storage tanks; a mixed waste storage pad; a sewage treatment plant; and a silver recovery plant.
WAG No. 9 - Homogeneous Reactor Experiment (HRE) Area	This WAG contains three SWMUs: the HRE pond; LLLW collection and storage tanks; and a septic tank serving the HRE.
WAG No. 10 - Hydrofracture Wells	WAG 10 consists of the injection wells and grout sheets from four SWMUs, two of which were experimental sites used in the development of the hydrofracturing process at ORNL. The other two sites are inactive operating facilities that were used to dispose of ORNL's LLLW.
WAG No. 11 - White Wing Scrap Yard	This WAG includes only the White Wing Scrap Yard, an above-ground storage area for contaminated equipment.
WAG No. 13 - Environmental Research Areas	This WAG includes a cesium-137 contaminated field and a cesium-137 erosion/runoff study area.
WAG No. 17 - ORNL Services Area	This WAG includes the photographic waste storage area (two above-ground tanks); a septic tank; and a waste oil storage area containing one above-ground tank, two below-ground tanks, and a tank truck.

remedial investigation focuses on defining the types and quantities of contaminants present in each SWMU or collection of SWMUs, providing a quantitative definition of how contaminants exit the site, gathering sufficient data to estimate the temporal and spatial distribution of off-site migration, and obtaining additional engineering data to accurately estimate the cost of potential remedies for the SWMU or collection of SWMUs.

Each remedial investigation consists of four basic tasks:

- o A Remedial Investigation Plan
- o Field Investigations
- o Laboratory and Bench Scale Studies (if necessary)
- o A Remedial Investigation Analysis Report

Figure 2-1 summarizes the steps to be followed during each RI effort.

Following completion of the remedial investigation for each WAG, a WAG-specific AA will be completed during Phase III of the project. The objective of the AA is to identify and screen potential remedial technologies that could be used at a particular WAG, develop a set of feasible remedial action alternatives, and compare the alternatives based on environmental protection, environmental effects, technical feasibility, and costs.

During Phase IV, the AAs for all WAGs will be combined into a comprehensive Feasibility Study. Remedial action scenarios for the ORNL complex will be developed, prioritized, and evaluated, and their costs will be estimated. The end product of this activity will be a documented approach for remedial activities at the ORNL complex that can be used as the basis for future remediation of the ORNL WAGs.

2.2 SCHEDULE OBJECTIVES

The baseline and target schedule for the ORNL RI/FS project is shown in Figure 2-2. RI/FS activities for 13 WAGs will be conducted over a 5-yr time frame. This schedule should be viewed as preliminary; it may be revised to reflect changing field conditions, the addition of other WAGs, or funding constraints.

2.3 COST OBJECTIVES

Energy Systems has estimated the cost for performing the ORNL RI/FS project to be approximately is $25,472,000, distributed by fiscal year as shown in Figure 2-3 (Myrick et al, 1984). The estimate includes costs for the Bechtel National, Inc. (BNI) Team and Energy Systems support costs. As with the project schedule, this cost estimate should be considered preliminary and is subject to revision as the RI/FS project progresses.

This estimate includes the cost of preparing the comprehensive Feasibility Study, which describes, prioritizes, and evaluates remedial action alternatives for the WAGs. That document will provide cost estimates for remedial action alternatives. The RI/FS project cost estimates contain no cost for remedial action.

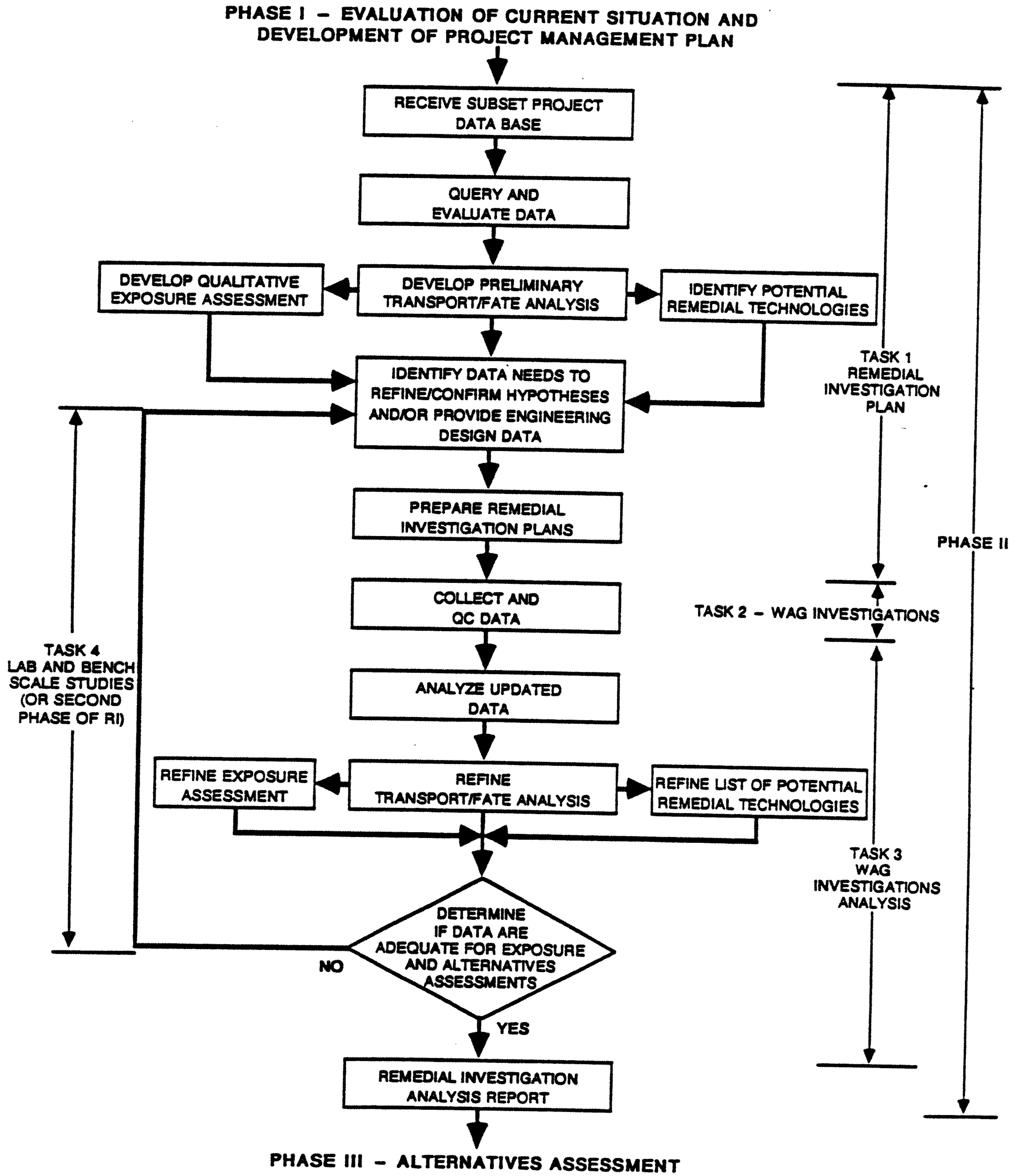

FIGURE 2-1
APPROACH TO PHASE II REMEDIAL INVESTIGATION

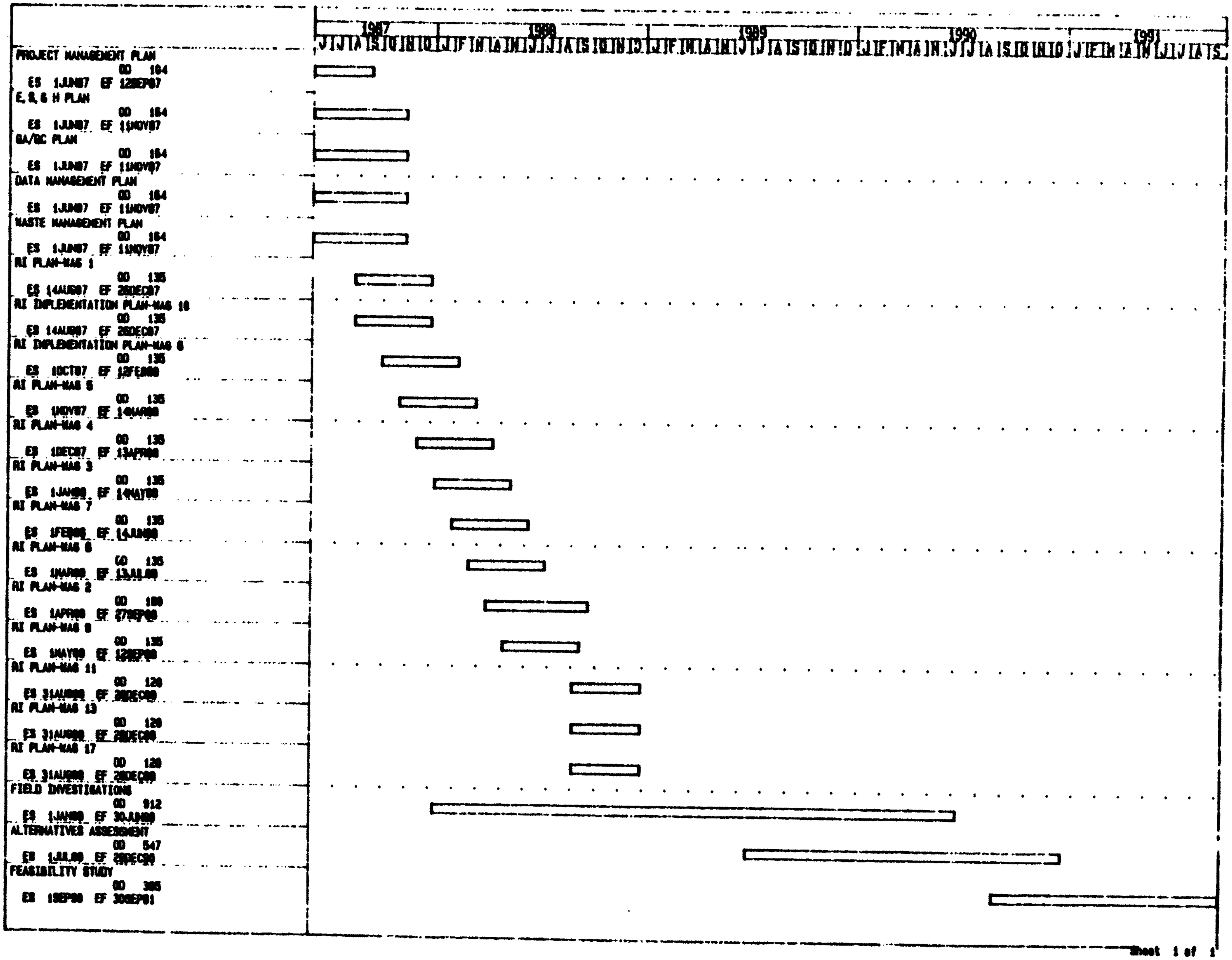

FIGURE 2-2
SCHEDULE FOR THE RI/FS PROJECT

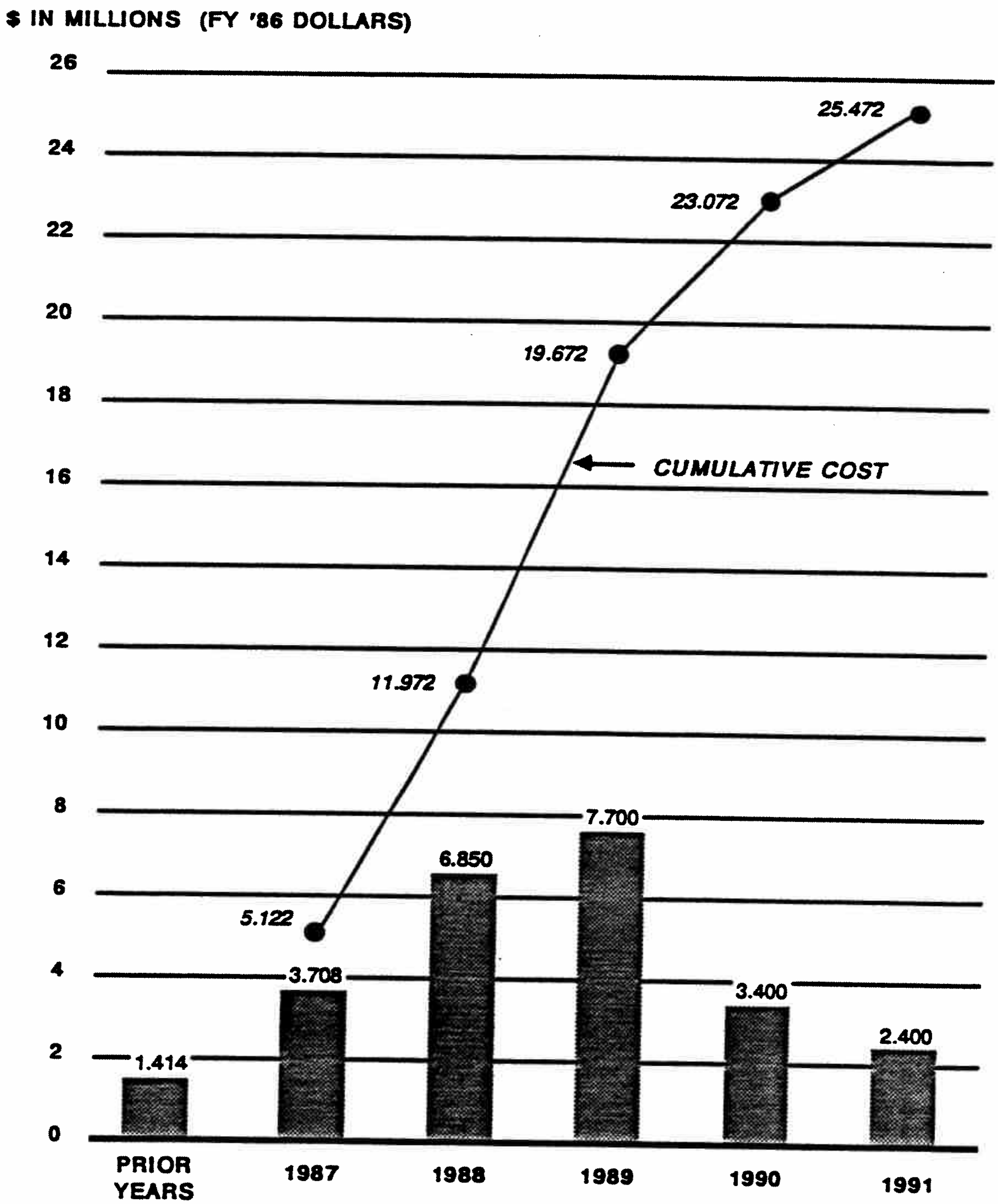

FIGURE 2-3
ESTIMATED COST FOR RI/FS
PROJECT BY FISCAL YEAR

3.0 EVALUATION OF CURRENT SITUATION

3.1 BACKGROUND

3.1.1 Location

The ORNL reservation is located in the southeastern United States approximately 13 miles northwest of the city of Knoxville, Tennessee and 8 miles south of the city of Oak Ridge.

3.1.2 Setting

The ORNL reservation lies in the Tennessee section of the Valley and Ridge Province (Fenneman, 1938). This province is characterized by northeasterly trending elongate valleys and alternating ridges, the latter of which are locally 200 to 500 feet higher than the valleys (Webster, 1976). The reservation is drained by the White Oak Creek (WOC) watershed, and White Oak Lake (WOL) acts as a retention basin for the facility. From northwest to southeast, the ridges and valleys encountered are Chestnut Ridge, Bethel Valley, Haw Ridge, Melton Valley, and Copper Ridge.

The ORNL portion of the reservation encompasses two valleys and their attendant ridges, with the majority of the laboratory and waste disposal operations occurring in the valleys. Bethel Valley contains the main laboratory and three SWSAs. Melton Valley contains the remaining three SWSAs, the LLLW seepage pits and trenches area, and other support and research facilities. These valleys are separated by Haw Ridge. The ORNL site and buffer zone encompass approximately 8,800 acres.

3.1.3 Surface Hydrology

The climate in the area of ORNL is moderately humid and temperate. The mean annual precipitation is 53.5 in., and the mean temperature is 57.9°F. The winter months are wettest, averaging more than 5 in.

per month; July also averages more than 5 in. The driest months are October, November, September, and June, all averaging less than 4 in. (Lamoreaux, 1985). Precipitation for 1986 was 38.8 in., about 16 in. short of the annual average (Oakes et al., 1987).

Both Bethel and Melton Valleys are drained by WOC and its tributaries, which drain into WOL. WOL, formed by White Oak Dam (WOD), is located approximately 3.7 miles downstream of the ORNL main plant (LAI, 1986). Discharges from WOL flow into the Clinch River.

3.1.4 Geology

All of the bedrock formations of the ORNL area are of sedimentary origin. They range in age from Middle Cambrian to Early Ordovician. The strata that underlie ORNL in Bethel Valley belong to the Chickamauga Group; those which uphold Haw Ridge to the southeast, to the Rome Formation; those which underlie Melton Valley adjacent to Haw Ridge on the southeast, to the Conasauga Group; and those which form Chestnut Ridge at the northwest side of Bethel Valley, to the Knox Group (Stockdale, 1951).

The direction of dip of all of the rock units in the ORNL area is southeast, at an average dip of 36°. The average direction of strike within the area is north 58° east. The rock units in the area display abundant flexures, folds, and fractures. Along Haw Ridge at the southeast side of Bethel Valley, a significant thrust fault (the Copper Creek Fault) occurs where the Rome Formation strata have been thrust over the younger Chickamauga Group (Stockdale, 1951).

3.1.5 General History

The ORNL site was conceived for atomic weapons materials research and development during World War II and began operation in 1943. The site was initially chosen for the Manhattan Project for security reasons, due to its isolation from population centers. The availability of inexpensive TVA electric power, the abundant supply of good water, and the available labor force from the surrounding rural areas were also factors in locating the facility (LAI, 1985).

Initially the facility had a planned life of only one year. This period was lengthened to last for 2-3 years and, as nuclear research and political climates evolved, ORNL became a permanent facility.

When operations at ORNL began, the risks and waste management requirements of radiological science, work, and production were unknown. Furthermore, the long-term effects of exposure or contamination to humans and the environment were not well understood. Due to these factors, the methods of operation, protection, and waste disposal at ORNL have been evolving processes, and many of the standard waste disposal methods now followed did not exist during past operations. Therefore, past practices account for the majority of the environmental problems affecting the ORNL reservation.

3.2 NATURE AND EXTENT OF PROBLEM

The following subsections discuss the types of wastes that have been or are dealt with at ORNL, traditional and current methods of storage, disposal, or retention, and the affected media and pathways to exposure from disposal/storage of waste.

3.2.1 Types of Waste

This subsection briefly describes the general classification of wastes dealt with at ORNL. In some cases, references are made to the methods that are presently used or that may have been used in the past to dispose or store such waste. However, for a detailed discussion of general classification of waste storage, disposal, or retention, see Subsection 3.2.2.

3.2.1.1 Solid Waste

At ORNL, uncontaminated solid waste consists primarily of rubbish and construction debris. Contaminated solid wastes may include a wide variety of materials, including concentrates of naturally occurring radioactive materials, fission products, activation products, mixed chemical and radioactive waste, transuranics, heavy metals, asbestos, PCBs, and organics.

Presently, uncontaminated solid waste is disposed of in two areas. Construction debris and the fly ash from the steam plant are placed in the ORNL contractors' landfill. All other uncontaminated solid waste is transported to the sanitary landfill at the Y-12 plant. Both of these landfills are permitted by the Tennessee Division of Solid Waste Management.

Contaminated solid wastes traditionally have been disposed of by burial in SWSAs (see Subsection 3.2.2). More recently, contaminated wastes have been segregated and handled depending on waste type, i.e., transuranic, hazardous chemical, radioactive, and mixed waste (radioactive/transuranic and chemically contaminated). Transuranic waste is presently placed in retrievable storage; hazardous chemical waste is transported off-site for disposal at a licensed treatment, storage, or disposal facility; mixed waste is stored on-site pending development of an approved disposal technique or site; and radioactive waste is disposed of in the traditional SWSA or placed in storage at K-25 (see Subsection 3.2.2).

3.2.1.2 Gaseous Waste

From 1943 to 1960, untreated gases containing radionuclides were released to the atmosphere. Releases of gases and particulates have been filtered and monitored since 1962. The primary radioactive constituents released were tritium, xenon-133, and krypton-85, along with small amounts of iodine-135 and radioactive particulates (Lamoreaux, 1985).

Air emission sources at ORNL are classified into the following three categories:

- Cell ventilation, which consists of high-volume, low-activity streams from enclosed areas such as containment or confinement areas (i.e., hot cells)
- Off-gas, which consists of low-volume, potentially high-activity gas streams from process vessels and from other areas where release of radioactivity is routine and of relatively high concentration
- Laboratory hoods and individual vents that provide low-volume, low-activity ventilation for laboratory-type operations and that normally vent at the source location

ORNL policy is to treat gaseous effluents, insofar as practical, at the source. Before the gases are discharged from any stack, the effluents are filtered through roughing and High Efficiency Particle Air (HEPA) filters to remove particulate matter. Where conditions dictate, charcoal absorbers or chemical scrubbers are also used to remove reactive gases such as halogens (Oakes, 1987.) The contaminated filter components are disposed of by burial in SWSA 6 in concrete encased steel silos located above the water table.

3.2.1.3 Liquid Waste

ORNL routinely produces and handles large amounts of liquid waste. There are five liquid waste systems at ORNL: (1) liquid low level (radioactive) waste (LLLW), (2) process waste (PW), (3) area sources, (4) point sources, and (5) sanitary sewage. The point sources and sanitary systems are conventional in design, providing for coal yard runoff, cooling tower, and sewage treatment discharges. They do not normally handle radioactive materials (du Mont, 1986). Area sources consist of storm sewers, roof runoff, and road drainage. These sources do not have a history of contributing to radioactive waste streams at ORNL, with the exception of storm drainage lines that may pick up contaminated groundwater.

The PW streams are primarily effluents that contain little or no radioactivity under normal operating conditions but that can become contaminated as a result of equipment failure or human error.

Process waste includes steam condensate from heating coils in vessels containing radioactive solutions, process vessel cooling water, rainwater runoff from potentially contaminated areas, condensate from the LLLW evaporator, and building sink and floor drains. A complex system of underground piping is provided to collect the waste, which flows by gravity to open collection ponds. The collection ponds will be phased out of operation by November 1988 and replaced with tanks of roughly equivalent volume.

3.2.1.4 Transuranic Waste

Transuranic waste is now defined in DOE Order 5820.2 as radioactive waste that, without regard to source or form, is contaminated with radionuclides that:

(1) are transuranic
(2) are alpha-emitting
(3) have half-lives greater than 20 years
(4) are contained in concentrations greater than 100 nCi/g

Oak Ridge Operations (ORO) has determined that wastes contaminated with the above concentrations of uranium-233 and radium-226 also will be handled as TRU wastes. Curium-244 is generally handled as TRU due to its hazard and the fact that, in most situations, it resides co-contaminated with other TRU isotopes (du Mont, 1986).

ORNL has no separate, independent systems to receive, process, and dispose of the minimal liquid or gaseous waste streams contaminated by TRU materials. TRU-contaminated liquids are not routinely generated in significant quantities, and the small quantities that may on occasion be generated are disposed of in the LLLW system.

The off-gas systems, consisting of a scrubber and double filtration, remove essentially all TRU material from the gas streams. If necessary, these filters are then handled as solid TRU waste (du Mont, 1986).

TRU wastes are categorized as either contact-handled (CH-TRU) or remote-handled (RH-TRU), based on the radiation level at the surface of the package. Those wastes exhibiting a surface dose rate of less than 200 mrem/h are handled as CH-TRU; those wastes exhibiting a surface dose rate of greater than 200 mrem/h are handled as RH-TRU.

Contact-handled TRU wastes are packaged in 30- or 55-gal stainless steel drums, which are collected, tested, and placed in retrievable storage. Remote-handled TRU wastes are packaged in either concrete casks or stainless steel cylinders. The concrete casks and stainless steel cylinders are retrievably stored. Waste consisting primarily of irradiated fuel elements or assemblies is packaged in stainless steel containers and stored in stainless steel auger holes.

In addition to the solid wastes contained in the concrete casks and stainless steel wells, ORNL has reclassified from LLLW to RH-TRU approximately 116,000 gallons of RH-TRU sludges that are currently contained in the Melton Valley Storage Tanks (MVST) facility and the old gunite tanks (du Mont, 1986).

With the exception of the gunite tanks and the MVST, all TRU waste storage facilities are located in SWSA 5. Prior to 1970 TRU waste was treated as regular solid waste and was buried in the various SWSAs. (du Mont, 1986).

3.2.1.5 Hazardous Chemical Waste

Hazardous chemical waste includes waste that exhibits the characteristics of ignitability, corrosivity, reactivity, and/or EP toxicity, as specified in 40 CFR 261.2-261.4, or that have measurable concentrations of any of the hazardous constituents listed in 40 CFR 264, Appendix IX.

Hazardous chemical wastes at ORNL are packaged in 55-gal drums and held for disposal at an off-site RCRA disposal facility.

3.2.1.6 Mixed Wastes

Mixed wastes are those that are both radiologically and chemically contaminated. These wastes currently are packaged in 55-gallon drums and held on-site pending development of an approved disposal facility.

3.2.2 Treatment, Storage, Disposal, and Retention of Waste

3.2.2.1 Liquid Waste Treatment

Historically, after collection in the ponds, wastewater has been sampled for pH and gross activity and then sent to the Process Waste Treatment Plant (PWTP) or discharged directly to WOC, whichever was appropriate. At the treatment plant the waste solution is passed through a filtration and ion-exchange system to remove the radioactive contaminants. The effluent is then adjusted back to a neutral pH and discharged to WOC (Myrick, 1984). Construction of a nonradiological wastewater treatment plant and associated tankage and piping has been initiated. Upon completion of this project in 1989, no untreated process wastewater will be released to WOC.

The LLLW system is designed to collect, neutralize, concentrate, and store liquid radioactive waste solutions having an activity level as high as 5.28 Ci/l that come from hot sinks and drains in R&D laboratories, radiochemical pilot plants, nuclear reactors at ORNL, and the PWTP (Oakes, 1987).

LLLW generated as part of the research and development activities at ORNL is transferred from the various sources by underground pipes to collection tanks located throughout the laboratory complex. The waste solutions that accumulate in these collection tanks are transferred to large storage tanks at the LLLW evaporator facility.

From the storage tanks, LLLW is transferred to one of two evaporators, where the aqueous solution is concentrated by a factor of 10 to 30. Condensate from the evaporator is normally directed to the PW system, while the waste concentrate is transferred to ORNL tanks for storage (Myrick, 1984) and subsequent solidification.

A complex system of liquid waste transfer lines exists throughout the facility. The main plant area contains the greatest concentration of underground lines; Melton Valley and the outlying areas of Bethel Valley contain lesser amounts. The underground lines consist of sewer, runoff, PW, LLLW, steam, potable water, electric, and other lines.

The construction materials of the transfer lines are not consistent, ranging from vitrified clay pipe, to carbon steel, to stainless steel, to PVC. All piping was installed with backfill and gravel in the pipe trench. Most lines are not doubly-contained nor cathodically protected. Investigations have indicated that many of the line systems have a history of leaks. Known leaks are either repaired or the lines are taken out of service. Recently, work has been done to upgrade portions of these lines.

3.2.2.2 Solid Waste Storage Areas

Since ORNL began, six SWSA sites have received wastes. The first three, SWSAs 1, 2, and 3, are located in Bethel Valley near the Laboratory. The locations were selected primarily because of their proximity to the Laboratory. No records were kept for SWSAs 1 and 2, and those for SWSA 3 were destroyed by fire in 1961. Sources of information for these sites include published and unpublished reports, file memoranda, and interviews with knowledgeable personnel (Webster, 1976).

Wastes primarily were buried in trenches, the orientation and dimensions of which varied. Beta-gamma wastes were covered with soil. Alpha wastes were also buried in trenches and, in most cases, were covered with a layer of concrete and then soil (Webster, 1976).

From 1951 to the present, the SWSAs have been located in Melton Valley within the Conasauga Group, which is primarily shale with thin interbeds of limestone and siltstone. From initial disposal in the Melton Valley SWSAs through the present, research has been conducted to define the hydrologic properties of the disposal medium (Conasauga shale), the methods of radionuclide transport on the surface and in the subsurface, and methods of reducing the transport.

SWSA 4 operated from early 1951 until 1959, with burials in trenches and auger holes. Disposal records were destroyed by fire in 1961. Approximately 50 auger holes were used for "higher-level" wastes and the short-term storage of materials contaminated with short half-life radionuclides. Part of SWSA 4 was constructed in low-lying areas that received wastes during dry months, while higher areas received wastes during the wet, winter months. This seasonal disposal pattern suggests the presence of a higher groundwater table in the low areas during the wet months. After closure, clean fill and construction debris were deposited over much of the site, increasing the land surface elevation by as much as 20 feet in some areas. Numerous contaminated seeps have been identified and studied (Webster, 1976).

Before SWSA 5 was selected, the necessity for a site not subject to flooding by surface waters or intrusion by groundwaters was recognized, and extensive geologic and hydrologic investigations were conducted to locate such a site. Recommendations also were made concerning site layout and trench design and drainage. However, disposal began in 1959 before the site studies were complete, and operations continued essentially the same as before, with the study recommendations not utilized (Webster, 1976).

As in the other SWSAs, alpha-contaminated wastes were initially placed in concrete-capped trenches. However, concrete-capping and segregation of alpha wastes were later discontinued during SWSA 5 operations. Beta-gamma, and subsequently alpha, wastes were placed in trenches and capped with soil. Higher level wastes were placed in auger holes. It is not known whether these auger holes were lined. Certain TRU wastes were segregated after 1970. Concrete- and steel-lined auger holes were also used after 1970 for storage of wastes with alpha and higher level beta-gamma activity.

SWSA 5, closed in 1973, has exhibited some subsidence, contaminated seepage, and bathtubbing of trenches (Webster, 1976). A portion of SWSA 5 is still used for the temporary retrievable storage of certain TRU wastes. Retrievable TRU wastes are stored in underground stainless steel silos and drum storage vaults.

SWSA 6 is the current active disposal site. It began receiving waste in 1969, after site hydrogeologic studies were conducted in 1964-65. However, it did not become the main disposal site until after SWSA 5 was closed in 1973. As with SWSA 5, study recommendations were made, but operations continued as before. In 1974 it was determined that groundwater had intruded into certain trenches during seasonal high water levels (Webster, 1976). Thereafter, trenches were placed in areas where wastes would be above the water table. Since the spring of 1986, practically all solid radioactive waste is now disposed of in concrete culverts or lined auger holes. Concrete culverts are generally used for low-level, non-TRU, and nonfissile wastes. Lined auger holes are used for waste containing fissile isotopes or non-TRU waste exhibiting a high beta-gamma background. The culverts are installed vertically in the ground with concrete bottoms about 12 in. thick. The bottoms are located at least 2 feet above the known high-water table level, as defined by the best currently available hydrologic profiles.

Auger holes are basically a form of trench burial that allows greater control of radiation exposure during disposal operations and prevents excessive quantities of fissionable material from accumulating in a given area. Auger hole disposal is used for either high-activity waste or fissionable (primarily uranium-235) waste. Auger liners usually consist of cast iron or carbon steel pipe with concrete plugs at the base and for the cap. Each auger hole is assigned a unique number, and records are maintained on the contents of each hole.

3.2.2.3 Tanks

Since ORNL operations began, underground waste storage tanks have been utilized for collection, interim storage, and transfer of liquid wastes. In general, tanks were installed to service specific laboratory facilities and provide a central hold-up and pre-treatment location prior to final processing through the LLLW evaporator system. Whenever the need for tanks ended or operational problems developed, the tanks were taken out of service to await final disposition.

These inactive waste storage tanks can be classified into two general categories based on their physical characteristics: sprayed concrete (gunite), and stainless steel. Tank capacities vary from 1,000 to 170,000 gallons. Most tanks are buried approximately 6 feet below ground, have buried piping and controls still intact, and contain some groundwater monitoring capabilities. Some leaks have occurred in the transfer piping or the tanks themselves, and some tanks are collecting groundwater through in-leakage (Myrick, 1984).

Although the tanks contain varying amounts of residual liquid and sludge, exhibit internal dose rates from 1 to 6,500 mrad/h, and have surface contamination on all internal surfaces, the containment and monitoring systems are adequate for control of the remaining activity (Myrick, 1984). Approximately 29,000 Ci of activity (principally cesium-137 and strontium-90) is estimated to be present in the inactive tanks. In addition, due to past operations, soil in the vicinity of many of the tanks has become contaminated, resulting in establishment of radiation/contamination zones for most of the tank farms.

Routine surveillance and tank farm monitoring is provided for all inactive waste tanks. The ORNL Waste Operations Control Center provides continuous surveillance of collection tank inventories and transfers, and monitors groundwater in the vicinity of the tank farms. In addition, periodic sampling and analysis is conducted from dry wells adjacent to the tanks to give an indication of the tank containment integrity (Myrick, 1984). The inactive tanks are currently being evaluated for closeout proceedings. This includes researching the historical engineering drawings and data for data gaps, assessing the regulatory status of the inactive tanks, and presenting draft closure options with estimated closure cost on a per tank/per option basis.

In addition to the inactive tanks, ORNL has many active tanks that receive LLLW streams from the various laboratories and buildings in both Bethel and Melton Valleys. These consist of single-contained tanks on a concrete slab and tanks in a concrete vault with sump (double-contained systems) (Boyle et al., 1982). The purpose of the active tanks is to collect, neutralize, concentrate and store radioactive waste solutions assumed to contain trace quantities of heavy metals. The system is designed to collect waste solutions from hot sinks and drains in research and development laboratories, radiochemical pilot plans and nuclear reactors located in Bethel and Melton Valleys (MCI, 1985).

ORNL's LLLW active underground tanks can be divided into the following four basic groups:

- Twenty tanks used to collect LLLW from buildings in Bethel Valley
- Four tanks used to collect LLLW in Melton Valley
- Five tanks used to store waste while it is processed at the evaporator facility
- Eight tanks used to store concentrated waste prior to final disposal

3.2.2.4 Pits and Trenches

From 1951 through 1966, ORNL disposed of LLLW by means of shallow seepage pits and trenches (Olsen, et al., 1983). Initially these wastes were hauled from the gunite tanks to the pits in a tank truck. After construction of the LLLW lines in 1954, the wastes were piped to the pits and trenches (Spalding, 1987).

Pit 1 was constructed in July 1951 and had a capacity of approximately 180,000 gallons. Over a period of time, during which most of the liquid portion of the waste seeped through the pit walls, approximately 123,000 gallons of waste were placed in the pit. At the time of closure, Pit 1 was filled with Conasauga shale and later, in 1981, a sloping concrete cap was placed over the site. Presently the site is fenced and appropriately posted to prevent unauthorized entry (Spalding, 1987).

Pit 2 was constructed in 1952 and had a holding capacity of approximately one million gallons. It received LLLW from tank trucks and the LLLW pipeline. The amount of active waste disposed of in Pit 2 is difficult to assess because it received overflow from Pit 3 and discharged overflow into Pit 4. The principal waste constituents disposed of in all three of these pits were cesium-137, ruthenium-106, strontium-90 and the trivalent rare earths (Edwards, 1986).

From 1950 to 1961, considerable amounts of ruthenium-106 were discharged to the pits, and a seep contaminated with ruthenium-106 was discovered on the west side of Pit 2. A trench was excavated at this location to intercept and collect the seep discharge, which was then pumped back into Pit 2. Sodium sulfide was added to Pit 2 in an effort to reduce the flux of ruthenium-106, but this was ineffective. Subsequently, the levels of ruthenium discharged from the plant were decreased. Final grading of Pit 2 was completed in late 1963, and a sloping asphalt cap was placed over it in 1970 (Baughn, 1987).

Pit 3 was constructed in 1955 and had the same holding capacity as Pit 2. It became the initial discharge point for the LLLW pipeline and was designed to overflow through a pipe into Pit 2. The principal radionuclides disposed of in Pit 3 were cesium-137, ruthenium-106, and trivalent rare earths, as well as sodium nitrate from the treatment process in the gunite tanks (Spalding, 1987). Seepage from Pit 3 was observed on its eastern side, but no corrective measures were taken. In September 1961, Pit 3 was closed and backfilled, then covered with an asphalt cap. Presently the asphalt cap appears well maintained; a fence has been erected and the area is appropriately posted (Baughn, 1987).

Pit 4, with the same storage capacity as Pits 2 and 3, went into operation in 1956, when it began to receive the LLLW overflow piped from Pit 2. In 1959, a ruthenium-contaminated seep resulted in an interception/collection trench 10-ft deep and 175-ft long excavated along the eastern side of the pit. The trench was part of a two-fold remediation effort that included pumping the accumulated contamination back into the pit and adding copper compounds to Pit 4 in hopes of immobilizing the ruthenium. In spite of its operational problems, Pit 4 remained in service even after the closure of Pits 2 and 3 and the advent of the disposal trenches. Pit 4 was gradually backfilled beginning in 1976 and was capped with asphalt in 1980.

Trench 5 was constructed in May 1960 (Spalding, 1987). Its design was markedly different from that of the pits in that it called for a long, narrow excavated trench partially backfilled with crushed stone. Feeder pipes connected to the LLLW transfer line were constructed atop the crushed stone, and the trench was backfilled with more gravel and covered with clay.

This design was intended to minimize worker exposure and reduce the amount of meteoric water collected. By orienting the trenches perpendicular to geologic strike, seepage capacity would be enhanced, since most of the seepage was believed to occur along strike via bedding planes.

The trench was 300 feet long by 15 feet deep, and was wider at the top than at the base. Before usage, it was treated with approximately 1,800 pounds of copper sulfate and approximately 1,000 pounds of sodium sulfide in an attempt to reduce the mobility of ruthenium-106. Trench 5 was operated for about 6 years (Edwards, 1986) and ultimately received about 9.5 millions gallons of waste containing strontium-89, strontium-90, cesium-137, ruthenium-106, and cobalt-60. In 1966, LLLW discharges to Trench 5 ended and the trench was backfilled. In 1970, it received an asphalt cap, which is currently well maintained (Baughn, 1987).

Trench 6 was constructed in 1961. Unlike Trench 5, Trench 6 was more normal to geologic strike than perpendicular. Prior to the beginning of waste disposal, it was treated with approximately 20,000 pounds of copper sulfate to reduce the mobility of ruthenium-106. However, just after coming on line, Trench 6 was removed from service because of seepage contaminated with strontium-90 and cesium-137. During its brief period of operation, approximately 130,000 gallons of LLLW discharge containing strontium-90, cesium-137, ruthenium-106, and cobalt-60 were disposed of in Trench 6. In 1981, Trench 6 received an asphalt cap; the area currently is fenced and appropriately posted (Baughn, 1987).

Trench 7, the last of the LLLW disposal trenches, was completed in August 1962. Its design called for three separate segments, but only two were built because during the site investigation phase shallow groundwater was discovered beneath the proposed third section (Spalding and Boegly, Jr., 1985). Trench 7 was oriented perpendicular to geologic strike, and before waste disposal commenced the trench was treated with 50,000 gallons of 4 percent sodium hydroxide.

Trench 7 received about 9.5 million gallons of LLLW containing strontium-90, cesium-137, ruthenium-106, and cobalt-60. Until operations ended in 1966, Trench 7 resulted in only one documented seep and contained relatively low levels of ruthenium-106. No remedial measures were taken. Trench 7 was paved with asphalt in

1970, and in 1985 the asphalt cap was expanded to enhance runoff and decrease surface water infiltration. Site reconnaissance in April 1987 showed that the asphalt cap is well maintained (Baughn, 1987).

3.2.2.5 Hydrofracture

During the history of ORNL, four hydrofracture injection wells, two experimental and two operational, were constructed in Melton Valley to facilitate the injection of mixtures of cement and waste into the Pumpkin Valley shale. The first and second hydrofracture experiments were conducted in October 1959 and September 1960, respectively, to determine the orientation of hydraulically induced fractures (Baughn, 1987).

After the initial experimentation, the first operational hydrofracture facility, now referred to as the Old Hydrofracture Facility (OHF), was constructed. At this facility, several test injections were made with water; 7 experimental injections were made with synthetic waste mixed with small quantities of radionuclides; and 18 operational injections were made with mixtures of cement and low level liquid waste (ORNL, 1987).

The second operational injection well is called the New Hydrofracture Facility (NHF). Through January 1984, when injections were stopped, this facility conducted 2 test injections, 3 injections made with LLLW, and 10 injections made with mixtures of cement and resuspended sludge from the gunite waste storage tanks (ORNL, 1987).

Numerous observation wells surround both injection facilities and monitor formations potentially affected by the hydrofracture technique. Since use of the hydrofracture injection wells began, several problems have been encountered, including borehole deviation, excessive injection pressures, improper grout-to-waste ratios, and casings breached by grout during injections.

Explanations and results of some of these problems can be found in the Remedial Investigation Plan for the Subsurface Characterization of the ORNL Hydrofracture Sites (Energy Systems, 1987).

3.2.2.6 White Oak Lake

The ORNL site is located in the WOC watershed, which drains an area of approximately 6.2 mi^2. The primary tributary to WOC is Melton Branch. At its intersection with Tennessee State Route 95, WOC is impounded by WOD. The resulting WOL is a small, shallow impoundment, the water level of which is controlled by a vertical sluice gate that remains fixed during normal operations. Since 1960, the normal lake level has been 745 feet msl, creating a pool surface area of approximately 24 acres. Retention time is approximately 2 days (Myrick, 1984). Water that drains from WOL flows southwest before entering the Clinch River approximately 0.6 miles downstream. Within the watershed, sediments have sorbed chemical and radioactive contaminants and have subsequently accumulated in the floodplain and WOL bed. Under high flow conditions, these sediments can be carried through WOD and into the Clinch River.

Since the beginning of ORNL operations, a number of studies have been undertaken to determine sources and quantities of contaminants released to WOC, retained in WOL, or discharged to the Clinch River. Studies have also been performed to characterize the geohydrology of the watershed. A summary of some of the more important studies is presented in Sherwood and Loar (1986).

Although the normal flow is low, flood frequency curves indicate that a 100-yr flood could cause discharges of approximately 2,000 cfs at WOD. Water levels and flow in the WOC embayment below WOD are largely controlled by the operation of Melton Hill Dam, 2.3 miles upstream on the Clinch River, and Watts Bar Dam, which forms Watts Bar Reservoir about 58 miles downstream on the Tennessee River. When the Watts Bar Reservoir is near full pool elevation (approximately April to October), backwater from the Clinch River creates an embayment in WOC below WOD. In addition to the seasonal changes caused by Watts Bar Reservoir, daily fluctuations in water levels and flow (including flow reversals) occur because of daily releases from Melton Hill Dam (Clinch River Study Steering Committee 1967; Project Management Corporation, 1975).

Oakes et al. (1982) have estimated that since 1943 some 5 million ft^3 of contaminated sediment have collected in the WOL bed, containing an estimated 650 Ci of radioactivity, primarily cobalt-60, strontium-90, and cesium-137. In addition to the sediment activity, the lake water contains measurable quantities of tritium and strontium-90 in solution, which are released through the monitoring station at WOD (Oakes et al., 1982). During periods of heavy rainfall, both waterborne radioactivity and contaminated sediment are released from the lake.

Water samples from the WOC embayment below WOD generally represent a mixture of WOC and Clinch River water because of the effects of releases at the dams on the Clinch River. However, sediments in the embayment provide a useful picture of contamination. In 23 core samples collected in the embayment during 1978-1979, average activity levels of cesium-137 and cobalt-60 in the upper fifteen 1-in. increments of the cores ranged from 12 Bq/g to 52 Bq/g and 0.3 Bq/g to 2.7 Bq/g, respectively, with the highest values in the upper increments (Oakes, 1982).

Little information exists on the content of RCRA hazardous chemicals in either the water or sediments of WOC/WOL. Implementation of a new National Permitted Discharge Elimination System (NPDES) ambient monitoring program is now providing information on releases of selected hazardous chemicals. Additional drilling in the WOC/WOL is also being conducted to establish similar information on the WOC/WOL streambed hydrogeology.

3.2.3 Affected Media and Pathways to Exposure

The primary pathway of release of radiological and chemical contaminants from the ORNL site is by surface water. Surface water from the site drains via WOC and its tributaries and has resulted in measurable contaminant levels in WOC, WOL, and the embayment of WOC caused by Melton Hill Lake.

Localized contamination of groundwater has occurred on-site as a result of loss of containment incidents and disposal actions. There is no evidence that these localized areas of groundwater contamination on-site have migrated beyond the site boundary.

The releases that caused surface water and groundwater contamination at the ORNL facility are reported in Annual Environmental Surveillance Reports. These releases have occurred over the past 45 years from several on-site sources.

Evaluation of the extent of human exposure are presented in the Environmental Surveillance Report (Oakes, 1987). Committed effective doses to the nearest resident are calculated over the 50-year-period. These doses, which are based on releases from the three installations comprising the DOE facilities at Oak Ridge, indicate near background doses from ingestion of fish and water in the local area. From these data, it is evident that ORNL operations and historical releases of radiological materials via the WOC watershed have had a minimal effect on radiation exposure to the surrounding population (Oakes, 1987).

3.3 HISTORY OF CORRECTIVE ACTIONS

Past research, development, and waste management activities at ORNL have resulted in several areas where low level radioactive waste has been disposed of or where contamination exists associated with surplus, inactive facilities. Such areas include former SWSAs, waste ponds and seepage pits, radwaste processing and transfer facilities, and the environments surrounding these facilities (Myrick et al., 1984). Several pilot or test-scale remediation projects have taken place at selected ORNL sites. Other corrective actions are continuing at several sites and are utilizing several technologies. In situ grouting of trenches with experimental grout mixtures is being conducted at both SWSA 4 and SWSA 6. An experimental burn of a mock-up trench using in situ vitrification has recently been completed. Also, there is an ongoing construction project in the Main Plant area that is relining in place certain parts of existing pipelines with inflatable liners. Short descriptions of several corrective efforts follow.

3.3.1 SWSA 4

The status of SWSA 4 as one of the prime contributors of contaminated groundwater (strontium-90) prompted construction of a surface runoff collector and diversion system in 1975. This system consists partly of a shallow, asphalt-lined ditch along the north side of the burial ground. The diversion system is designed to carry large amounts of water during heavy rains. In 1983, a second surface water diversion project was undertaken to channel runoff from north of the burial ground around the site rather than through it. Evaluation of the diversion is currently underway, and early indications are that a significant reduction is being achieved in strontium-90 releases to WOC (Myrick, 1984).

3.3.2 SWSA 5

Also in 1975, efforts were undertaken at SWSA 5 to reduce seepage in an area found to have relatively high amounts of strontium-90 and measurable amounts of curium-244 and plutonium-238. Initially, about 2 feet of overburden was removed from atop four trenches in this area. Two underground dams, one of concrete and one of bentonite-shale, were then installed across two parallel trenches. The stripped area was covered with an impermeable PVC membrane and the overburden was replaced. In the TRU waste area of SWSA 5, a near-surface seal was placed over an additional 14 trenches. Other corrective actions at SWSA 5 include filling collapsed trench caps, installing concrete drainage ditches, and surface contouring for better drainage (Myrick, 1984).

3.3.3 SWSA 6

Water table measurements in SWSA 6 indicated the presence of groundwater in an isolated area known as the 49-Trench area. In an attempt to prevent rainfall from infiltrating the cover material and collecting in the trenches, this area was sealed with a bentonite cover in 1976.

Despite this cover, water was still detected in this area. Therefore, in 1983, a second barrier was installed consisting of a French drain designed to prevent lateral movement of groundwater into the trenches. The drain was installed at a depth of approximately 30 feet, on the north and east sides of the group of trenches. Early monitoring has shown the dewatering of several trenches as well as a general lowering of the groundwater table (Myrick, 1984).

3.3.4 Melton Valley Area

The seepage pits and trenches in the Melton Valley area have had a history of groundwater releases to the Melton Valley watershed. Significant corrective actions thus far consist of asphalt capping all of the pits and trenches to prevent surface infiltration.

3.4 CURRENT SITE OPERATIONS

3.4.1 Laboratory Mission and Scope

ORNL was created for research and production needs of the atomic weapons program during World War II. Originally designed for a lifetime of 1 to 2 years, the facility instead continued and grew due to the need for continued research and development in atomic science. Since 1943, ORNL's major efforts have included research and development related to reprocessing of nuclear reactor fuels, producing isotopes for medical and industrial applications, and significant basic and applied research in nuclear and nonnuclear areas (LAI, 1986).

The laboratory is now a major national research center housing several nuclear reactors, isotope processing facilities, and laboratories for research in many of the sciences. ORNL is also a major environmental research center due to its unique combination of facilities and areas affected by past releases of contaminants.

3.4.2 Company Operations Impacting RI/FS Activities

As stated above, ORNL's primary mission is scientific research and isotope production for medical or study needs. Several support systems exist to aid these efforts. Areas that will have an impact on the RI/FS project are ongoing plant operations, research, and construction.

Because ORNL is an operating facility, there is a significant amount of activity involving large numbers of personnel ongoing at all times. These activities include the routine operation of the facility, isotope production, reactor operation, various environmental and waste management activities, and construction projects. Any of these activities could impact the RI/FS project activities.

The significant amount of research ongoing throughout the individual WAGs could have significant impacts on the RI/FS project. Past or current projects could have WAG-specific data that could expedite the remedial investigation process and save time and money. Also, field research taking place either during, or after, the investigation phase of the remedial investigation could potentially affect environmental conditions at the WAG.

Ongoing, or planned, construction projects also could impact the RI/FS effort. Without an exchange of information about such activities, the remedial investigation schedule or scope of the effort could be impacted.

3.5 REGULATORY FRAMEWORK

The regulatory framework that applies to the ORNL reservation and the remedial investigations or other actions likely to be performed as part of the RI/FS project is derived from three federal statutes. These statutes and their applicability to the RI/FS project are as follows:

- National Environmental Policy Act (NEPA) requirements are applicable to "major federal actions significantly affecting the quality of the human environment."
- The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), including the Superfund Amendments and Reauthorization Act of 1986 (SARA), specifically require that, where appropriate, each facility on the Federal Agency Hazardous Waste Compliance docket perform an evaluation in accordance with the criteria established in accordance with Section 105 of CERCLA under the National Contingency Plan (NCP) for determining priorities among releases.
- The Resource Conservation and Recovery Act, including the Hazardous and Solid Waste Amendments (HSWA) of 1984, regulates the owners and operators of facilities that treat, store, or dispose of hazardous waste. EPA Region IV personnel elected to enforce requirements for remedial actions at ORNL through its RCRA Corrective Action authority.

In addition, Department of Energy (DOE) Order 5480.14 lays out a remedial action activities process that is heavily modeled on CERCLA's NCP.

RCRA is the statute most clearly applicable to the RI/FS project because its provisions are being used by the Environmental Protection Agency (EPA) in enforcement actions at ORNL. However, failure to comply with NEPA or CERCLA requirements could result in future requirements to revise deliverables or repeat procedures to attain compliance. Therefore, to the extent possible, the procedures to be followed at ORNL will be tailored to meet the provisions of all three statutes, minimizing the possibility of future schedule delays or technical revisions due to compliance issues.

Deliverables should follow the formats required by RCRA but will be modified as necessary to include all pertinent or applicable information required by NEPA and/or CERCLA.

Remedial investigations shall be conducted on each WAG in accordance with the procedures suggested in EPA's RCRA Facility Investigation (RFI) Guidance (currently in draft form). This guidance is similar to but more recent than that described in Guidance on Remedial Investigations under CERCLA (EPA/540/G-85/002, dated June 1985).

Alternative Assessments on each WAG and the overall Feasibility Study shall be conducted in accordance with guidance forthcoming (presumably) from EPA's RCRA program. Until such guidance is available, these studies will follow Guidance on Feasibility Studies Under CERCLA (see EPA/540/G-85/003, dated June 1985).

Wherever RCRA guidance is unclear or unavailable, guidance from EPA's CERCLA program shall be used.

It is important to stress that public participation and community awareness are crucial aspects of compliance criteria for NEPA, CERCLA, and other federal statutes. Therefore, a comprehensive plan for community relations and public participation should be developed and implemented to ensure compliance within the regulatory framework. However, this activity is outside the scope of work of this project.

4.0 TECHNICAL APPROACH TO THE RI/FS PROJECT

The ORNL complex has been divided into a number of WAGs that contain from 1 to 99 SWMUs each. Work releases under this contract will be issued for work at individual WAGs, but it is important to note that remedial actions must be evaluated and recommended for each SWMU or collection of SWMUs within each WAG.

This section describes the technical approach for completion of the RI/FS project for ORNL. As discussed in Section 3.5, the deliverables produced will adhere to guidance provided under RCRA, CERCLA, and NEPA. Due to the multiple applicable regulations, the magnitude of this project, and the number of specific contaminated sites (SWMUs), the content of specific deliverables has been tailored to meet project-specific needs.

The remedial investigation (RI) for each WAG will generally adhere to guidance documents provided under RCRA and CERCLA. The scope of the RI will be designed to produce characterization of each SWMU or collection of SWMUs within the WAG. In comparison to typical RIs produced under CERCLA guidance, the NEPA requirements of this project may require additional baseline environmental data for environmental impact evaluation.

The Feasibility Study process defined under CERCLA has been broken into two phases of work for ORNL:

- An Alternative Assessment (AA) will be conducted for each WAG. The AA will consider remedial action alternatives for each SWMU or collection of SWMUs within a WAG. The level of detail provided in the AA will generally follow guidance documents under RCRA and CERCLA. AAs will be conducted on individual WAGs and will be phased over the life of the project. Remedial alternatives will be developed in this phase of work, but no final recommendations will be prepared.
- After AAs are prepared for each WAG, a single FS will be prepared for the overall project. The FS will, to the extent possible, reference the AAs, but will produce overall remedial action scenarios designed to address all SWMUs in

all WAGs. The level of detail in the FS will generally follow CERCLA guidance, but the environmental impact analysis will be expanded to fully meet NEPA requirements. The FS will conclude with a recommendation for remedial actions at all SWMUs or collection of SWMUs.

4.1 MANAGEMENT PLANNING

During Phase I, the RI/FS Subcontractor will produce five plans that will form the basis for management of the RI/FS project. These plans are:

- Project Management Plan
- Environmental Safety and Health Plan
- QA/QC Plan
- Data Base Management Plan
- Waste Management Plan

These plans, including applicable procedures and policies, will define the overall technical approach to the RI/FS project and will be used as the basis for subsequent WAG-specific planning and implementation activities.

4.2 REMEDIAL INVESTIGATION PLANNING/IMPLEMENTATION

4.2.1 Planning

4.2.1.1 Objectives of Remedial Investigations

The objectives of the remedial investigations are to:

- Characterize the nature, extent and rate of migration of the radioactive wastes, hazardous wastes or constituent releases to soils, groundwaters, subsurface gas, air and surface waters from SWMUs in ORNL's WAGs
- Provide information to determine the need for remedial actions and make recommendations to the DOE and regulatory agencies
- Evaluate releases against health and environmental criteria

- Obtain engineering data to develop and evaluate remedial action alternatives

4.2.1.2 Data Recording

Prior to detailed planning for remedial investigations at individual WAGs, all currently available data will be reviewed for validity and entered into the Data Base Management System. As planning begins for individual WAGs, all data potentially applicable will be retrieved to provide as complete a description of the current situation as possible.

Data from adjacent WAGs will be used to assess boundary conditions. Existing information will be used to assess the nature, extent, and types of contaminants expected to be present at each SWMU within the WAG. The RCRA Facilities Assessment (RFA) - ORNL provides a summary of known contaminants in each WAG.

All sampling and data recording will be tied to the existing ORNL coordinate system to permit comparisons of various work products and EPA permits. To avoid overlaps in study areas, WAG grid coordinates will be established early in the program.

4.2.1.3 WAG-Specific Remedial Investigation Plans

The final Remedial Investigation Plan for each WAG shall contain the following elements:

- A description of the current situation
- A preliminary assessment of risk
- A preliminary assessment of potentially feasible remedial alternatives
- A summary of data requirements
- Development of data quality objectives
- A summary of the technical approach to the RI, data analysis, and report preparation
- A site-specific sampling plan

- A site-specific Project Management Plan
- A site-specific Environmental Safety and Health Plan
- A site-specific Quality Assurance/Quality Control Plan
- A site-specific Data Base Management Plan
- A site-specific Waste Management Plan

The following paragraphs describe the elements of the Remedial Investigation Plan.

A description of the current situation will be prepared. This description will review all available existing data and will result in the preparation of a conceptual model of the site. The information to be presented includes geographical information (such as topographic maps, etc.), and historical and operational data describing the activities which have been and are being conducted in the WAG.

A preliminary risk assessment will be conducted to identify, to the extent possible, risks associated with the WAG (in most cases, insufficient data will be available to conduct such an assessment on individual SWMUs). The risk assessment will provide analysis of pathways and receptors based on available existing information and will identify problem areas at the site. Procedures to be followed are outlined in the Superfund Public Health Evaluation Manual, the draft Superfund Exposure Assessment Manual, and applicable DOE modeling documents for the Surplus Facilities Management Program sites and DOE low-level waste sites. This preliminary risk assessment will be used to guide the planning of further investigations and, if appropriate, to identify areas which require no further investigation.

A preliminary assessment of potentially feasible remedial alternatives will be developed for each SWMU or collection of SWMUs to guide the development of plans for field data acquisition efforts. An assessment then will be made of the types and quantities of data necessary to evaluate those alternatives and conduct a risk assessment for individual SWMUs and for the overall WAG. These data requirements will be compared to the available valid data on the WAG. Data required from the field investigations will be the difference between that required and that available.

Once data acquisition requirements are identified, data quality objectives (DQOs) will be developed. DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions during the remedial action selection process. The DQO process results in a well-thought-out sampling plan, which details the chosen sampling and analysis option and provides a basis for statements of the confidence in decisions made during the remedial process. Procedures to be followed are outlined in EPA's Data Quality Objectives for Remedial Response Activities. A description of the technical approach to the remedial investigation will be prepared, outlining data analysis techniques and the format and content of the Remedial Investigation Analysis Report.

A site-specific sampling plan will be prepared for each WAG. The sampling plan will clearly define the number, types, and locations of samples to be taken, field methods to be used, equipment to be used, etc. To the extent possible, field activities will be conducted in accordance with standard operating procedures. One document which is particularly useful is EPA's Compendium of Field Operations Methods. Where necessary, procedures outlined in this document shall be modified to account for radiological and other site specific hazards at the ORNL facilities and include the requirements of ORNL/M-116, Health, Safety and Environmental Protection Procedure for Well Drilling Operations.

A site-specific Environmental, Safety and Health Plan shall be prepared for the remedial investigations at each WAG in accordance with the overall Environmental, Safety and Health Plan. A site-specific Quality Assurance/Quality Control Plan also shall be prepared for each WAG. The Quality Assurance Program Plan (QAPP) shall be prepared in accordance with EPA's Interim Guidelines for Preparing Quality Assurance Plans and NQA-1. Based on the data quality objectives developed above, the QAPP shall specify project data requirements and evaluate available sampling analytical and QA/QC options to identify the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters for the investigation.

Additionally, approved EPA analytical methodologies, specifically those identified in the third edition of Test Methods for Evaluation of Solid Wastes, will be utilized as appropriate, or approved substitutes will be used as needed.

A site-specific Data Base Management Plan, consistent with the overall project Data Base Management Plan, will be prepared for each WAG. Such a plan will identify methods for documenting and tracking the required data and entering such data into the overall data base management system. A site-specific Waste Management Plan in accordance with the overall Waste Management Plan and will also be prepared to detail the methods for handling wastes generated during the remedial investigation.

4.2.1.4 Strategy for Conducting Multiple WAG Remedial Investigations

Because of schedule commitments negotiated with EPA, the priorities for preparation of Remedial Investigation Plans is more or less fixed. Depending on the information gathered during the remedial investigation planning process, it is possible that remedial investigation implementation may follow a different order.

Once the existing data base is tabulated and reviewed during the remedial investigation planning process, the recommended order of remedial investigations at various WAGs will be prioritized. The order of investigation of the various WAGs will be based on the following:

- Order of study will be negotiated with EPA
- To the extent possible, higher risk WAGs will be investigated first (if the work done in the RI planning process indicates that reprioritization is advisable)
- To the extent possible, investigations will be conducted first on upgradient WAGs and then on downgradient WAGs
- Estimated duration of remedial investigation activities may impact the required start date

To aid in overall planning for the project, available information will be briefly reviewed and the following will be prepared by the project management staff for the planning process:

- A summary of types of waste present
- A summary of field investigations expected
- A summary of potential exposure pathways and receptors from each WAG
- A preliminary identification of generic studies

A baseline schedule will be prepared identifying the timing of investigations at various WAGs. After this schedule has been prepared, the Program Manager will develop an overall master strategy for conducting multiple WAG investigations. This master strategy will estimate manpower loading and cash flow versus time and will identify strategies for staffing as project needs dictate. The strategy will incorporate cost saving features such as conducting similar types of investigations (e.g., remote sensing) sequentially at various WAGs rather than paying mobilization costs for each WAG.

4.2.2 Implementation

The remedial investigation shall be conducted in accordance with the plans developed earlier. All available data, including historical data and that collected during the remedial investigation, shall be analyzed for validity. Because site characterizations and the later

Feasibility Study depend on the data collected, evaluation of the validity of data is essential. Validation of analyses will be performed to ensure that errors are identified and corrected.

After data are validated, the quantity of data will be compared to that deemed necessary in the remedial investigation planning process. If the quantity of information available is insufficient to proceed further, data gaps will be identified and a recommendation will be prepared to conduct further field investigations under the remedial investigation.

Once all data gaps have been filled, data will be analyzed and summarized for presentation. Presentation techniques are described in EPA's <u>RCRA Facility Investigation (RFI) Guidance</u>, Section 5.

A risk assessment will be prepared for the no action alternative. The risk assessment will include a pathway/receptor analysis and will be conducted in accordance with the guidance cited earlier.

To guide the Alternatives Assessment scoping effort, a further listing of potentially feasible remedial alternatives will be developed at the conclusion of the remedial investigation. Potentially feasible alternatives should follow EPA's <u>Interim Guidance on Superfund Selection of Remedy</u>.

If potentially feasible remedial alternatives for an individual WAG include relatively new or untested processes, bench or pilot scale testing requirements will be quantified and recommendations to perform will be made.

4.2.3 Remedial Investigation Analysis Report

The Remedial Investigation Analysis report will consolidate all available, appropriate, and applicable data on a WAG. The report should contain or reference all data that will impact the evaluation and selection of remedies for SWMUs within the WAG. The report will summarize the analyses conducted by the project team and, to the extent possible, define the areal and vertical extent of contamination; present the team's assessment of surface and subsurface conditions impacting contaminant migration; present a risk assessment for each SWMU or collection of SWMUs; and present a summary of remedial actions which are felt to be potentially feasible.

The Remedial Investigation Analysis Report will also include a preliminary identification of Applicable or Relevant and Appropriate Requirements (ARARs) from federal and state statutes. Early identification of ARARs (and signoff by review agencies) will clarify issues to be addressed in the Alternatives Assessment phase of the work.

The Remedial Investigation Analysis Report should include the following elements:

- Executive Summary
- Introduction

    Site Background Information
    Description and location of SWMUs
    Nature and Extent of Problem(s)
    Remedial Investigation Summary
    Overview of Report

- Site Features Investigation

    Demography
    Land Use
    Natural Resources
    Climatology

- Hazardous Substances Investigation

    Waste Types
    Waste Component Characteristics and Behavior

- Hydrogeologic Investigation

    Soils
    Geology
    Groundwater
    Subsurface Gas

- Surface Water Investigation

  Surface Water
  Sediments
  Flood Potential
  Drainage

- Air Investigation

- Biota Investigation

  Flora
  Fauna

- Public Health and Environmental Concerns

  Pathway Analysis
  Potential Receptors
  Public Health Impacts
  Environmental Impacts
  Risk Assessment

- Identification of Potentially Feasible Alternatives for Individual SWMUs or Collection of SWMUs

- Applicable or Relevant and Appropriate Requirements

- Identification of Bench or Pilot Testing Requirements

- Technical Appendices as Required

The body of the report will present a concise summary of the technical work completed on the project. The Remedial Investigation Analysis Report will be written in language easily understood by the public. To reduce the complexity of the report, materials will be presented, to the extent possible, with a high reliance on figures and tables, with text minimized. Complex computations and analyses will be placed in appendices.

4.3 ALTERNATIVES ASSESSMENT PLANNING

4.3.1 Approach

To meet NEPA requirements and the requirements of the NCP, the assessment of alternative remedial actions for each SWMU or collection of SWMUs must consider all reasonable alternatives and produce a clear record of how and why the recommended alternative was selected.

The NCP requires that, unless special waivers are obtained, the selected corrective measures attain the ARARs of other federal environmental and public health statutes. SARA added the provision that remedial actions also attain state requirements more stringent than federal requirements if they are also applicable or relevant and appropriate.

The Alternatives Assessment will involve the development of alternatives, initial screening of alternatives, and detailed analysis of alternatives. During the course of this work, Alternatives Assessments may proceed simultaneously on SWMUs located in contiguous or nearby WAGs. The program schedule will be utilized to show project direction, priorities, milestones, and contingency work plans.

Potential impacts of alternatives on adjacent WAGs will be communicated by the RI/FS Manager to the WAG Managers and to the Review Team Leader (RTL). Each alternative assessment will be reviewed by the Technology Review Group, which will include all WAG Managers, the RTL, and the Technical Integration Manager. This review will provide for a comprehensive management review and will ensure that information developed for each WAG is made available to those working on other assessments.

4.3.2 Development of Alternatives

The NCP specifies that at least one remedial alternative be developed for each of the following categories:

- o Treatment or disposal at an off-site facility
- o Attainment of ARARs for federal and state public health and the environmental statutes

- o Exceeding ARARs for federal and state public health and the environmental statutes
- o Falling below ARARs but reducing the likelihood of the threat and providing significant protection to public health and the environment
- o No action

SARA also mandates permanent solutions whenever possible. Alternatives will be developed for each SWMU or collection of SWMUs to satisfy the NCP requirements to the extent that it is both possible and appropriate.

In defining alternatives for consideration, current developments in remedial technologies such as incineration (for destruction of chemicals), waste minimization, in situ stabilization, in situ vitrification, and biological treatment will be given careful attention. Key data required to establish the applicability of remedial technologies are the waste type and concentration and geohydrologic site conditions. WAG-specific studies will be performed to evaluate technical issues that are unique to one WAG. Studies that are applicable to more than one WAG will be addressed as generic studies to the extent possible.

4.3.3 Analysis of Alternatives

4.3.3.1 Initial Screening of Technologies

The purpose of the screening step is to reduce the number of technologies for further analysis while preserving a range of options. Consultation between Bechtel and Energy Systems is very important at this stage. This screening is accomplished by considering the technologies against effectiveness, engineering feasibility, and cost factors. Cost is an important factor when comparing technologies that provide similar results (i.e., cost may be used to discriminate among treatment technologies, but not between treatment and nontreatment technologies).

In some situations, the above factors could occasionally result in elimination of alternatives that involve treatment of the source as the principal element (e.g., on large, complex sites). Typically, groundwater actions will be necessary at such sites to achieve adequate protection. The Record of Decision (ROD) must eventually explain the rationale for eliminating source treatment options at this point in the process. When any technology is eliminated in the screening, the rationale will be documented in the Alternatives Assessment Report.

Innovative technologies should be carried through the screening step if there is reasonable belief that they offer potential for better treatment, performance or implementability, few or lesser adverse impacts than other available approaches, or lower costs than demonstrated technologies.

The ARARs developed in the Remedial Investigation Analysis Report should be checked again during this step to ensure that all ARARs have been identified.

4.3.3.2 Detailed Analysis of Alternatives

Once technology screening has been completed, the remaining technologies should be "assembled" into overall alternatives that address the problems of the WAG. An "assembled alternative" may consist of numerous individual technologies.

In performing the detailed analysis it may be necessary to gather minor quantities of additional data. This phase of work should focus on collecting those detailed data necessary to make a well-substantiated analysis of alternatives. For example, to accurately estimate foundation costs it might be necessary to conduct engineering soils analysis. After a literature survey is conducted to identify existing treatment data, treatability tests at the bench- and sometimes pilot-scale may be necessary to test a particular technology on actual site waste. In some cases, it could become necessary to obtain additional field data if needed to further assess alternatives. At this phase, however, field data requirements should be minimal.

The alternatives passing through the initial screening will be analyzed in further detail against a range of factors and compared against one another. The effectiveness of the alternatives will be assessed, taking into account whether or not an alternative adequately protects human health and the environment and attains federal and state ARARs; whether or not it significantly and permanently reduces the toxicity, mobility, or volume of hazardous constituents; and whether or not it is technically reliable.

Alternatives will be evaluated against implementability factors, including the technical feasibility and availability of the technologies such alternatives would employ; the technical and institutional ability to monitor, maintain, and replace technologies over time; and the administrative feasibility of implementing the alternative.

Finally, the costs of construction and long-term costs of operating and maintaining the alternatives will be analyzed using present-worth analysis.

4.3.3.3 Selection of Remedy

WAG alternatives that achieve adequate protection, are technically feasible, and are cost-effective will advance to the facility-wide Feasibility Study, which is discussed in later sections of this plan.

4.3.4 Alternatives Assessment Report

The Alternatives Assessment Report shall contain the following information:

- Introduction

  Site Background Information
  Nature and Extent of Problem
  Objectives of Remedial Action
  ARARs

- Screening of Remedial Technologies

  Technology Screening Summary

- Assembly of Alternatives

- Initial Screening of Alternatives

  Technical Criteria
  Environmental and Public Health Criteria
  Effectiveness Criteria
  Cost Criteria

- Detailed Analysis of Alternatives

  Non-Cost Criteria
    Technical Feasibility
    Environmental Evaluation
    Institutional Requirements
    Public Health Evaluation
  Cost Analysis

- Selection of Remedy

  Eliminated Alternatives
  Summary of Remaining Alternatives
  Potential Impacts on Adjacent or Down Gradient WAGs
  Partial or Temporary Alternatives

4.4 GENERIC STUDIES AND ISSUES PLANNING

Generic studies may be performed as a cost effective approach for addressing technologies or issues that apply to more than one WAG or that are needed to complete the Feasibility Study. Such studies, for example, may include waste and water treatment studies, containment design studies, migration analysis studies, environmental definition studies, off-site disposal studies, and regulatory strategy studies. BNI will submit a separate work plan for any proposed study for Energy Systems' approval prior to performance of such studies. Specific studies are expected to be identified during the development of remedial investigation plans for each WAG.

4.5 FEASIBILITY STUDY DEVELOPMENT AND INTEGRATION

4.5.1 Approach

Alternatives Assessment Reports from each WAG will be integrated into a single Feasibility Study. The Feasibility Study will provide a comprehensive assessment of the need, extent, priority, and timing for future remedial actions, and will also describe the short- and long-term environmental consequences of the remedial actions.

By the time the Feasibility Study is initiated, the Alternatives Assessment will have been completed (or will be nearing completion) for SWMUs in each of the WAGs. Because each WAG will be studied separately and the various studies will be staggered over time, it will be necessary to review individual Alternatives Assessments and supplement them as necessary before preparing the Feasibility Study. Of specific importance in this review will be:

- "New" data available from the WAGs that would impact the types of alternatives considered
- Potential impact on alternatives considered for each WAG from alternatives developed for other WAGs
- Potential impact on the remedial action selection process from ongoing development and/or demonstration of new technologies
- Changes in the regulatory environment

Preparation of the Feasibility Study will proceed in steps, and interim deliverables to Energy Systems will ensure that the approach and the alternatives being considered are appropriately reviewed. The interim deliverables will be incorporated into the final Feasibility Study as discussed below.

4.5.2 Statement of the Problem

After beginning work on the Feasibility Study, a draft copy of the Statement of the Problem will be issued to Energy Systems and will contain the following elements:

- Overview of the nature and extent of contamination at each WAG (referencing other studies as appropriate)
- Overview of alternatives assessed for each SWMU
- Overview of risks associated with each SWMU
- Remedial action objectives for WOC watershed, or for the particular WAG if not located in the watershed
- Regulatory status of SWMUs within each WAG
- A summary of regulations applicable to each SWMU and/or of regulatory interpretations that would impact selection of remedies
- A discussion of recently demonstrated technologies that could impact selection of remedies
- A discussion of interactions between SWMUs and/or WAGs that could impact selection of remedies
- Expedited responses believed to be prudent (e.g., recommended actions prior to initiation of final site remediations
- An overview of any facility-wide modeling efforts or multi-site generic studies that could impact remedy selection

After receipt of Energy Systems comments, the Statement of the Problem will be submitted to Energy Systems in final form, and work will proceed on development of remedial action scenarios.

4.5.3 Development of Remedial Action Scenarios

Based on the studies completed on individual WAGs and on the framework developed in the Statement of the Problem, remedial action scenarios will be developed for the overall ORNL complex. Where possible, scenarios will be developed to take advantage of technologies and facilities common to multiple SWMUs and/or WAGs. The priority and timing of remedial action implementation will be prioritized within each scenario.

In general, the criteria to be used in screening alternatives will be as described in the National Contingency Plan (currently being revised) and EPA's Feasibility Study Guidance Manual (currently being revised). Broad considerations will include compliance with regulations, environmental protection, environmental impacts, health and safety factors, technical feasibility, cost, time required to implement, and the permanence of the remedy.

Considering the regulatory situation at ORNL, considerations which may also be appropriate include:

- o Compliance with negotiated schedules
- o Compliance with RCRA, CERCLA, NEPA, ARARs, DOE Orders, CWA, TSCA, etc.
- o Prioritization of remedial action by risk
- o Interaction among WAGs

In the development of remedial action scenarios, site-wide modeling studies and other multi-site generic studies may affect the selection of alternatives from those developed earlier for individual WAGs.

A matrix will be prepared to illustrate major features of each scenario and to summarize the considerations described above. Based on this initial screening, a limited number of scenarios will be recommended for detailed evaluation. From each of the areas listed below, at least one scenario will be selected for further evaluation. The areas are:

- o Scenarios for treatment or disposal at an off-site facility approved by EPA
- o Scenarios that attain applicable and relevant federal public health and environmental standards

- o As appropriate, scenarios that exceed applicable and relevant public health or environmental standards

- o Scenarios that do not attain applicable or relevant public health or environmental standards but that will reduce the likelihood of present or future threats from hazardous substances

- o A no action scenario

4.5.4 Evaluation of Remedial Action Scenarios

Each of the scenarios carried into the detailed evaluation process will be developed in detail sufficient to allow a more thorough evaluation. Preliminary site plans, cross-sections, process flow diagrams, unit operation sizing, and similar materials will be developed. Additional analyses will be performed as necessary to incorporate results of site-wide modeling studies and other generic studies that address multiple WAGs.

Following this more detailed development, the remedial action scenarios will be evaluated in terms of engineering feasibility, environmental impact, public health and institutional considerations, and cost effectiveness. An order of magnitude cost estimate (+50 percent to -30 percent) will be prepared for each scenario. An estimated implementation schedule will be prepared with individual remedial actions prioritized within each scenario.

4.5.5 Feasibility Study Report

The Feasibility Study Report will discuss the remedial technologies that were considered applicable and what data were taken during the remedial investigations to evaluate the technologies. The Feasibility Study strategy development will identify any area-wide (or watershed) issues that impact the remedial action. Such issues might include, for example, hydrologic connections between WAGs or areas contiguous to the ORNL complex, development of broad modeling capabilities for the watershed, scheduling considerations on remedial actions within the watershed, and sharing remedial technologies between WAGs.

The Feasibility Study Report will include a recommendation for the remedial action scenario to be implemented at ORNL. The report is outlined in Table 4-1.

4.5.6 Definition of NEPA Compliance

The Feasibility Study report for the ORNL complex must be the functional equivalent of an Environmental Impact Statement for the recommended remedial action scenario. This requirement necessitates provision of sufficient detail to document the environmental impacts of the proposed action, any adverse environmental impacts that cannot be avoided if the action is completed, and an analysis of alternatives to the proposed action.

Consideration of environmental consequences, including economic and social effects as well as physical and natural effects, will require substantially more detail than provided in a typical CERCLA Feasibility Study. Planning and execution of WAG-specific and generic studies will involve a systematic interdisciplinary approach to evaluation of the full range of potential impacts.

The Feasibility Study report will present the environmental impacts of the recommended remedial action and alternative scenarios in comparative form, defining the issues and providing a basis for choices among options. The Alternatives Assessments for individual WAGs and the overall Feasibility Study report should document that all reasonable alternatives have been considered. Each reasonable alternative should be evaluated in sufficient detail to document its comparative merits and the reasons for eliminating it or carrying it into later, more detailed evaluation. An analysis of the "no action" alternative also will be completed.

NEPA also requires that the public, state, other federal agencies, and other interested parties be provided an opportunity to present their views and comments on the recommended and alternative remedial actions. Public participation starts with a public notice of the planned preparation of the EIS (the RI/FS in this case).

TABLE 4-1

FEASIBILITY STUDY REPORT OUTLINE

Executive Summary

1.0 Statement of the Problem

1.1 Site background information
1.2 Nature and extent of problems
1.3 Objectives of remedial action
1.4 Regulatory status and climate
1.5 New remedial technologies
1.6 Recommended expedited responses

2.0 Development of Remedial Action Scenarios

2.1 Technical criteria
2.2 Remedial action scenarios developed
2.3 Environmental and public health criteria
2.4 Other screening criteria
2.5 Cost criteria

3.0 Remedial Action Scenarios

3.1 Scenario 1 (No action)
3.2 " 2
.
.
.
3.N " N
3.N+1 Scenarios eliminated because of environmental, technical, and cost aspects

4.0 Analysis of Remedial Action Scenarios

4.1 Non-cost criteria analysis

4.1.1 Technical feasibility
4.1.2 Environmental evaluation
4.1.3 Institutional requirements
4.1.4 Public health evaluation

4.2 Cost analysis

5.0 Summary of Scenarios and Ranking

6.0 Remedial Action Recommendation and Environmental Impact Analysis

References

Appendices

Interaction with the public continues throughout the project via such activities as public meetings or notices. Public comments, both verbal and written, are solicited during both the planning process and after preparation of the draft and final Feasibility Study report. Since community relations work is not included in BNI's subcontract with Energy Systems, it is assumed that Energy Systems and/or DOE will fulfill NEPA's public participation requirements for the RI/FS project.

4.6 ENVIRONMENTAL, SAFETY AND HEALTH PLANNING

4.6.1 Scope

The objective of Environmental, Safety and Health (ES&H) planning is to provide complete and thorough ability to monitor and ensure the health and safety of on-site and off-site personnel and the public and to protect the environment. The ES&H program is conducted with the objective of controlling exposures and potential releases to levels that are as low as reasonably achievable (ALARA).

4.6.2 Management Approach

The ES&H program will be implemented under the direct supervision of the ES&H Manager. The ES&H staff will include professionals and technicians specializing in industrial hygiene, health physics, and industrial safety.

The ES&H program will serve as a management extension of the Energy Systems representatives through the Energy Systems ES&H Coordinator. The program will complement the Energy Systems program in each safety discipline and will, as a minimum, be as stringent as similar Energy Systems programs.

Performing the RI/FS project work safely is a total corporate commitment backed by the top levels of management of the Bechtel organization. This commitment is reflected in the independence the ES&H Manager has within the overall RI/FS project organization. The

ES&H Manager is responsible to BNI corporate management for ensuring that work on the RI/FS project is performed in an environmentally and physically safe manner. He performs these duties in coordination with the Program Manager, and provides support and guidance to other project department managers, but remains independent of them. He has authority to stop work at any time if necessary to protect on-site or off-site personnel, the public, or the environment. Also, due to the nature of the situations often encountered in hazardous or uncertain work, the stop-work authority is typically delegated to field level ES&H staff, who can react to halt work if safety is threatened. Stop work authority is also vested in Energy Systems management.

4.6.3 Environmental, Safety and Health Plan Technical Overview

The ES&H program will be conducted in accordance with applicable DOE, NRC, EPA, OSHA, and State of Tennessee regulations and Energy Systems procedures. Within this regulatory framework, field activities will be evaluated to ensure that any resulting exposures are ALARA. Action levels will be established to provide a comprehensive system of checks to ensure exposures are maintained at acceptably low levels, usually significantly below regulatory standards.

As a part of the ALARA philosophy, comprehensive training is provided to all project employees who frequent contaminated work sites. This training provides the basis for informing employees of the generic hazards that may be encountered, their effects on the human body, how to recognize potential hazards, what protective equipment is available, and how to effectively use the protective equipment. The training program includes a 40-hour indoctrination on generic safety and health principles, a waste area-specific program to provide instruction about hazards specific to an individual waste area, site-specific training by Energy Systems, annual refresher training, and weekly "lunch box" safety meetings. Some specific aspects of the ES&H plan as applied to the RI/FS project are described in the following subsections.

4.6.3.1 Hazards Assessment

Prior to the initiation of field studies, hazard assessments will be conducted for each WAG. These assessments will utilize available historical data, discussions with knowledgeable personnel, and area screening surveys to identify radiological, chemical, and physical hazards.

The hazards associated with remedial investigations at the various areas and knowledge relating to hazards may vary significantly, and most likely it will not be possible to identify all hazards. Therefore, safety and health requirements will be conservative. It will be assumed that hazardous materials will be encountered during operations, even when historical information and initial survey data do not indicate their presence.

Surveillance methodologies for radiological contaminants include real time measurements of direct exposure, periodic surface contamination levels, area and breathing zone air sampling, plus an exposure documentation and evaluation program that includes bioassay sampling, whole body counting, TLD badging and other special techniques as may be appropriate. Surveillance methodologies for chemical contaminants include breathing zone air sampling, real time assessments of volatiles and semi-volatiles, real time measurement for explosive atmospheres, and a medical surveillance program that includes bioassay of body fluids as required to evaluate exposures.

Personnel dosimetry records generated by BNI will be available for Energy Systems audit at any time. These records shall be transmitted to Energy Systems upon completion of the Project. Those records generated by Energy Systems dosimetry programs (TLD, bioassay, and in-vivo) will be transferred to BNI in summary form. All data and backup QA/QC data will be maintained by Energy Systems.

4.6.3.2 Field Surveillance and Monitoring

A comprehensive field surveillance and monitoring program, coupled with appropriate use of personal protective clothing, will be used to ensure worker safety. For those areas and operations for which hazards cannot be quantified or where the hazard exceeds agreed-upon levels, the ES&H staff will monitor worker safety continuously. Surveillance and monitoring will be conducted under a set of procedures and instructions that define methodologies and protocols. Dosimetry and oversight of resulting records will be provided by Energy Systems. Radiation detection instruments will be supplied by BNI and calibrated by Energy Systems in accord with industry and DOE standards.

Field monitoring will also ensure that radiological and chemical contamination is not spread beyond the work area and that the contamination status of the work area is not degraded as a result of investigative activities in the field. To ensure that contamination is controlled, a comprehensive program of inspection and contamination control will be employed. All equipment will be comprehensively scanned for radiological contamination prior to its initial use on the project. Equipment relocated intra- or inter-WAG will be surveyed and released or packaged for transportation purposes. Comprehensive radiological surveys will be conducted on equipment prior to release from the project. All personnel exiting remedial investigation areas shall be frisked for radiological contamination. Other more stringent personal hygiene and monitoring techniques will be instituted as dictated by hazard potentials.

4.6.3.3 Hazards of Special Concern

The types of hazards and potential problems that are of most concern are undocumented burials or unknown constituents of known burials. Every effort will be made to quantify hazards prior to initiation of subsurface investigation. However, the potential for exposure of personnel and insult to the environment from unknown dispositions of hazardous materials will exist at all drill locations. Therefore, while safety and health plans will provide assessments of hazards based on available data, it will be necessary to develop plans to provide protection from unquantified hazards.

4.6.4 Environmental, Safety and Health Plan

The Environmental, Safety and Health Plan document for the RI/FS project will be a comprehensive plan for maintaining the health and safety of on-site and off-site personnel, the public, and the environment. It will set forth the BNI Team philosophy, detail regulatory requirements, and describe the project's organization, responsibilities, authorities, and interfaces with the Energy Systems ES&H organizations. In addition, the plan will present detailed discussions of the following:

- Hazard Assessment
- Personal Protective Equipment
- Respiratory Protection Program
- Personnel Decontamination Procedures
- Equipment Decontamination Procedures
- Training
- Medical Surveillance, Bioassay, and TLD Programs
- Air Monitoring
- Perimeter Monitoring
- Emergency Action Plan
- Records Plan

4.7 QUALITY ASSURANCE/QUALITY CONTROL PLANNING

4.7.1 Scope and Objectives

The RI/FS Project Quality Assurance/Quality Control (QA/QC) Plan will apply to activities related to the RI/FS contract deliverables. This includes personnel responsibilities, authorities, and qualifications; inspection activities; sampling strategies; and documentation. The QA/QC Plan will comply with the requirements of DOE Order OR-5700.6A, ANSI/ASME NQA-1-1986, the Martin Marietta/ORNL Quality Assurance program, and EPA guidance documents as described within the QA/QC Plan and standard operating procedures.

The objectives of the QA/QC Plan are to define the management approach, organization, interfaces, and controls that will be used to ensure that project quality requirements are documented, implemented, and verified, and to ensure that resulting documentation and records are complete, accurate, defensible, and retrievable. The QA/QC Plan will help ensure that the project activities are performed with quality and in a cost- and schedule-effective fashion.

The level of quality assurance and quality control applied will be based on the relative importance an item or activity has to safety, performance, reliability, and overall project objectives. Quality Assurance Assessments (QAAs) will be performed routinely and will identify items or activities that require action beyond the routine QA/QC program controls.

4.7.2 Management Approach

The QA/QC program will be implemented under the direct supervision of the QA/QC Manager. The QA/QC staff will include a field QA/QC supervisor, a laboratory QA/QC supervisor, and technicians specializing in sampling acquisition and analytical methods.

The QA/QC program will interface with Energy Systems representatives through their QA Specialist.

The QA/QC Manager is independent from project operations and reports directly to the President of BNI through the Manager of Quality Assurance. The QA/QC Manager directs and controls the project QA/QC program and works with the Program Manager to coordinate its implementation.

The QA/QC Manager represents the President of BNI to ensure that the overall BNI approach to quality is implemented on the RI/FS project. This includes stop work authority, which permits suspension of any activity when the QA/QC Manager determines that the project or any segment of the project is improperly controlled or nonconforming. The stop work order is directed to the Program Manager, and affected activities or work operation can not resume until the QA/QC Manager has verified that the condition has been corrected. Stop work authority is also vested in Energy Systems management.

4.7.3 Technical Overview

The QA/QC Plan will reflect the policies contained in the BNI Quality Assurance Manual, which complies with ANSI/ASME-NQA-1-1986, and will be formatted using the 18 elements of ANSI/ASME-NQA-1. In addition, the QA/QC Plan will comply with any additional requirements contained in the ORNL Quality Assurance Manual, such as the procedure for software quality assurance, QA-L-19-100.

For quality related activities, the QA/QC Plan will be implemented through technical documents, procedures, instructions, and drawings. Technical procedures will control the following activities:

- Field operations
- Laboratory activities
- Sampling, monitoring, and chain of custody
- Environmental, Safety and Health
- Calibration
- RI/FS reports
- Data Quality Objectives (DQO) Reports
- Data reduction, validation, and reporting
- Decontamination
- Waste management
- Preventive maintenance
- Procurement of equipment, material, and services

Quality related project documents will be reviewed by the QA/QC Manager to verify compliance with QA/QC requirements.

Quality Assurance Assessments will be performed to review and document the probability and consequence of failure of an activity. The QAA will be performed by the group responsible for the activity, and the QAA will then be reviewed and approved by key project personnel meeting as a team. Quality Action Plans (QAP) will be used when special actions beyond routine QA/QC Program requirements are required.

Project documents will be controlled by a document control system. Quality related documents and records will be controlled, collected, stored, and maintained by a records management system. An indoctrination and training program will be established to include the project QA/QC program, ES&H program, and project procedure requirements.

Quality control checks will be used to ensure the quality of laboratory analytical data. These checks will include the use of blanks, duplicates and replicates, spike recoveries, and standards. Quality control inspections will be performed for remedial investigation activities, environmental measurements, laboratory operations, document control systems, and data base management systems.

Using audit checklists, scheduled and unscheduled audits will be performed on project quality related activities, including the activities of each remedial investigation team. Audit findings will be documented and an audit report will be issued. Corrective actions, including actions to preclude recurrence, will be documented and verified. Monthly quality assurance management review meetings will be held, at which time reviews and performance of project activities will be discussed and evaluated.

4.8 DATA BASE MANAGEMENT PLANNING

4.8.1 Scope

The Data Base Management Plan defines the data base management system and establishes the procedures to be followed in gathering, storing, processing, and analyzing data associated with the Remedial Investigations, Alternatives Assessments, and Feasibility Study being conducted at ORNL. The objectives of the plan are to:

- Provide a centralized repository for site characterization data
- Facilitate manipulation, analysis, and display of data
- Provide a procedure for tracking, retrieving and safeguarding project data

4.8.2 Technical Overview

The Data Base Management Plan will be organized into eight sections. The first section will define the general purpose and scope of the Data Base Management Plan. The content of the other seven sections is summarized below.

4.8.2.1 Data Base Management Team and Services

The data base management team will initially consist of a supervisor, two data coordinators, a Statistical Analysis Systems (SAS) specialist, a BGIS/CADD operator, and a computer programmer. The supervisor defines and manages the work, ensures that procedures are followed, and provides overall coordination with other team members. The data coordinators carry out day-to-day data base management operations associated with each of the WAGs. The SAS specialist will provide training and support in utilization of the SAS system. The BGIS/CADD operator performs data analysis and develops the graphical results from the analysis. The computer programmer provides data manipulation and program development as required to automate data handling and analysis.

4.8.2.2 Data Base Management System

The BNI computer system for storing and analyzing project data will be a VAX 11/785 Supermini Computer accessed through an AT&T network of small terminals, microcomputers, and remote terminals. The data will be stored in SAS data sets and will be compatible with formats used on ORNL's IBM 3033 system. BNI plans to use Bechtel's Geographic Information System (BGIS), Intergraph CADD system, and third-party software for data analysis and interpretation.

SAS data sets and electronic mail will be transferred between BNI and Energy Systems using a combination of modems and magnetic media.

4.8.2.3 Organization and Content of Data Base

The data base will generally be organized and structured by type of data. The types of data to be included are: field, laboratory, personnel health and safety, engineering and geotechnical, bibliographic and historical, and project management. Field and laboratory data will include physical, chemical, radiological, and geological characteristics of the facility.

Some data sets will pertain to multiple or all WAGs. Examples of such data are results of generic studies, site flora and fauna data, well construction parameters, surface water discharge, meteorological, and socioeconomic parameters that are expected to be similar for all WAGs. These data sets will be organized by type of data but will be identified as being non-WAG specific.

4.8.2.4 Data Acquisition

Methods for data collection will differ for various types of data. General methods include:

- o Review of existing data, photographs, and literature
- o Field measurements and observations
- o Laboratory analyses of field samples
- o Computer analyses
- o Personnel submittals

All data collected will be given identifying documentation for inclusion into the data base. This will include sample type, sample date, sample location and description, field and/or laboratory preparation technique, and analysis method as appropriate. Identification codes and standard data entry collection forms will be utilized to facilitate encoding of data.

To minimize the likelihood for human error in handling data, data input will be automated to the extent possible. Use of the Ultrasonic Ranging and Data system (USRAD) will be explored, and whenever possible, laboratory and field data will be electronically entered directly from the laboratory or field location. Scanners will be considered for graphical data. Double entry of data, summary reports, formatted data collection forms, and graphical overlays will also be used to minimize potential errors associated with data acquisition.

4.8.2.5 Data Base Management Approach

Data will be handled in accordance with the data handling protocol defined in the Data Base Management Plan. The protocol defines data flow from acquisition to utilization and defines procedures for computer information exchange.

All modified project data base files will be backed up at least daily to protect against loss of data. An additional condensed tape backup will be produced weekly of all data. These tapes will be stored off-site for protection for 4 weeks and then rotated back to receive new backup data. At completion of the project, the backup tapes will be maintained until all data have been transferred to the Energy Systems data base and archives.

Data contained in the data base will include data in four specific forms: unverified, verified-invalid, verified-limited use, and verified-valid. All data sets will include variables for indicating data verification status. Unverified and verified-invalid data will have restricted access to protect against inadvertent use of such data for data interpretation or analysis. Verified-limited use and verified-valid data will be made available to qualified project users, and to Energy Systems. Access to all data will be controlled by use of passwords, file protection schemes, and physical access limitations.

4.8.2.6 Data Analysis

The technical data collected and entered into the data base will be the basis for the extensive analysis needed to characterize the radiological, chemical, geohydrological, physical, and environmental features of the site, predict potential future contaminant migration, and evaluate potential waste treatment technologies. State-of-the-art computer software will be utilized in performing data analysis. BGIS will be used to create isopleths of contamination and graphics of existing site physical and geohydrologic conditions. The system also can be used to create 3-D topographical and geohydrologic as well as detailed civil designs and contamination models.

The GS2 computer software is another code developed by Bechtel that will be used to predict potential contamination migration. It has previously been used by Bechtel on the FUSRAP project to predict contaminant migration after 200 and 1000 years.

SAS will be used to perform statistical analysis of the data as appropriate, in addition to being used to manage the data base.

4.8.2.7 Quality Assurance and Data Security

Quality assurance is an integral part of the basic data management approach discussed in Section 4.8.2.5. The QA/QC Plan will describe standards for precision and accuracy for data acquisition and analysis. It will also set standards for chain of custody. The data handling protocol defined in the Data Base Management Plan also includes procedures for ensuring data backup, controlling access to data, controlling accuracy of the data, and verifying the data integrity.

Changes to the established data base will be controlled by limiting access to the data and by requiring documentation of the basis for changes and proper management authorization before an established data file can be changed.

4.9 WASTE MANAGEMENT PLANNING

4.9.1 Scope

The objective of waste management planning is to ensure that, for all stages of waste management, procedures are properly defined and followed and that regulatory compliance is achieved. The organizational relationships, interfaces, responsibilities, and authorities to accomplish these objectives are also a crucial aspect of waste management planning. Planning will be formalized into a Waste Management Plan, a document that provides specific guidance for waste management. The document is discussed in Subsection 4.9.3. Basic approaches to waste management are briefly described in the following subsections.

4.9.2 Technical Overview

4.9.2.1 Waste Minimization

The waste management program will incorporate waste minimization into remedial investigation planning. Waste minimization assessments will be conducted as part of drilling and sample collection protocols to ensure that minimal waste volumes are generated. When techniques are available that generate less residual wastes, the use of such techniques will be carefully evaluated. Evaluation of these techniques shall include sample reproducibility, productivity, and whether the technique is an approved or accepted technique by EPA.

4.9.2.2 Waste Handling, Packaging, and Disposal

Once wastes are generated, whether they are drilling spoils, disposable protective clothing, or decontamination solutions, they will be handled in a controlled manner to ensure proper disposal, which can include a wide range of techniques from leave-in-place to store-for-disposal. At the time they are generated the wastes will be characterized to determine contamination status, then segregated by waste form (e.g., compactible, non-compactible, liquids, soils/soil-like materials), and then disposed of or stored in accordance with approved policies and procedures.

Wastes generated will be collected, packaged, and disposed of in accordance with applicable DOE Orders and Energy Systems procedures. Wastes will be analyzed utilizing approved methodologies, which may include field screening techniques or laboratory analyses, depending on the contaminant type and the available historical data.

Personnel packaging wastes will be trained in proper waste packaging techniques and will be certified per Energy Systems procedural requirements. Wastes transferred to Company disposal or storage facilities will be certified as to waste form, waste type, and applicable concentrations.

BNI will be responsible for collection, segregation, packaging and certifying waste for disposal/storage by Energy Systems, specifically ORNL Waste Operations. The Energy Systems Field Coordinator is responsible for final certification of wastes prior to transfer to ORNL Waste Operations.

4.9.2.3 Equipment Contamination/Decontamination

Equipment used for field investigation will be controlled to minimize contamination, thus reducing the spread of contamination and decontamination requirements. All equipment will be radiologically surveyed prior to initial use on the project, routinely during use, and prior to release from the project.

To the extent practicable, equipment will be maintained in a clean status during use. Prior to release for unrestricted use, equipment will be thoroughly cleaned and radiologically surveyed. Decontamination facilities for drilling rigs and other large pieces of equipment will be provided as needed. A washdown facility for uncontaminated equipment also will be provided to keep equipment clean between drilling operations. This facility will not be used to decontaminate equipment.

4.9.3 Waste Management Plan

A Waste Management Plan will be prepared as part of Phase I of the RI/FS project to provide details pertaining to the waste management program. At a minimum, it will address the following subjects:

- Expected waste characteristics (in terms of radiological and chemical hazards)
- Estimated quantities and schedule of generation of wastes
- Expected sources of wastes
- Regulations, responsibilities, and authorities
- Process flow charts for waste handling
- Vehicle and equipment decontamination facilities (including design requirements)
- Procedures and methodologies for waste minimization, handling, collection, packaging, certification, disposal and storage

5.0 PERFORMANCE CRITERIA

The basic technical performance objectives are as follows:

- o Characterize the radiological and toxic/hazardous wastes
- o Define and evaluate alternatives for remedial action
- o Prepare a feasibility study that evaluates remedial action scenarios

Guidance for identifying acceptable alternatives will be established in coordination with Energy Systems, DOE, EPA, and state agencies. General guidance has been given by EPA under SARA that alternatives that result in permanent detoxification or a reduction in volume are preferred over land disposal options. The Project Management Plan will be updated to reflect more specific performance criteria as they are developed.

Alternatives will be defined in accordance with RCRA requirements and will be consistent with CERCLA and NEPA guidelines. At least one alternative for each of the following will be evaluated within the requirements of the feasibility study guidance.

a. Alternatives for treatment or disposal at an off-site facility approved by EPA

b. Alternatives that attain applicable or relevant and appropriate federal public health and environmental standards

c. As appropriate, alternatives that exceed applicable or relevant and appropriate public health or environmental standards

d. Alternatives that do not attain applicable or relevant public health or environmental standards but that will reduce the likelihood of present or future threat from hazardous substances. This must include an alternative which closely approaches the level of protection provided by the applicable or relevant and appropriate standards and meets CERCLA's objective of adequately protecting the public health, welfare, and environment.

e. A no action alternative

6.0 PROJECT MANAGEMENT APPROACH

6.1 WORK BREAKDOWN STRUCTURE

The ORNL RI/FS project work breakdown structure (WBS) provides a method for the systematic management and coordination of project activities. The WBS identifies the work elements necessary to accomplish the project objectives and establishes a formal structure for organizing, planning, and scheduling work. Each element of the WBS has a unique identifier that provides a means for collecting cost and schedule information for each work element. Under this structure, cost, schedule, and technical performance are integrated, allowing reporting and management analyses at various levels of the project.

The project WBS is shown in Figure 6-1. Level I comprises the entire RI/FS project. Level II includes Phase I (Project Planning), Phase II (Remedial Investigations) and Phase III (Alternatives Assessment) grouped by each WAG, Phase IV (Feasibility Study), Generic Studies, and General Project Support. Levels III, IV, and V of the WBS provide a further breakdown of the Level II work to facilitate planning and control of project activities.

6.2 ORGANIZATIONAL APPROACH

6.2.1 Summary

The RI/FS project organization is structured to provide a clear line of management authority, accountability, and responsibility to facilitate successful execution of the project. The organization provides for clear lines of communication between the project participants to facilitate effective exchange of information and timely identification and resolution of issues. The key participants include:

- DOE Oak Ridge Operations Office (DOE-ORO)
- Martin Marietta Energy Systems, Inc. (Energy Systems)
- The RI/FS Subcontractor: Bechtel National, Inc. (BNI) supported by EDGe/MCI, CH2M Hill, and PEER

Figure 6-2 illustrates the overall RI/FS project management structures.

6.2.2 DOE Oak Ridge Operations Office

The Manager of DOE-ORO has ultimate responsibility for execution of the RI/FS project. Within DOE-ORO, under the Assistant Manager for Energy Research and Development, the Environmental Restoration and Facilities Upgrade Program Manager has been appointed the RI/FS Project Manager and has been delegated direct, primary authority and responsibility to accomplish the project. The DOE-ORO organization is shown in Figure 6-3.

The RI/FS Project Manager is responsible for satisfactory completion of the project within established schedule and budget. He is the prime point of contact within DOE for all communications between DOE and Energy Systems and between DOE-ORO, DOE-Headquarters, and all regulatory agencies.

6.2.3 Martin Marietta Energy Systems, Inc.

As the Operating Contractor for the ORNL complex, Energy Systems represents DOE-ORO in planning and implementing all RI/FS activities. Within Energy Systems, the ultimate responsibility for execution of the project rests with the Director of ORNL. Direct, primary authority and responsibility for project activities has been delegated through the Associate Director of Nuclear and Engineering Technologies, the Director Nuclear and Chemical Waste Programs, the Program Manager of Environmental Restoration and Facilities Upgrade Program, the ORNL Remedial Action Program Manager, to the RI/FS Subcontract Project Manager. The Energy Systems organization is shown in Figure 6-4.

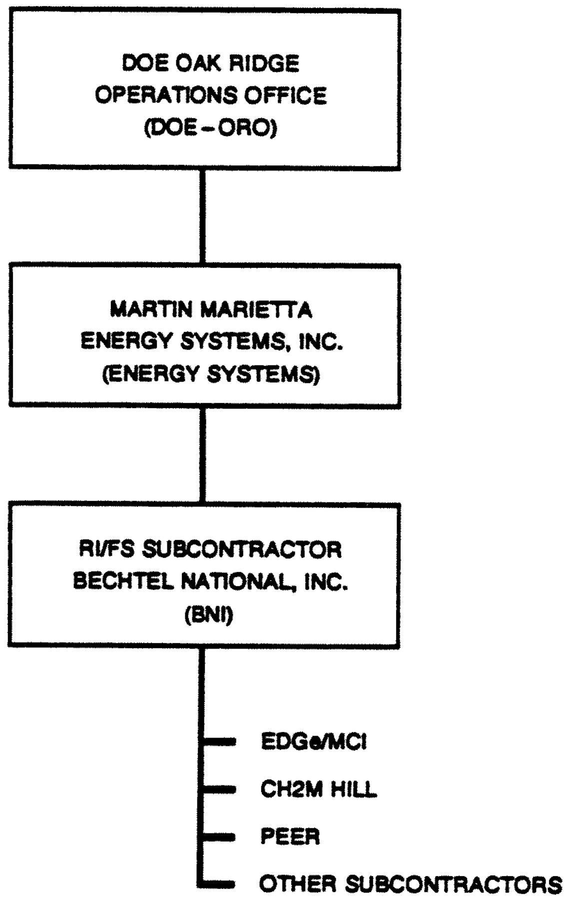

FIGURE 6-2
RI/FS PROJECT MANAGEMENT STRUCTURE

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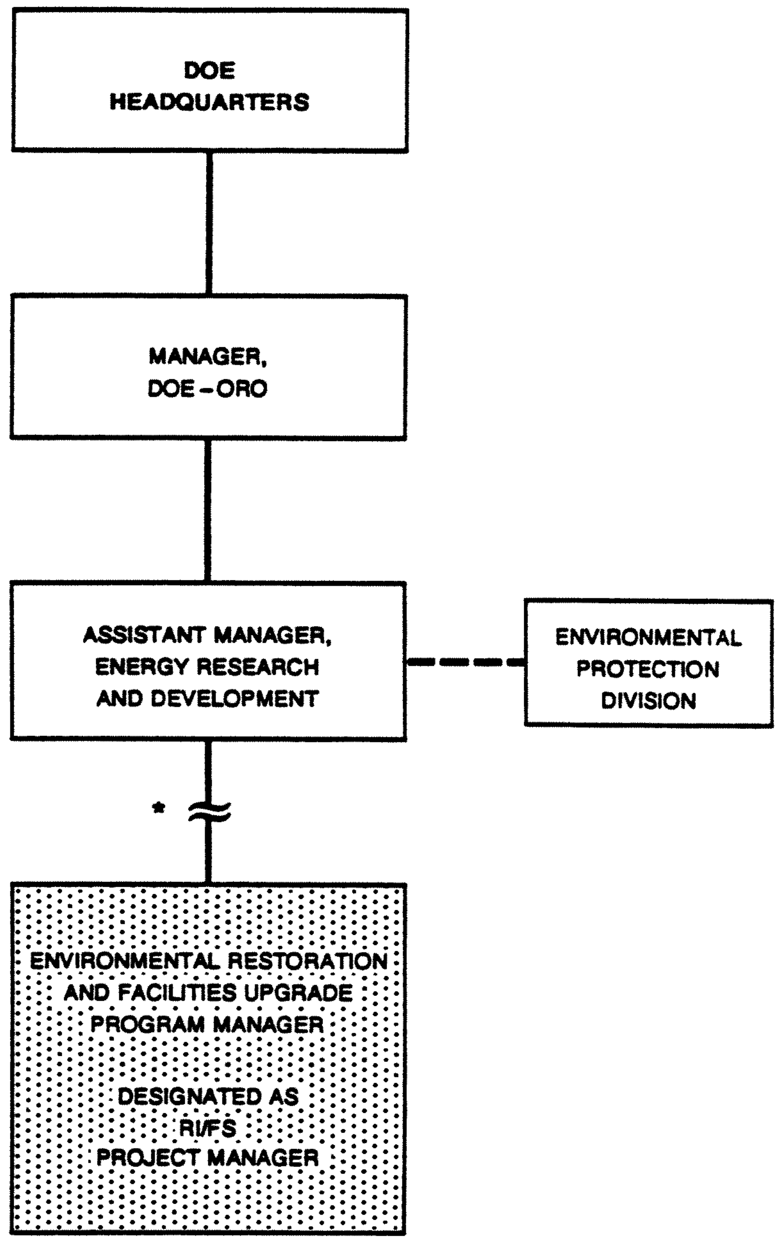

* FOR CLARITY AND SIMPLICITY, THE DOE-ORO ORGANIZATION AND THE CHAIN OF COMMAND SHOWN IS ABBREVIATED.

FIGURE 6-3
DOE-ORO ORGANIZATION FOR THE RI/FS PROJECT

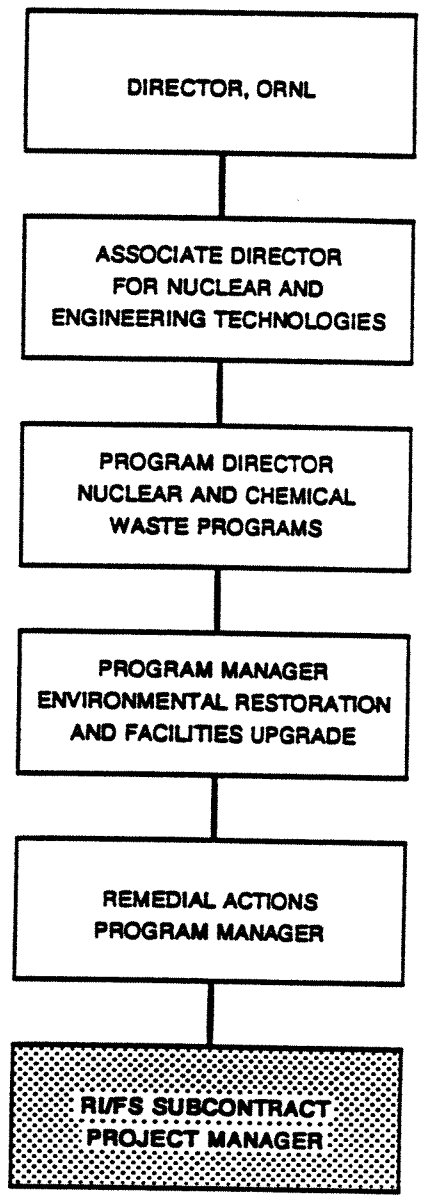

FIGURE 6-4
ORGANIZATION OF MARTIN MARIETTA ENERGY SYSTEMS FOR RI/FS PROJECT

RI/FS Subcontract Project Manager. The RI/FS Subcontract Project Manager has prime responsibility for the technical, financial, and administrative performance of the overall program. He leads and directs the effort to ensure that the program is conducted to the highest safety and quality standards, on time, and within allocated resources. He is the single point of contact for the BNI Program Manager on all project-related matters. Other responsibilities include cost and schedule reporting and control; preparation of inputs to the current year work plan; field task proposals/agreements; approving Subcontractor deliverables; preparing status reports and program reviews; and certifying, reviewing, and periodically auditing claims for reimbursement (invoices) and preparation of the Work Release Statements of Work. The RI/FS Subcontract Project Manager is supported by the organization illustrated in Figure 6-5. The responsibility and authority of each element within this organization is discussed below.

Contract Administrator. The Contract Administrator acts as the overall contract controller, ensuring compliance with Energy Systems subcontracting regulations, requirements, and statements of work; submitting work release statements of work to the Subcontractor; and conducting work release negotiations and approving changes to the subcontract.

Field Coordinator. The Field Coordinator will provide a single point of contact between the Subcontractor Field Services and Support Manager and various ORNL service and support organizations, including Laboratory Protection, Plant and Equipment, Waste Operations, Project and Construction Engineering, etc., and will coordinate training of Subcontractor personnel relative to Energy Systems and ORNL policies and procedures. The Field Coordinator will also keep the RI/FS Subcontract Project Manager informed on the status of Subcontractor field operations versus approved plans and procedures. He will also assist ESH and QA/QC coordinators in identifying, reporting, and resolving field problems.

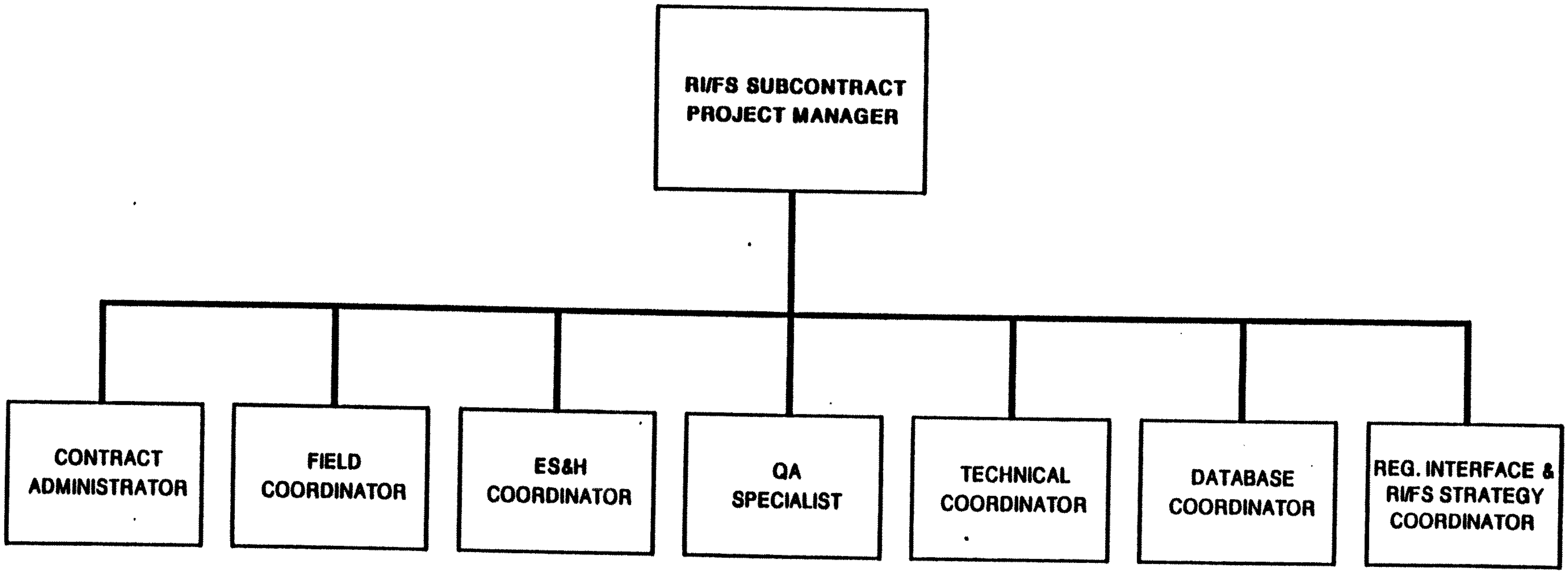

FIGURE 6-5
ENERGY SYSTEMS RI/FS PROJECT MANAGEMENT TEAM

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ES&H Coordinator. The ES&H Coordinator will provide a single point of contact between the Subcontractor ES&H Manager and the ORNL Environmental Compliance and Health Protection Division, the Health Division, and Energy Systems Central Staff Office of Environmental and Safety Activities. The ES&H Coordinator will provide the Subcontractor with information pertaining to appropriate DOE orders, state and federal regulations, Energy Systems requirements, and lines of communication to be incorporated in the RI/FS project health, safety, and environmental management plans and procedures. He will also provide review and approval of these documents and coordinate the ongoing audit of their implementation.

Quality Assurance (QA) Specialist. The QA Specialist will provide a single point of contact between the Subcontractor QA/QC Manager, the ORNL Quality Department, and the Energy Systems Quality Director. The QA Specialist will provide the Subcontractor with information pertaining to appropriate DOE orders, state and federal regulations and guidelines, Energy Systems requirements, lines of communication, and reporting to be incorporated in the RI/FS project QA/QC plans and procedures; provide review and approval of these documents; and audit their implementation.

Technical Coordinator. The Technical Coordinator will provide a single point of contact between the Subcontractor Technical Integration Manager and WAG Managers and the ORNL and Energy Systems technical divisions (e.g., Environmental Sciences, Energy, Analytical Chemistry, Chemical Technology, Engineering, etc.). The Technical Coordinator will establish and coordinate review, comment, and approval of Subcontractor deliverables (e.g., Remedial Investigation Plans and Alternatives Assessments) and the collection, review, and collation of these comments. The Technical Coordinator will also act as the official interface between Subcontractor personnel and ORNL scientific personnel relative to information requests and technical problem resolution. The Technical Coordinator will also act as the Deputy Subcontract Project Manager and will assume full responsibility for the project in the absence of the Subcontract Project Manager.

Data Base Coordinator. The Data Base Coordinator will provide a single point of contact for the Subcontractor Technical Integration Manager and Data Base Management Specialist relative to interfaces with the Remedial Action Program and other Energy Systems data bases. The Data Base Coordinator will also be responsible for the collection and dissemination of information (e.g., document collection and reproduction, literature searches, and bibliographic report preparation) needed to facilitate timely and effective Subcontractor information transfer throughout the contract period.

Regulatory Interfaces and RI/FS Strategy Coordinate. The Regulatory Interfaces and RI/FS Strategy Coordinator will establish, implement, and maintain mechanisms to facilitate timely and effective regulatory interaction and to provide overall project strategy relative to remedial action objectives, performance criteria, and regulatory actions. Regulatory interaction is required to establish overall RI/FS direction relative to the above strategies; to provide a means for the review, comment, and approval of deliverables; and to report program status (i.e., program reviews, etc.). In establishing the RI/FS strategies and regulatory interfaces, the Regulatory Interfaces and RI/FS Strategy Coordinator will work with and through Energy Systems Central Staff Office of Environmental and Safety Activities, the ORNL Environmental Compliance and Health Protection Division, and DOE.

The Energy Systems team structure, size, and composition are based on preliminary estimates of the scope of work involved. As Subcontractor interfaces are established and program plans and procedures are developed, the structure, size, composition, and responsibilities of the team may change, depending on program requirements.

6.2.4 The RI/FS Subcontractor

Bechtel National, Inc., with support from EDGe/MCI, CH2M Hill, and PEER, leads the Subcontractor Team responsible for planning and implementing assigned RI/FS activities. These include project planning, remedial investigations, alternative assessments, and preparation of an integrated feasibility study. Within BNI, the Manager of the Bechtel National, Inc. Oak Ridge Office has delegated prime responsibility for the RI/FS project to the RI/FS Program Manager. Subcontractor personnel will work as an integrated team under the direction of the RI/FS Program Manager. The organizational structure established for the RI/FS project is illustrated in Figure 6-6. Responsibilities and authorities are described below.

Program Manager. The role of the Program Manager is to direct the RI/FS program in accordance with Energy Systems requirements and to ensure that the resources are available to accomplish each phase of the work on time and with quality. The Program Manager is ultimately responsible for cost, schedule, and quality of performance. He will delegate appropriate authority to his staff, providing them with the freedom to exercise their responsibilities and use their technical expertise. However, he will review technical and programmatic activities to ensure that quality is maintained and that Energy Systems needs are satisfied. He will, in addition, make timely changes or modifications dictated by evolving program needs.

Technical Integration Manager. The Technical Integration Manager reports directly to the Program Manager and performs as Acting Program Manager in the Program Manager's absence. He is responsible for management of all project activities related to data base management and generic studies, and acts as a liaison with the analytical laboratory. He is responsible for assessing the technical quality of all project deliverables.

Field Services and Support Manager. The Field Services and Support Manager will direct field and support activities for the work on all WAGs in accordance with Energy Systems requirements. He will manage the field office and work with the ES&H Manager, the Analytical

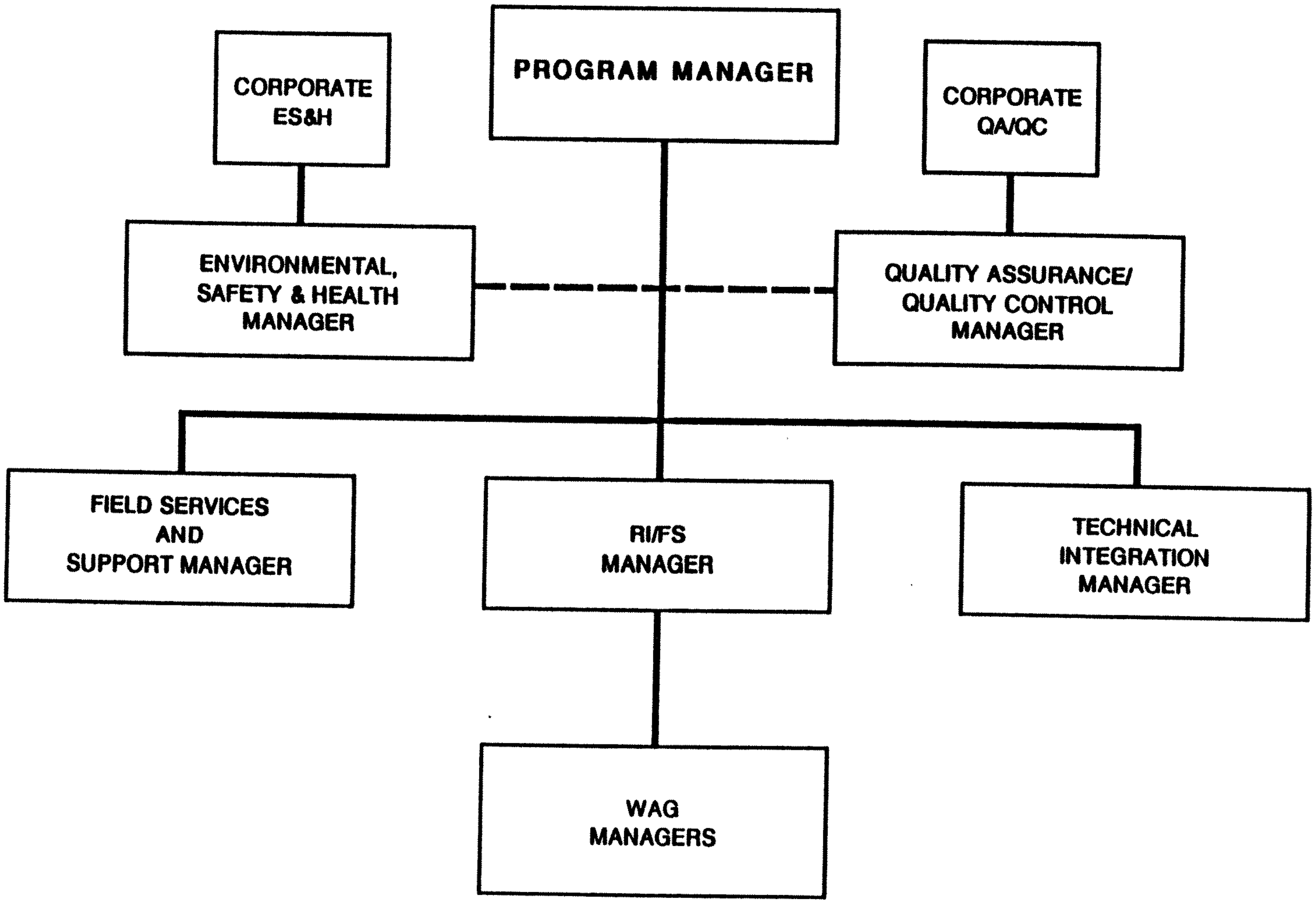

FIGURE 6-6
RI/FS SUBCONTRACTOR ORGANIZATION

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Laboratory Coordinator, the Data Base Management Coordinator, and the Geophysical Survey and Drilling Supervisor. He will be the focal point with Energy Systems regarding all field coordination activity.

Quality Assurance/Quality Control Manager. The QA/QC Manager is independent from project operations and reports directly to the President of BNI through the Manager of Quality Assurance. The QA/QC Manager directs and controls the project QA/QC program and works with the Program Manager to coordinate its application. The QA/QC Manager is responsible for development of the QA/QC Plan and monitoring its implementation. In conjunction with BNI's corporate QA staff, he will establish audit teams and ensure the proper conduct of audits at appropriate stages. He will also supervise the QC staff, which will monitor drilling crews, laboratory staff, and others to ensure that their activities are being conducted in accordance with the QA/QC Plan. His authority includes the right to stop work, if that is appropriate.

Environmental, Safety and Health Manager. As shown in Figure 6-6, the ES&H Manager reports directly to the corporate ES&H organization and is responsible for ensuring compliance with all applicable federal, state, and local environmental protection, safety, and health protection statutes; executive orders; operating orders; permits and regulations; and ORNL policy and procedures during all phases of the RI/FS project.

The ES&H Manager works with the Program Manager concerning all environmental, health, and safety aspects of the RI/FS project, including environmental protection, fire protection, occupational health monitoring, construction safety, industrial hygiene, radiation protection, and special nuclear material control.

However, the ES&H Manager is independent of the Subcontractor organization in performance of responsibilities. He has authority to immediately halt any activity believed to pose a danger to employees or the environment, and has authority to require changes in operations or designs as necessary to keep radiation exposures, hazardous substances exposures, or environmental releases ALARA.

RI/FS Manager. The RI/FS Manager is responsible for overall management of all remedial investigation and alternative assessment activities for the WAGs assigned to the Subcontractor. All WAG Managers report to the RI/FS Manager, who in turn reports to the Program Manager. During the RI and AA phases of work the RI/FS Manager will be responsible for preparation of QA Assessments of RI Plans, oversight and monitoring of the performance of WAG Managers, Review Team Leaders and Review Teams, distribution of technical guidance to WAG Managers, and approval of invoices for field services. The RI/FS Manager will manage the preparation of the Feasibility Study.

Waste Area Group (WAG) Managers. The Program Manager, through the RI/FS Manager, has delegated responsibility and authority and holds the WAG Managers accountable for budget, schedule, and quality of performance within their assigned areas. Specifically, WAG Managers are responsible for the direct management of all remedial investigation planning, field investigations, data analysis, and alternatives assessments for their assigned WAG. Each WAG Manager will be expected to interact with Energy Systems staff frequently as work progresses.

6.2.5 Document Review and Approval

All technical reports prepared for the ORNL RI/FS project will be reviewed and approved consistent with the procedures outlined herein and illustrated in Figure 6-7. For the purpose of this plan, technical reports include, but are not limited to, planning documents, Remedial Investigation Plans, Remedial Investigation Analysis Reports, Alternatives Assessments, results of generic studies, bench scale and laboratory test results, and the Feasibility Study.

BNI will prepare an annotated outline for any first-of-a-kind report and will forward it to the RI/FS Subcontract Project Manager for comment. Energy Systems comments/approval will be transmitted to BNI and a revised annotated outline will be prepared.

BNI then will prepare the draft report according to the approved outline. This process will include editorial review by the Technical Reports Group of the rough draft of the report, internal BNI review, incorporation by the Technical Reports Group of review comments, and final internal BNI review.

BNI will transmit the draft report to the Energy Systems RI/FS Subcontract Project Manager under a transmittal letter signed by the BNI Program Manager. Energy Systems will be responsible for coordinating reviews. Energy Systems comments/approval will be transmitted to BNI under signature of the Energy Systems RI/FS Subcontract Project Manager. BNI will record resolution of the comments.

A second generation draft, when necessary, will be transmitted to Energy Systems following the above procedure. After receiving final written approval on the draft report from Energy Systems, BNI will provide 25 copies and one reproducible original of the final report to the Energy Systems RI/FS Subcontract Project Manager.

6.2.6 Interfaces

Successful implementation of the ORNL RI/FS project requires close communication and coordination between DOE-HQ, EPA-Region IV, state agencies, DOE-ORO, Energy Systems, and the BNI Team.

DOE-ORO is responsible for the interface with DOE-HQ, EPA-Region IV and state agencies. DOE-ORO will arrange for appropriate review of technical documents, schedule interface meetings, and determine the attendance at such meetings.

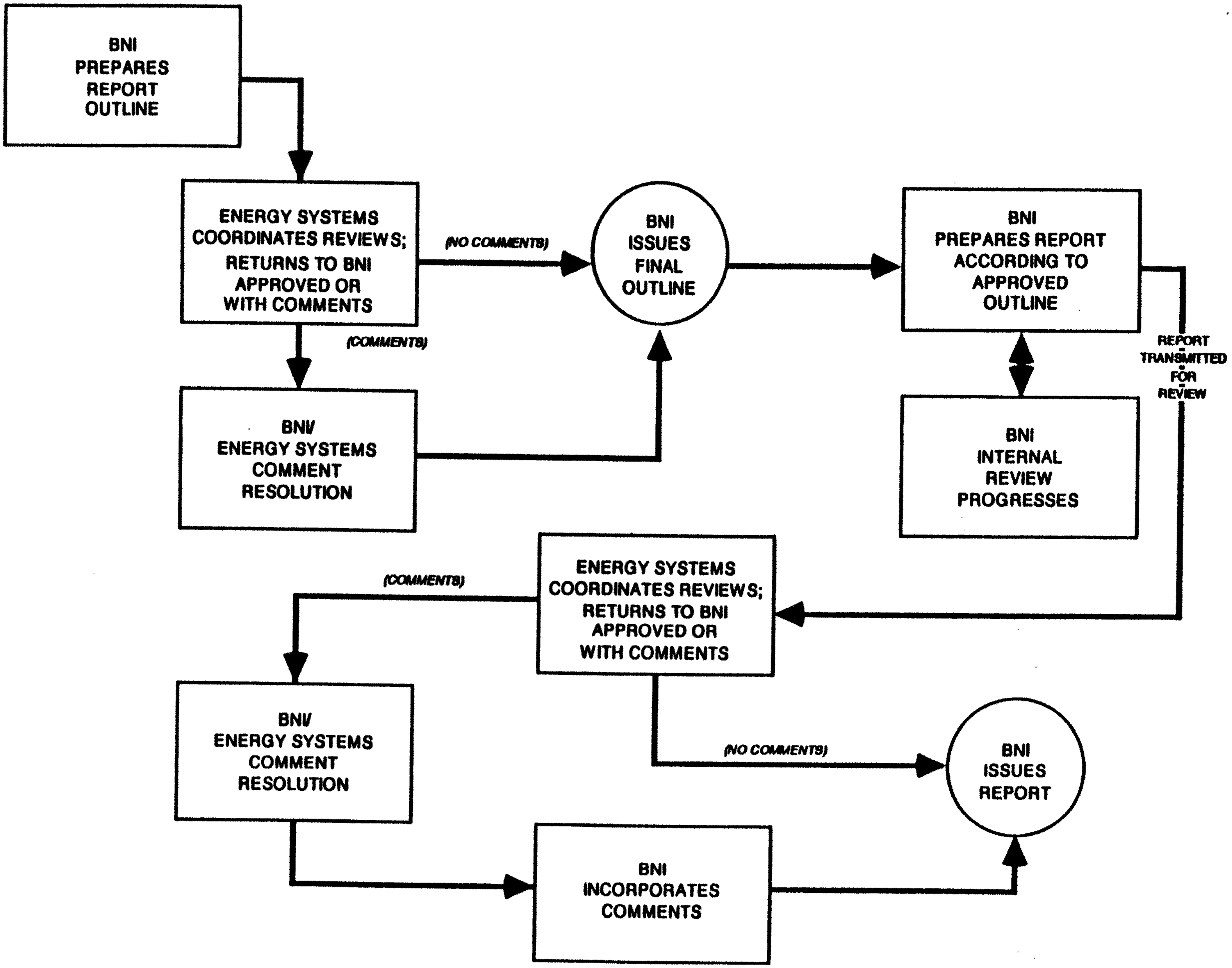

FIGURE 6-7
FLOW DIAGRAM ILLUSTRATING RI/FS DOCUMENT PREPARATION AND APPROVAL

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The Energy Systems RI/FS Subcontract Project Manager is responsible for the interface with DOE-ORO, other Energy Systems components, and BNI. Responsibilities include the review of technical documents, monitoring and reporting project progress, and conducting appropriate interface meetings.

The BNI Program Manager is responsible for the interface with the Energy Systems RI/FS Subcontract Project Manager and the BNI subcontractors. He is primarily responsible for establishing and maintaining well-defined communication channels to facilitate timely information flow between Energy Systems and BNI.

Interfaces with the public and development of appropriate public participation plans are the responsibility of DOE-ORO, with appropriate support from Energy Systems and BNI.

From time to time special interfacing arrangements may be required. Such arrangements will be documented in project procedures or letters approved by the Energy Systems RI/FS Subcontract Project Manager.

6.2.7 Key Personnel Staffing Plan

The RI/FS Baseline Schedule provides a phased approach to accomplishing the project objectives. Table 6-1 identifies key personnel for each phase of the project.

6.3 MANAGEMENT OF FIELD OPERATIONS

Field activities conducted as part of the investigations of the WAGs will be managed by the Field Services and Support Manager (FSSM). The FSSM will also be responsible for quality of data as required by the WAG Remedial Investigation Plans, the QA/QC Plan, and WAG Managers. The FSSM will coordinate field activities to be consistent with WAG schedules.

TABLE 6-1

KEY PERSONNEL STAFFING PLAN

PHASE I - PLANNING

Program Manager	J. F. Nemec
Technical Integration Manager	R. B. Barber
RI/FS Manager	M. R. Harris
ES&H Manager	W. C. Borden
QA/QC Manager	C. B. Rogers

PHASE II - REMEDIAL INVESTIGATIONS

Program Manager	J. F. Nemec
Technical Integration Manager	R. B. Barber
RI/FS Manager	M. R. Harris
Field Services and Support Manager	M. J. Levy
ES&H Manager	W. C. Borden
QA/QC Manager	C. B. Rogers
WAG 1 Manager	P. R. Bengel
WAG 2 Manager	H. J. Harris
WAG 3 Manager	M. Forth
WAG 4 Manager	TBD
WAG 5 Manager	TBD
WAG 6 Manager	B. A. Skelton
WAG 7 Manager	TBD
WAG 8 Manager	TBD
WAG 9 Manager	TBD
WAG 10 Manager	C. T. Rightmire
WAG 11 Manager	TBD
WAG 13 Manager	TBD
WAG 17 Manager	TBD
WAG XX Manager	TBD

TABLE 6-1
(continued)

PHASE III - ALTERNATIVES ASSESSMENT

Program Manager	J. F. Nemec
Technical Integration Manager	R. B. Barber
RI/FS Manager	M. R. Harris
ES&H Manager	R. D. Glenn
QA/QC Manager	C. B. Rogers
WAG 1 Manager	P. R. Bengel
WAG 2 Manager	H. J. Harris
WAG 3 Manager	M. Forth
WAG 4 Manager	TBD
WAG 5 Manager	TBD
WAG 6 Manager	B. A. Skelton
WAG 7 Manager	TBD
WAG 8 Manager	TBD
WAG 9 Manager	TBD
WAG 10 Manager	C. T. Rightmire
WAG 11 Manager	TBD
WAG 13 Manager	TBD
WAG 17 Manager	TBD
WAG XX Manager	TBD

PHASE IV - FEASIBILITY STUDY

Program Manager	J. F. Nemec
Technical Integration Manager	R. B. Barber
RI/FS Manager	M. R. Harris
QA/QC Manager	C. B. Rogers

6.3.1 Field Operations Management

The FSSM will establish a field organization comprising numerous specialty task groups. During periods of peak activity, each specialty task group will have its own coordinator.

The FSSM will participate in the development of the Remedial Investigation Plans for each of the WAGs and will be familiar with the scope of work and type of activities required. The FSSM will also help develop schedules for the various work elements. With a thorough understanding of the work required and the schedules for each WAG, the FSSM will integrate requirements for each WAG into a comprehensive planning schedule. This schedule will identify peaks and will allow long-range planning for efficient use of resources.

6.3.2 Interfaces

Before any field activities begin, the FSSM will interface with the ES&H, QA/QC, and WAG Managers to ensure that all proposed operations conform to procedures and requirements. Reviews of the proposed field investigations will be held to determine the regulatory framework under which they must be conducted.

The FSSM will ensure that field activities are conducted consistent with the WAG Manager's Remedial Investigation Plan, schedule, and project QA/QC Plan. Each work element will be directed by that task's coordinator. The task coordinators' responsibility will be to assist the FSSM in scheduling and tracking their assigned areas such as drilling, surveying, excavating, and sampling. The FSSM will ensure that the task coordinators understand the intent of the WAG Remedial Investigation Plan for each work element and that the appropriate QA/QC protocols and regulatory requirements are understood and enacted. The FSSM will interface with the Field Health and Safety Supervisor (FHSS) to develop work permits for applicable tasks.

Task coordinators will interface with the field activity teams to ensure that they understand their objectives, QA/QC procedures, and ES&H procedures. The task coordinators will provide daily updates on all field activities to the FSSM so that progress can be tracked and scheduling adjustments can be made as necessary.

The FSSM will also be responsible for coordinating field activities with the Energy Systems Field Coordinator. The FSSM will inform the Field Coordinator of the plans, timing, personnel, and equipment related to field activities so that requirements for access and excavation permits and radiation work permits, where applicable, can be met. The FSSM will also update Energy Systems on the status of ongoing and future operations on a weekly basis, or more often if needed and will assist the Energy Systems Field Coordinator in interfacing with ORNL staff for coordination of RI/FS activities with routine plant operations and emergency response needs.

Interfaces regarding waste management will be coordinated through the Energy Systems Field Coordinator. The interface is described in more detail in the Waste Management Plan. Interfaces relating to health and safety will be coordinated through the Energy Systems ES&H Coordinator. These interfaces and emergency response interfaces are described in the Environmental Safety and Health Plan.

6.3.3 Equipment and Personnel Mobilization

There are a number of work elements associated with a remedial investigation. As a typical activity, the installation of a groundwater monitoring well would require the following steps:

- o Note the location and dimensions of the well specified by the Remedial Investigation Plan
- o Identify the source and type of drill rig to be used: e.g., will the rig be coming from off-site, from an adjacent WAG, etc. Determine if this activity will need to be subcontracted

- After determining the source of equipment, identify time frame for this activity so it can be coordinated with the WAG Manager

- Field locate the well; identify and plan for ES&H and waste management procedures required; apply for any necessary excavation or radiation work permits

- After receipt of permits, survey the drilling site

- Prior to beginning the field work, identify decontamination resources and potential emergency response scenarios

- Inform the WAG Manager and Energy Systems Field Coordinator at least 24 hours in advance when the drilling will begin and the length of time it will take

- Inform the WAG Manager and Energy Systems representative of progress daily

- When the well is complete, necessary surveying activities will commence and pertinent data will be entered into the data base management system

- Coordinate waste generation with Energy Systems waste management personnel

Other types of field investigations (trenching, sampling, etc.) will involve similar steps. In all cases, strict adherence to applicable standards and regulations, ES&H requirements, and QA/QC protocols will be maintained. Specific procedures for field operations will be addressed in the individual Remedial Investigation Plans. These procedures will be developed and approved prior to initiating field operations.

6.3.4 Support Facility Requirements

In addition to the remedial investigation teams, additional support staff will be necessary, including subcontracting specialists, budgetary personnel to monitor the costs of the investigation at each of the individual WAGs, and clerical and data entry personnel. During the RI/FS project, it is anticipated that these personnel will be stationed in a field operations building.

A staging building also will be required for dry storage of various materials and equipment such as well casings, security casings, and drilling supplies. At this time, it is assumed that it will also be necessary to have a geotechnical laboratory at the site. Such a facility may require sophisticated environmental systems due to the potential contaminated nature of the soil samples. An area for preparing samples for shipping and storage will also be necessary.

6.3.5 Special Capabilities and Equipment

At this time, the BNI Team does not anticipate that it will require additional equipment from Energy Systems for performing the field operations. However, cooperation in all permitting (i.e. excavation, radiation) etc. activities will be required for the field activities to be conducted in a timely fashion.

Drilling, sampling, geophysical, aquifer testing, geotechnical laboratory, and field vehicles will be provided by the BNI Team. However, when necessary, additional equipment will be provided by subcontractors for such services as air-rotary drilling, earthmoving equipment, robotic and remote television capabilities, and analytical services. We anticipate that Energy Systems will provide the necessary containment boxes for air-rotary drilling activities. BNI may be required to develop a containment system for deep hole drilling, if needed.

7.0 PROJECT COST AND SCHEDULE CONTROL

7.1 PROJECT CONTROL

The ORNL RI/FS project control system is an integrated technical, schedule, and cost control system that defines the methods of planning, work authorization and control, and identifies responsibilities and interfaces. The basic objectives of this system are to:

- Establish a formal baseline plan within the framework of the established WBS
- Monitor and measure cost and schedule performance against the plan
- Analyze variances from the plan, forecast the impact of these variances, recommend corrective action, and modify the plan as mutually agreed upon by BNI and Energy Systems

Figure 7-1 illustrates the components of the project control system including the flow of information and the interrelationships of major components. These components include:

- Work Release Technical and Cost Proposals
- Work Authorization
- Detailed Work Release Planning
- Data Collection
- Analysis and Reports
- Corrective Action
- Reporting
- Change Control
- Plan Revision

The detailed work release component of the project controls system consists of four interrelated elements: work definition, budgeting, scheduling, and work authorization. These are described in the following subsections.

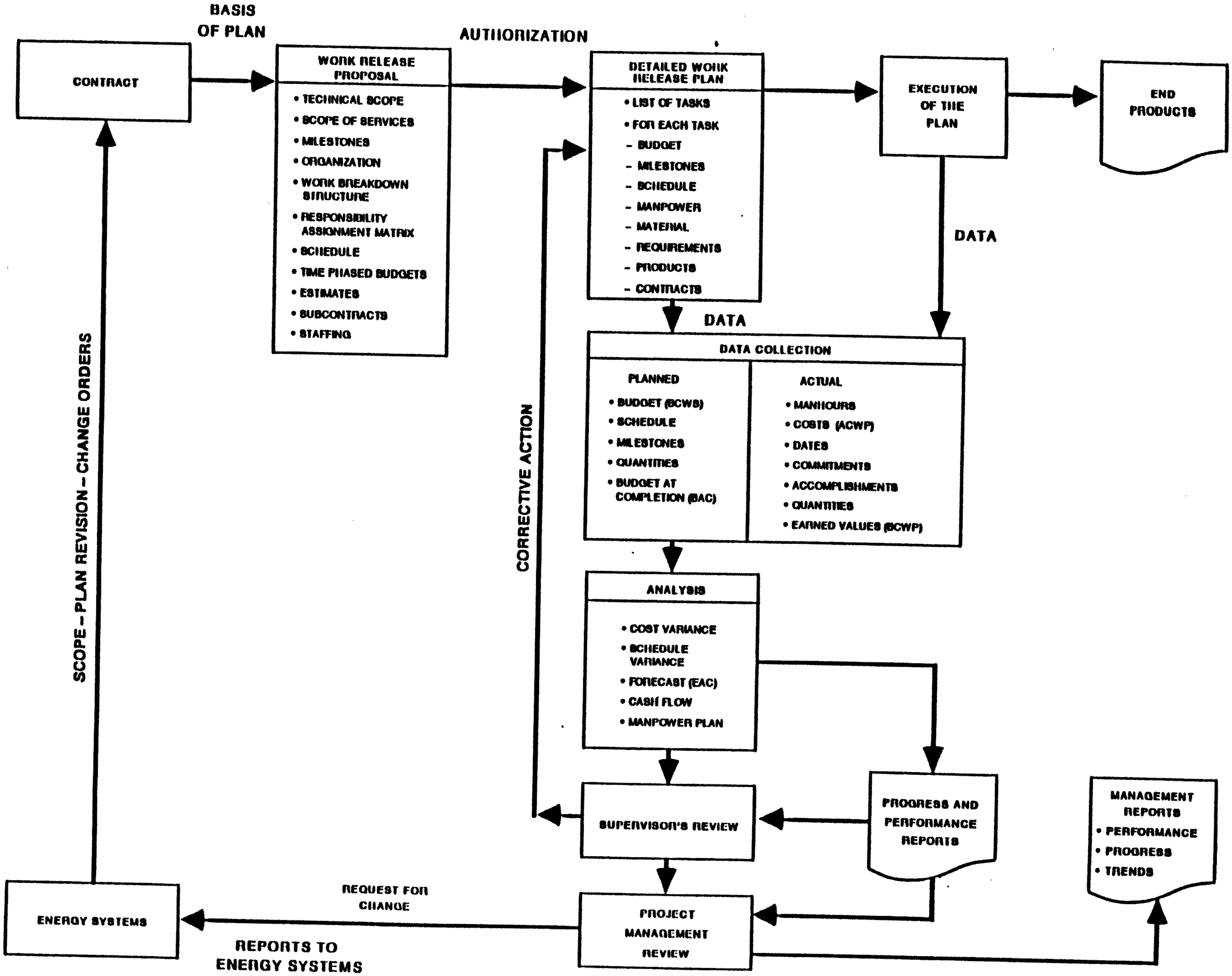

FIGURE 7-1 RI/FS PROJECT MANAGEMENT CONTROL SYSTEM

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7.1.1 Work Definition Element

The Work Definition Element translates all requirements into identifiable pieces of work to be accomplished. Documents integral to the element are: WBS, WBS Dictionary, and Responsibility Assignment Matrix (RAM).

The WBS will ensure that all work requirements within the project are assigned and tracked, that there will be no duplication of effort, and that all contract efforts are integrated and mutually supportable. The end-item-oriented WBS is a progressive subdivision of the work release requirements. The proposed subdivision is broken down to the level appropriate to plan, budget, and control the project, and provides the basis for all program planning, implementation, and measurement. It will assist in organizing, defining, and graphically displaying the deliverable end-items of the work release and relating them to the work to be accomplished. A copy of the WBS structure is shown in Figure 6-1.

A WBS Dictionary will be prepared to provide a narrative description of the work tasks to be accomplished within each WBS element. The WBS and WBS Dictionary will be reviewed regularly for completeness and updated to ensure that:

- o All work is defined and included
- o Work is structured to permit independent planning, scheduling, budgeting, estimating, and performance in a logical manner
- o Work elements can be easily related to project objectives and technical requirements

The RAM, shown in Figure 7-2, has been developed to identify the project organizations involved with specific elements of the WBS. This matrix is used to integrate and coordinate organizational groups, work descriptions, cost estimates, and schedules. The RAM will identify the individuals responsible for accomplishing specific

WORK BREAKDOWN STRUCTURE							PROGRAM MANAGER	TECH. INTEGRATION MANAGER	FIELD SVS. & SUPPORT MANAGER	RI / FS MANAGER	WAG MANAGER	QA / QC MANAGER	ES & H MANAGER
WBS LEVEL					ELEMENT I.D.	ELEMENT DESCRIPTION							
1	2	3	4	5									
X					19118	RI/FS ORNL	●						
	X				10	PROJECT PLANNING	●						
		X			101	PROJECT MANAGEMENT PLAN	●						
		X			102	ES&H PLAN							●
		X			103	QA/QC PLAN						●	
		X			104	DATA MANAGEMENT PLAN		●					
		X			105	WASTE MANAGEMENT PLAN							●
	X				20 *	WAG 1				●			
		X			201 *	RIs					●		
			X		2011 *	RI PLAN					●		
			X		2012 *	FIELD INVESTIGATION					●		
				X	20121 *	CIVIL SURVEY			●				
				X	20122 *	SAMPLE COLLECTION			●				
				X	20123 *	SAMPLE ANALYSIS			●				
			X		2013 *	LAB & BENCH-SCALE STUDIES					●		
				X	20131 *	STUDY 1					●		
			X		2014 *	RI ANALYSIS REPORT					●		
		X			202 *	ALTERNATIVES ASSESSMENT					●		
			X		2021 *	STATEMENT OF PURPOSE					●		
			X		2022 *	INITIAL SCREENING					●		
			X		2023 *	EVALUATION/RANKING					●		
	X				60	FEASIBILITY STUDY		●					
		X			601	STATEMENT OF PROBLEM				●			
		X			602	R/A SCENARIOS				●			
		X			603	FEASIBILITY STUDY REPORT				●			
	X				80	GENERIC STUDIES		●					
		X			801 *	STUDY 1		●					
	X				90	GENERAL PROJECT SUPPORT	●						
		X			901	PROJECT MANAGEMENT	●						
		X			902	PROJECT CONTROLS	●						
		X			903	PROJECT ADMINISTRATION	●						
		X			904	PROCUREMENT		●					
		X			905	PERSONNEL		●					
		X			906	TRAINING		●					
		X			907	LEGAL		●					

* THESE TASKS WILL BE DUPLICATED FOR EACH WAG OR STUDY.
EACH WILL BE ASSIGNED A UNIQUE ELEMENT IDENTIFICATION.

FIGURE 7-2
RI/FS PROJECT RESPONSIBILITY
ASSIGNMENT MATRIX

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WBS elements within the defined budgets and schedules. It will be maintained for the duration of the project and will be revised and updated as required.

7.1.2 Budgeting Element

Project budgets will be prepared at the WBS level required for effective planning and control of costs. With the WBS used as a basis, budgets will be prepared in conjunction with schedule planning for the individual project tasks. Budgets will incorporate estimates of manpower and other resource requirements and will be prepared in terms of jobhours and total labor, material, subcontract, and other costs.

7.1.3 Scheduling Element

A hierarchy of schedules will be developed for the project. This hierarchy approach, shown on Figure 7-3 provides successively greater detail for each element, from the project baseline schedule through the lower level detailed schedule. The WBS elements provide the framework for planning and scheduling activities and milestones from the highest level down through each WBS element. These schedules are used to formulate overall logic, timing, staff allocation, and material needs and will aid in the establishment of a time-phased performance baseline. In addition, both the baseline schedule and the staffing plans will be consistent with the WBS and the budgeted cost for the project.

7.1.4 Work Authorization Element

The Project Control Manager will work with the appropriate project managers to prepare their respective Work Authorization (WA). WAs will define the products and services required to accomplish WBS element work. The work will be defined in terms of the activities to be performed within a schedule and in estimated jobhours, total labor, material, subcontract, and other direct costs. Work will be

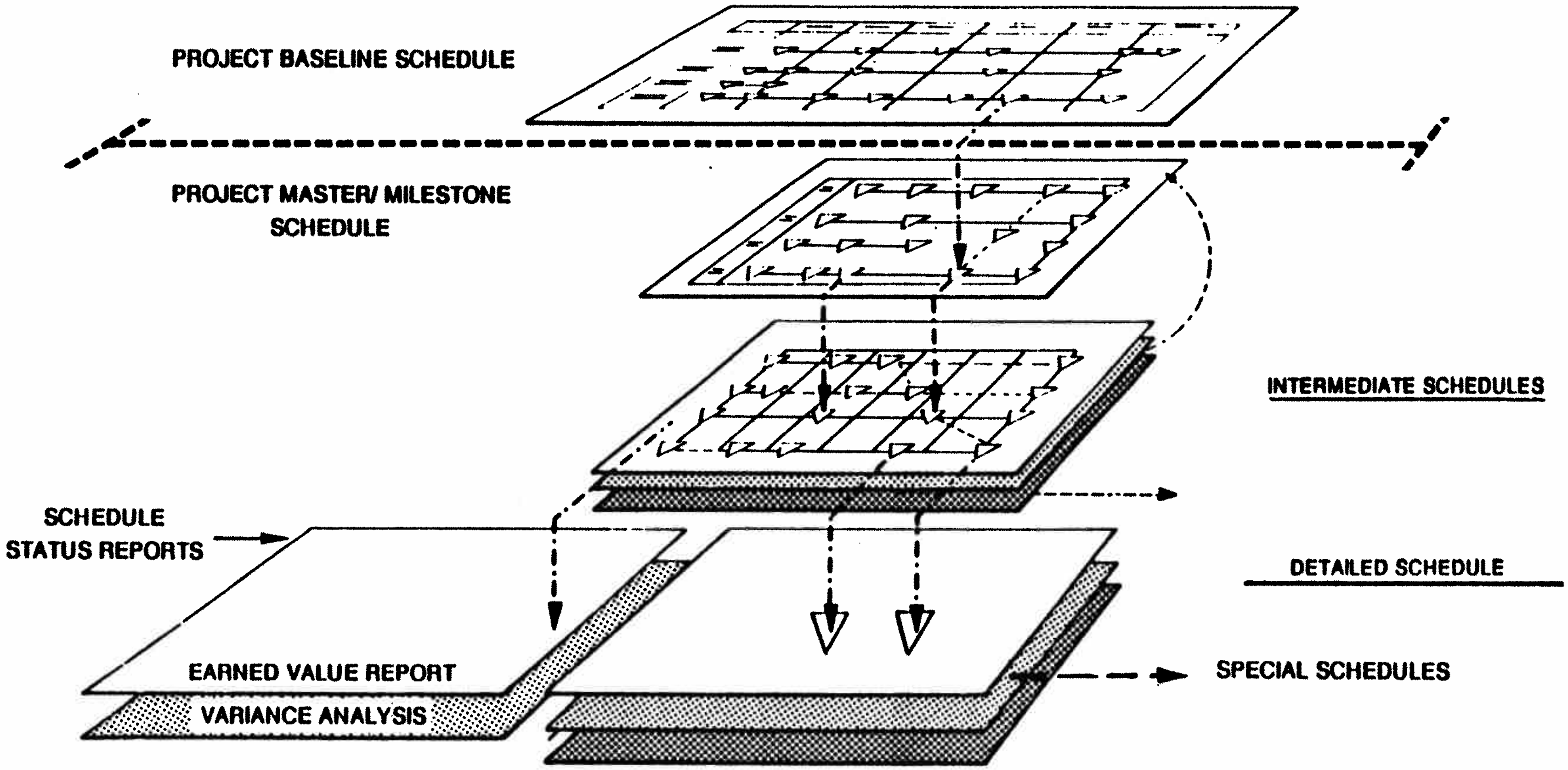

FIGURE 7 – 3
RI/FS PROJECT SCHEDULE HIERARCHY

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assigned to specific project groups. The WAs will provide the basis for planning and for monitoring performance and progress.

7.1.5 Performance Measurement

The project control system allows project management to gauge progress toward project objectives and work tasks. Work accomplishment will be assessed as objectively as possible. Budgets and schedules will be identified directly and consistently with the accomplishment of work, so that performance measurement is more than measurement of spending. The following is a list of earned value techniques to be employed, depending on the type of activity:

- Equivalent units (quantities or units performed)
- Discrete milestones
- Level-of-Effort
- Percent complete (tasks without discrete milestones)

Two types of variances will be monitored: schedule and cost. Cumulative-to-date and incremental variances will be evaluated monthly.

A schedule variance (SV) occurs when Budgeted Cost of Work Performed (BCWP) varies from the Budgeted Cost of Work Scheduled (BCWS). If BCWP is less than BCWS, less work has been done than was planned, and a behind-schedule condition or unfavorable SV exists. It will be the responsibility of the appropriate manager to analyze the SV to determine actual schedule status with regard to cost account milestones, possible impact on higher level milestones, and appropriate corrective action.

A cost variance (CV) occurs when BCWP varies from Actual Cost of Work Performed (ACWP). A negative CV (BCWP-ACWP) indicates an unfavorable cost status. A negative CV does not necessarily indicate a cost overrun; it merely indicates the potential for a cost problem.

The responsible manager will have the responsibility for performing a variance analysis. This analysis will include identifying the cause of the variance, determining its impact, and proposing corrective action. At the end of each accounting month, the Project Control Group will provide summaries of BCWS, BCWP, and ACWP for each WBS element. Cost and schedule variances will be provided for WBS elements, and if the variance exceeds established thresholds, a Variance Analysis Report (VAR) will be prepared.

7.1.6 Evaluation and Management Reporting

A project status report will be prepared monthly to provide Energy Systems with current and cumulative costs by WBS element for BCWS, BCWP, ACWP, SV, and CV. The status report will provide variance analysis when variances exceed thresholds, and will also provide a summary of authorized work in progress.

7.2 BASELINE ESTABLISHMENT

An important ingredient in the project control measurement system is the establishment of a meaningful baseline that can be used to measure accomplishments during the performance of the work. The measurement baseline results from integrating the scope of work, schedule, and budget with each other through an iterative planning process. Initially the detailed work release component will establish the boundaries within which the work is to be accomplished by providing a statement of work, schedule targets, and cost targets. To effectively measure performance, these targets will be established within the framework of the WBS.

7.3 TREND PROGRAM

The Trend Program is a system that provides management with the earliest possible warning of possible changes in scope, cost, or schedule. Any potential change in the scope of work or plan of execution that impacts the cost or schedule as originally specified will be identified as a trend. The purpose of the trend program is to inform management of pending decisions and their related impacts prior to implementation. Generally, these evaluations are on an order-of-magnitude level. This level of accuracy is appropriate because the timeliness of identifying and resolving trends is the key to a successful program.

The Project Control Manager will hold regularly scheduled trend meetings that will be attended by key project personnel. Immediately after these reviews, a trend report will be issued.

Major benefits of the trend program are:

- Cost versus necessity evaluations of potential scope changes
- Early warning for corrective action
- Control of project expenditures
- Stimulation of continuing cost consciousness
- Less probability of late cost or schedule surprises
- Improved project communications
- Evaluation of job problems in brief format for managers

8.0 INFORMATION AND REPORTING

8.1 PROJECT REPORTING SYSTEM

Effective management of the RI/FS project requires a formal system for the exchange of information between project participants and documentation of cost, schedule, and technical progress. To fulfill this need, a project reporting system has been developed that includes a monthly progress report, weekly project coordination meetings, and project review meetings.

8.2 MONTHLY PROGRESS REPORTS

The ORNL RI/FS Monthly Progress Report is a key element in the project reporting system. This report is prepared by the RI/FS Subcontractor for distribution to the Energy Systems Subcontract Project Manager and lower tier subcontractors. It includes:

- An overview of accomplishments and summary cost information
- A description of accomplishments, plans, problems, and corrective actions for each activity element of the WBS
- A discussion of major environmental, safety and health concerns or issues
- A discussion and graphic representation of the current project schedule, including an analysis of any variances from plans
- Planned and actual status of cost, including variance analysis as required

The monthly progress report must be submitted to Energy Systems by the third working day preceding the last working day of the report month. Consequently, the report includes a projection of activities and an estimate of costs through the month's end. Actual progress and costs will be updated as required in the subsequent monthly progress report.

8.3 PROJECT REVIEWS AND MEETINGS

To facilitate effective and timely exchange of information between the project participants, coordination meetings and review meetings will be held. Weekly coordination meetings are held to exchange general information, review and identify action items, report project status, and exchange technical information. Minutes for each coordination meeting are prepared by Energy Systems.

It is anticipated that other review meetings will be held periodically to discuss specific topics or general project progress. These meetings, which will be scheduled on an as-needed basis, include technical review meetings, change control meetings and project reviews. In all cases minutes will be prepared to record the topics discussed, conclusions, and action items.

8.4 DELIVERABLES

Table 8-1 provides a listing of technical documents to be prepared during the project. The table assumes there will be 13 WAGs. Table 8-2 provides a breakdown of technical deliverables by project phase.

TABLE 8-1

RI/FS DELIVERABLES

Document	Schedule	No. of Copies
Draft Project Management Plan	90 days ASA[1]	25
Final Project Management Plan	30 days ACC[2]	25 + 1 RO[3]
Draft Health and Safety Plan	120 days ASA	25
Final Health and Safety Plan	30 days ACC	25 + 1 RO
Draft QA/QC Plan	120 days ASA	25
Final QA/QC Plan	30 days ACC	25 + 1 RO
Draft Data Base Management Plan	120 days ASA	25
Final Data Base Management Plan	30 days ACC	25 + 1 RO
Draft Waste Management Plan	120 days ASA	25
Final Waste Management Plan	30 days ACC	25 + 1 RO
Preliminary Draft Remedial Investigation Plan for WAG 2	120 days ARWA[4]	25
Preliminary Draft Remedial Investigation Plan for Other WAGs	75 days ARWA (may be longer or shorter depending on complexity of WAG)	25
Draft Remedial Investigation Plan for Each WAG	30 days ACC	25
Final Remedial Investigation Plan for Each WAG	30 days ARRC[5]	25 + 1 RO
Draft Remedial Investigation Analysis for Each WAG	30 days after RI Completion	25
Final Remedial Investigation Analysis for Each WAG	30 days ACC	25 + 1 RO

1 ASA - After Subcontract Award
2 ACC - After Company Comments
3 RO - Reproducible Original
4 ARWA - After Receipt of Work Authorization
5 ARRC - After Receipt of Regulatory Comments

TABLE 8-1
(Continued)

Document	Schedule	No. of Copies
Work Plans for Laboratory and Bench Scale Studies	Prior to Performance	10
Draft Statement of Purpose for Each WAG	30 days ARWA	25
Final Statement of Purpose for Each WAG	30 days ACC	25 + 1 RO
Draft Initial Screening of Alternatives for Each WAG	75 days ARWA	25
Final Initial Screening of Alternatives for Each WAG	30 days ACC	25 + 1 RO
Draft Evaluation and Ranking of Alternatives for Each WAG	150 days ARWA	25
Final Evaluation and Ranking of Alternatives for Each WAG	30 days ACC	25 + 1 RO
Draft Statement of Problem	45 days ARWA	25
Final Statement of Problem	15 days ACC	25 + 1 RO
Draft Remedial Action Scenarios	90 days ARWA	25
Final Remedial Action Scenarios	30 days ACC	25 + 1 RO
Preliminary Draft Feasibility Study	180 days ARWA	25
Draft Feasibility Study	60 days ACC	25 + 1 RO
Final Feasibility Study	60 days ARRC	25 + 1 RO

1 ASA - After Subcontract Award
2 ACC - After Company Comments
3 RO - Reproducible Original
4 ARWA - After Receipt of Work Authorization
5 ARRC - After Receipt of Regulatory Comments

TABLE 8-2

BREAKDOWN OF DELIVERABLES BY PROJECT PHASE*

	Documents Draft	Final
Phase I - Planning	5	5
Phase II - Remedial Investigations**	39	26
Phase II - Alternatives Assessment	39	26
Phase IV - Feasibility Study	4	3
	87	60

Total Drafts and Finals: 147

* Assumes 13 WAGS
**Assumes no lab and bench-scale studies or generic studies

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