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MARTIN MARIETTA

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DESIGN CRITERIA

FOR

UPGRADED STEAM DISTRIBUTION SYSTEM, WEST END

OAK RIDGE NATIONAL LABORATORY

PROJECT NUMBER 92-ORNL-KG01-1

Prepared by

MARTIN MARIETTA ENERGY SYSTEMS, INC.

September 9, 1991

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

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DESIGN CRITERIA

FOR

UPGRADED STEAM DISTRIBUTION SYSTEM, WEST END

Prepared by

MARTIN MARIETTA ENERGY SYSTEMS, INC.

OAK RIDGE NATIONAL LABORATORY

OAK RIDGE, TENNESSEE 37831

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Prepared for the U.S. Department of Energy
Under U.S. Government Contract DE-AC05-84OR-21400

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1.0 INTRODUCTION

This document contains the design criteria to be used by the architect-engineer (A-E) in the performance of Titles I and II design for the construction of piping systems to replace deteriorated underground steam and compressed air piping as well as to add a condensate return system at the Oak Ridge National Laboratory, Oak Ridge, Tennessee.

2.0 GENERAL DESCRIPTION AND REQUIREMENTS

2.1 Facilities Description

This project will replace deteriorated portions of the Oak Ridge National Laboratory (ORNL) steam distribution system (predominately in the western portion of ORNL), provide looping and isolation valves to improve system reliability and maintainability, and provide for condensate return from 10 buildings to the steam plant. Concurrently, deteriorated air lines paralleling the steam distribution system will be replaced.

Figure 2-1 shows the proposed routing of the upgraded steam distribution system. Existing deteriorated aboveground steam insulation and jacketing will be replaced with new insulation and jacketing. All steam loads provided by existing steam lines to be abandoned will be connected to the new steam line.

Figure 2-2 shows the proposed routing of the upgraded compressed air distribution system. All compressed air loads, provided by existing compressed air lines to be abandoned, will be connected to the new compressed air lines.

The route of the new steam condensate return system is shown on Figure 2-3.

2.2 Methods of Accomplishment and Responsibilities

2.2.1 Department of Energy

The Department of Energy (DOE) will furnish overall project management, administer all prime contracts, and direct and administer all aspects of the project, including specific approval of work assignments.

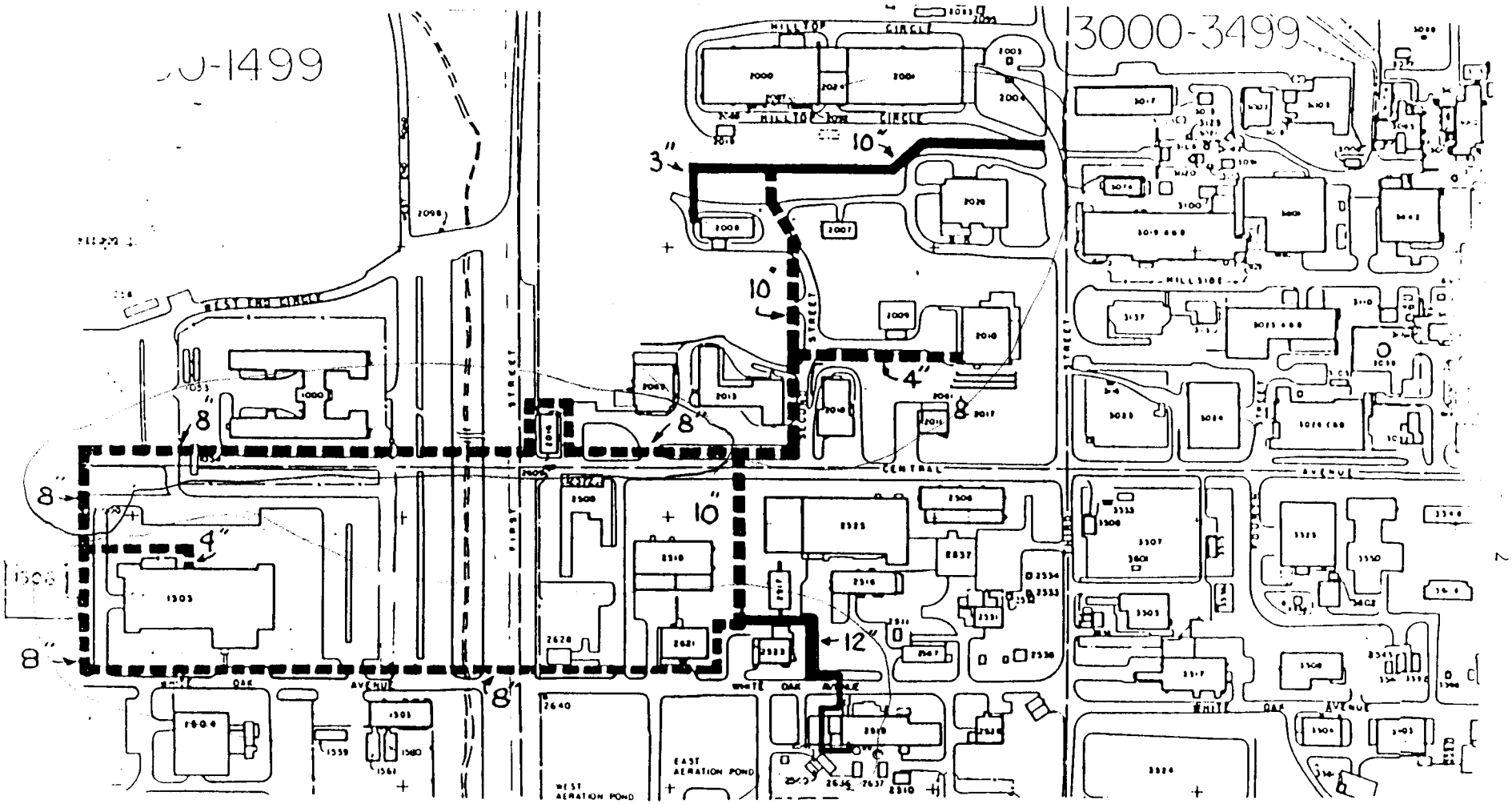
2.2.2 Martin Marietta Energy Systems, Inc.

Martin Marietta Energy Systems, Inc., will prepare design criteria, review and furnish comments to DOE on all Titles I and II engineering documents prepared by the A-E, and provide Title III engineering and inspection services.

Energy Systems will perform work associated with tie-ins, testing, pre-operational check-out of the new facilities, and miscellaneous field services as needed.

2.2.3 Architect-Engineer (A-E)

The A-E will perform Titles I and II engineering, including design drawings, specifications, bills of materials, data sheets, and detailed cost estimates.



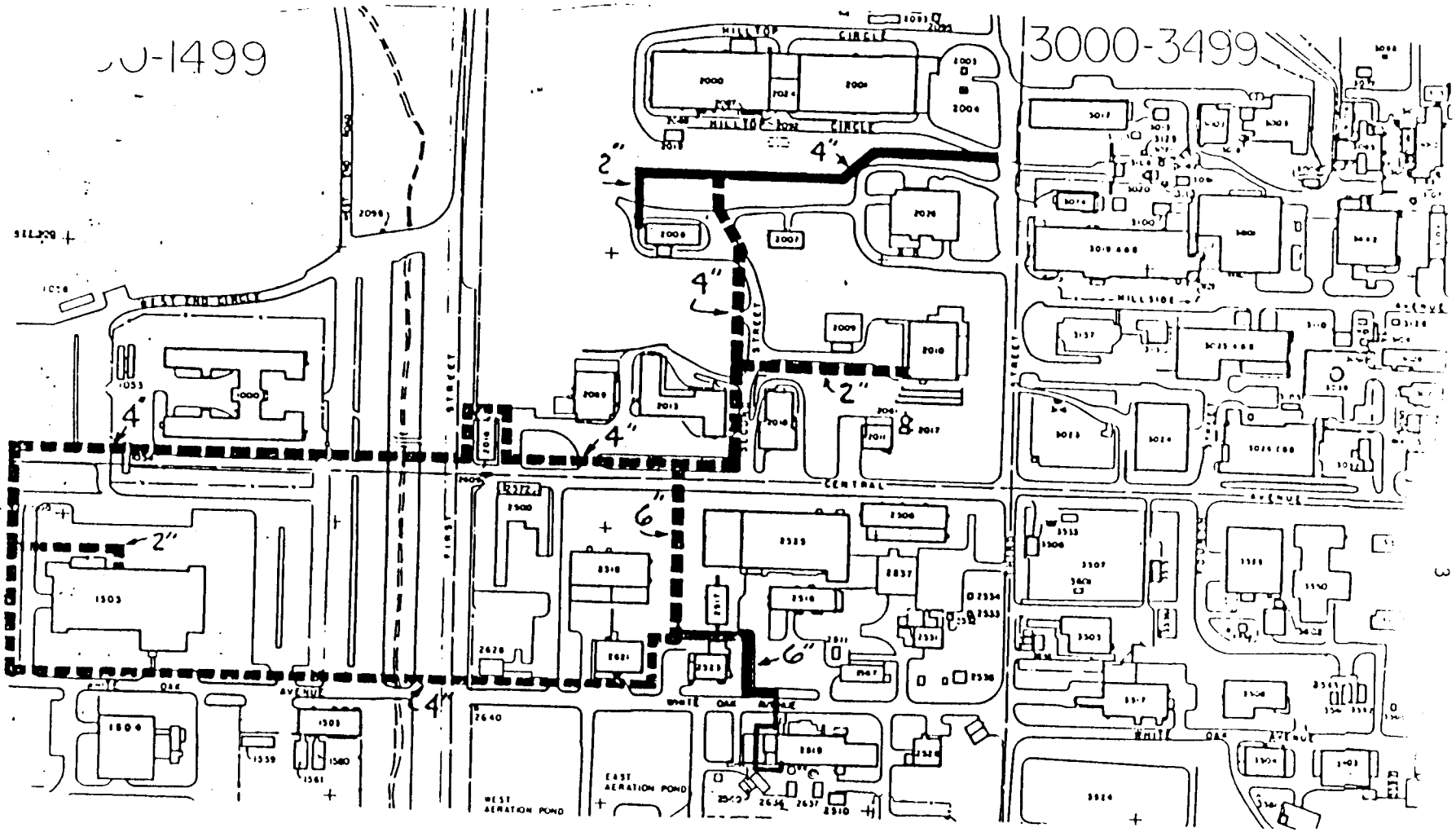
STEAM

125 PSIG, 370°F

EXISTING — ABOVEGROUND — NEW

UNDERGROUND

Figure 2-1
Scale: 1" = 286'



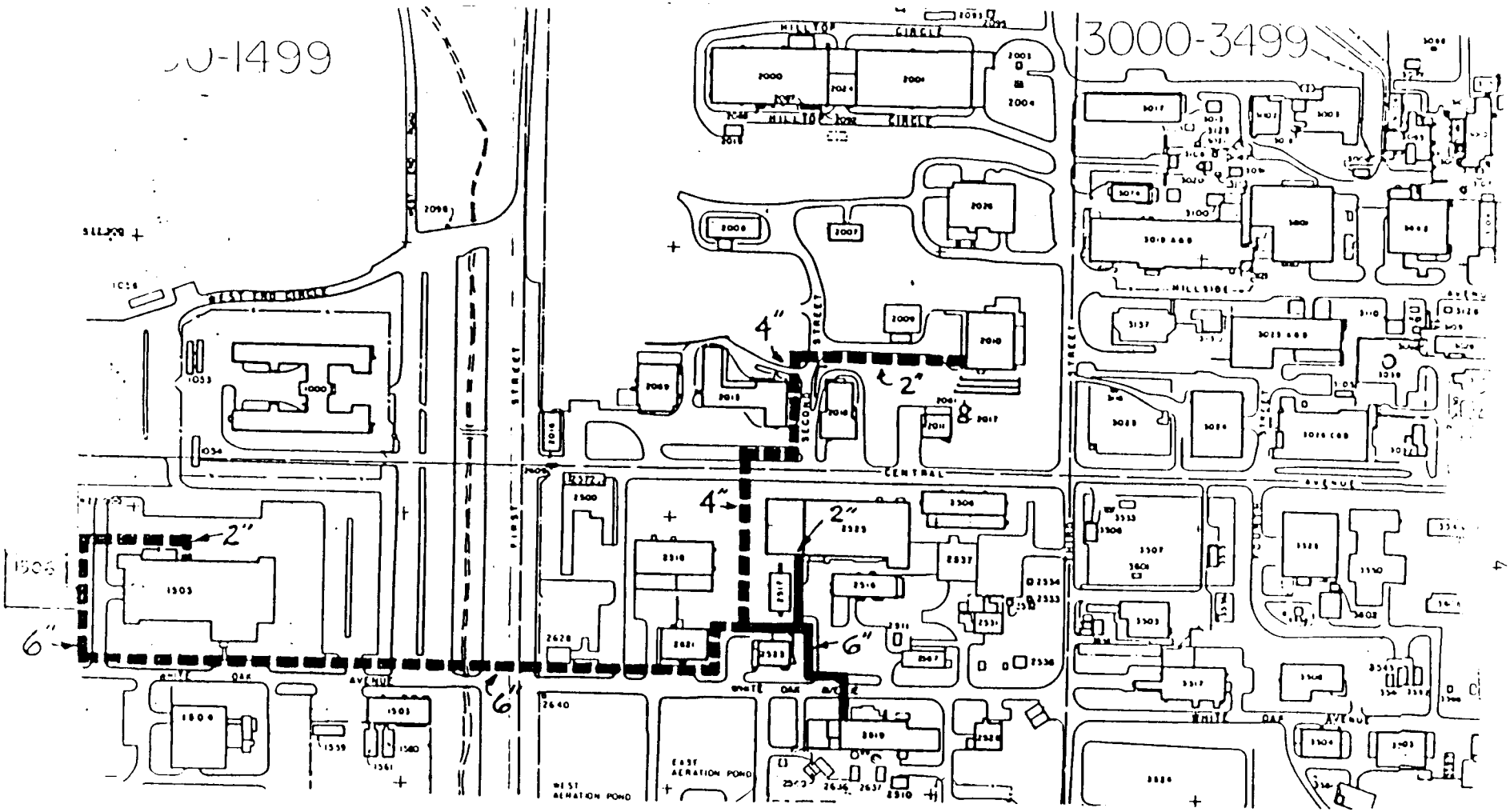
COMPRESSED AIR

100 PSIG

EXISTING: ABOVEGROUND / UNDERGROUND

NEW

Figure 2-2
Scale: 1" = 286'



CONDENSATE RETURN

EXISTING ABOVEGROUND
UNDERGROUND

NEW

Figure 2-3
Scale: 1" = 286'

Design analysis and calculations shall be prepared by the A-E in accordance with Engineering Procedure EP-C-20 and Engineering Standard ES-0.7.

The A-E shall prepare a proposed list of drawings and of design analysis and calculations for review and approval.

The A-E shall be responsible for making any additional field checks or measurements necessary to perform the design.

All documents transmitted to the A-E for reference information only shall be returned at the completion of the A-E design work. Where applicable, reference drawings may be referred to on the new A-E drawings. All reference drawings must be included in the construction packages.

The existing reference drawings do not necessarily reflect "as-built" conditions; therefore, it will be the responsibility of the A-E to determine the actual field conditions for adjacent streets, security barriers or boundaries, buildings, utilities, or for any other facilities or services to be affected by this project.

2.2.4 MK-Ferguson of Oak Ridge Company

The MK-Ferguson of Oak Ridge Company, the Construction Manager, will furnish all material and labor required for construction. It is anticipated that this will be accomplished by a fixed-price subcontractor to the Construction Manager.

2.3 General Codes, Standards, and Specifications

The applicable portions of the latest revision of the following codes, standards, and specifications shall govern the work on this project. In the event of discrepancies between this criteria document and the codes, standards, or specifications, this document will govern.

DOE Order 5480.1A, "Environmental Protection, Safety, and Health Protection Program for DOE Operations "
DOE Order 6430.1, "General Design Criteria"
American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete
American Institute of Steel Construction - Specification for the Design, Fabrication, and Erection of Structural Steel for Building
American Iron and Steel Institute, Inc. Standards
American National Standards Institute (ANSI) Standards
American Society of Heating, Refrigeration, and Air Conditioning Engineering (ASHRAE) Handbook
American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sect. VII, Div. 1 and Publication Fluid Meters, 6th Edition
American Society for Testing and Materials Standards
American Water Works Association Standards
American Welding Society Standards
Electronic - Industries Association Standards
Energy Systems Engineering Standards

Energy Systems "General Design Criteria," Y/EF-538/R5
Energy Systems Technical Specifications
Energy Systems Welding Specifications
Environmental Protection Agency Standards and Regulations
Institute of Electrical and Electronic Engineers Standards
Instrument Society of America Standards
Insulated Cable Engineers Association
Insulated Power Cable Engineers Association Standards
National Electrical Code (ANSI C1)
National Electrical Manufacturers' Association Standards
National Fire Protection Association (NFPA), National Fire Codes
National Standard Plumbing Code
Occupational Safety and Health Act Regulations
Standard Building Code (SBC)
Underwriters' Laboratories, Inc. (UL) Building Material List
Uniform Building Code (UBC) (Seismic Only)
ORNL Environmental Protection Procedure EPM-1.0, "Asbestos"
ORNL Industrial Hygiene Manual, Procedure 1.10, "Operations Involving Handling of Asbestos and Asbestos-Containing Materials"
USDA, Erosion and Sediment Control Handbook for Urban Areas and Construction Sites in Tennessee, 1974
U.S. Department of Transportation (DOE), Best Management Practices for Erosion and Sediment Control, December 1978
U.S. Environmental Protection (EPA), Guidelines for Erosion and Sediment Control Planning and Implementation, EPA-R2-72-015, August 1972

Martin Marietta Energy Systems, Inc., Engineering Standards and Engineering Technical Specifications are referred to in this document and will be provided to the A-E for reference and to indicate required quality in the design documents. The A-E may incorporate specific standards and/or technical specifications which provide for equal quality.

2.4 Principal Safety, Fire, and Health Hazards

No unusual, special requirements have been identified for this project. Both the design and materials of construction have been proven at other sites. As with any construction project at ORNL, several concerns will be addressed throughout the project.

Construction of the project, however, will require the removal of existing steam line insulation containing asbestos. Removal and disposal of this material will be accomplished in accordance with ORNL procedures. While no construction is anticipated in an area of radioactive contamination, suitable surveillance will be provided by ORNL staff members to assure the safety of the construction workers, the public, and the environment. Construction of shallow trenches beneath security fences will require planning and temporary security measures, but this is not unusual.

Engineering Procedure EP-D-06, "Construction Excavation/Penetration Permit" and "Supplement to Engineering Procedure EP-D-06, Guideline for Issuance of Excavation Permits for Well Drilling at ORNL" provides guidance for this type of activity.

A Risk Assessment/Plan has been completed for this project. Action items include emphasis on control of materials and welding inspection.

No fissile material involved in this project, and no further safety documentation is required.

2.5 Environmental Impact

An Action Description Memorandum (AD) has been written for this project and has been transmitted to DOE. The AD concludes that no significant environmental impact is anticipated as a result of the project. The AD does require that a number of actions be taken to protect the environment during construction. A copy of the AD will be provided to the architect-engineer.

2.6 Quality Assurance

The QA program shall be a NQA-1 based program and shall be responsive to DOE-ORO Order 5700.6B, Quality Assurance, Energy Systems Policy Procedure GP-5, Quality Assurance Program, Energy Systems Standard ESS 2.0, Quality Assurance Program, and Energy Systems Engineering Procedure EP-E-04, Engineering Quality Assurance Program.

Control mechanisms shall be established to ensure that design inputs are correctly translated into design documents in a timely manner; organizational and physical interfaces are identified and controlled; changes to design are controlled in a manner commensurate with the original design; the design is independently verified to be adequate; and documentation and records of the design and design verification processes are maintained in accordance with the QA program.

QA encompasses all those planned and systematic actions and controls necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. QA includes quality control, which includes actions needed to ensure that the physical characteristics of a material, structure, component, or system meet predetermined requirements.

An adequate QA program provides the following assurances:

- Organization interfaces are identified and controlled;
- The design is independently verified to be adequate;
- A document control system is in place, and
- A change control system is in place.

The QA program shall include quality control functions in the following areas:

- The design shall satisfy program and project requirements;
- The prepared drawings and construction specifications adequately incorporate QA, design, and codes and standards required and are available in a timely manner;

- Construction can be performed in accordance with design;
- Tests, reviews, or inspections confirm that adequacy of design and quality of construction and manufactured components, where appropriate; and
- Lock and tag systems are provided for turnover acceptance, maintenance, and system outages.

As a part of the QA program, architectural and engineering portions of design should be closely coordinated and functionally analyzed during the conceptual, preliminary (Title 1), and detailed (Title II) design phases to avoid conflicts that could result in costly changes during construction. Prior to initiating Title I and Title II design, QA requirements shall be established for the project systems, subsystems, and components. The following shall be determined:

- What the facility is to accomplish;
- The range of operating conditions;
- The required degree of reliability;
- The intended useful life; and
- How it can be maintained, repaired, or replaced.

Wherever possible, design shall reflect experience gained on similar projects or similar types of construction.

Provisions shall be made for review and checking design calculations, drawings, and construction specifications by qualified personnel other than those responsible for the original design.

Deviations from specified standards shall be identified and procedures established to ensure their control.

To the extent practicable, and particularly in the case of innovative design, the design should be independently reviewed by competent consultants in construction or manufacturing techniques to confirm the practicability of construction or manufacture.

A Quality Assurance Evaluation (QAE) has been prepared for the project. A Quality Category III has been assigned to the project. As a result, standard engineering practices and procedures are adequate for the control of quality-related activities.

2.7 As-Built Drawings

The contract documents shall require that the subcontractor maintain a set of "red marked" drawings at the consturction site. These drawings shall be maintained by the subcontractor to show all "as built" conditions as well as the location of all underground utilities, etc., located during construction. At the completion of construction, these drawings shall be turned over to the Construction Manager.

Energy Systems will transfer all "as built" information to the appropriate Area Atlas drawings. Project drawings will be marked to refer to Area Atlas drawings for "as built" information.

2.8 Integrated Test Plans

Integrated Test Plans are not required as component and system testing, to be specified by the A-E will be adequate. Energy Systems will provide requirements for welding and welding inspection.

2.9 Reliability, Availability, and Maintainability

This project will increase the reliability of 125 psi steam distribution system by replacing the existing deteriorated system which is nearing the end of its expected service life. The use of shallow trench rather than direct buried conduit-encased pipe will provide a system of inherently improved reliability availability, and maintainability. In addition, the careful selection and testing of components such as valves and steam traps will further assure performance. A project-specific RAM analysis is not required.

2.10 Risk Assessment

A Risk Assessment/Plan has been written for this project. The major risk identified is that of excavation within the boundaries of ORNL. While the route of the shallow trenches has been carefully selected to avoid areas of potential contamination, the risk of encountering radioactive or other hazardous contamination is not zero. Both Health Physics and Industrial Hygiene protection will be provided as required.

Another risk identified is that of damaging existing underground services. The design drawings will locate all know existing services, these will be located in the field, and hand excavation will be required within several feet.

No other unusual risks were identified.

3.0 LAND IMPROVEMENTS

3.1 General

The existing west end steam distribution system consists of both above ground and underground steam pipe. Improvements will consist of replacing the existing underground pipe with new pipe in shallow concrete trenches. Existing above ground steam piping and insulation will be replaced. New valve pits will also be provided.

Existing compressed air lines that parallel underground steam lines to be abandoned will be replaced. These new compressed air lines will be routed in the new shallow trenches with the new steam lines.

Condensate return lines will be installed in the new shallow trenches with the steam and compressed air lines and will be provided with insulation.

The design drawings shall show all obstructions above and below ground and identify all communications conduits and other non-reroutable utilities, and will identify all existing utilities that are hazardous to personnel and/or to the environment.

The design drawings which show routings shall consist of plan and profile shown on the same sheet. The plan shall be at a scale of at least 1"=20'. The profile shall have a horizontal scale equal to the plan scale and the vertical scale at least twice that of the horizontal scale. These plan and profile drawings shall use standard civil engineering stationing methods. Plant coordinates shall be used to define new locations and routes. All existing and known underground utilities shall be shown and labeled with line size and text.

Strip topography shall be included on the plans for a distance of 50 feet on each side of the new route. If the plans are too crowded, include the topography on separate drawings. The scale shall be the same as that used on the plan and profile sheets. The contour interval shall be 1 foot, and all cultural features must be shown.

There shall be an adequate number of cross-sections taken along the route to define details at connections, etc. All sections and other needed details shall be included on one or more detail sheets as needed.

3.2 Dewatering

The design, installation, and operation of dewatering systems for groundwater control shall be the responsibility of the construction contractor, unless stipulated otherwise in the contract. A groundwater investigation and the selection and design of a dewatering control system shall comply with TM 5-818-5. The design engineer shall determine if the assistance of a qualified groundwater hydrologist shall be needed.

3.3 Shoring and Underpinning

All shoring and underpinning shall comply with the safety requirements of 29 CFR 1926, Subpart P.

Tiebacks analysis of plastic yielding in strutted excavations, analysis of the stability of the bottom of excavations, and shoring for deep excavations shall comply with SSFI SH 300.

Remedial underpinning shall be performed where existing foundations are inadequate. Precautionary underpinning shall be performed where new construction adjacent to an existing structure requires deeper excavation.

The services of a structural engineer specializing in underpinning shall be used to perform any underpinning design, which shall comply with the principles in Winterkorn and Fang, Foundation Engineering Handbook.

3.4 Earthwork, Grading, Erosion, and Sediment Control

Earthwork to include trenching and backfilling, grading, excavation, and disposal of excavated material will be required for the installation of the new reinforced concrete trenches and its associated piping,

new reinforced concrete valve boxes and new above ground pipe supports. Earthwork shall be in accordance with Energy Systems Technical Specification CV-1.2, "Earthwork for Roads and Streets," and CV-1.3, Earthwork - General Section."

The Contractor shall provide erosion and sediment control to minimize erosion and the transport of sediment into storm sewers or beyond the limits of the Contractor's work area. Methods of control may include geotextile filter fabric silt fences, straw bale barriers, sediment traps, check dams, or other control structures as approved by the Construction Manager. The erosion control plan shall be detailed on the drawings and the material and requirements included in the specifications. Design of erosion control methods shall be in accordance with the U.S. Department of Transportation Best Management Practices for Erosion and Sediment Control, dated December 1978; USDA Erosion and Sediment Control Handbook for Urban Areas and Construction Sites in Tennessee, 1974; U.S. EPA Guidelines for Erosion and Sediment Control Planning and Implementation, EPA-R3-015, August 1972, or other guidelines as approved by the Construction Manager. Erosion control measures shall be maintained during the life of the project. Maintenance shall be performed after each rainfall event as a minimum.

3.5 Paving Repair

Materials and requirements for paving repair shall be in accordance with Energy Systems Technical Specifications CV-2.1, "Stabilized Aggregate Base Course," and CV-2.3, "Hot Asphaltic Concrete Pavement."

Road closings shall be minimized as much as possible. Maximum closing time shall be included in the specifications. Curing time shall be taken into account for the street crossings. Street crossings and pedestrian right-of-ways shall be provided.

4.0 BUILDINGS

4.1 Demolition

The buildings to be connected to the condensate return system are the following:

1503	1506	2518	2621
1504	2010	2523	
1505	2013	2525	

Existing steam condensate trapping stations shall be removed prior to replacement. Do not remove existing condensate vent piping that has flashed steam and air flowing through it.

Insofar as practical, existing equipment and piping should remain in service during the installation and testing of the new system. The removal of piping, traps, strainers, valves, etc., from air heating coils shall be scheduled for the summer months. New design shall provide for a minimum downtime during the tie-ins to the new system.

4.2 Structural and Architectural

Concrete supports shall be provided for the condensate return units.

No supports shall be attached to existing structures without first ensuring the adequacy of the structure to safely support the added load and with Energy Systems approval.

Piping and electrical conduit penetration of fire zone floors and partitions shall be consistent with Engineering Standard ES-4.11-6.

Vent and stack flashing shall be consistent with Engineering Standard ES-7.4-13.

4.3 Piping

The new condensate return units and piping shall be designed with an allowance of 25 percent for additional steam usage. The new condensate return units shall be duplex-type with controls and alternator, or steam-pressure operated pumps. The new condensate system shall be designed consistent with Engineering Standard ES-4.16-5 (except that banks of heating coils served by a temperature control valve shall be connected to individual float and thermostatic (F&T) trap). All steam coils are to be trapped consistent with Engineering Standard ES-4.16-3 and ES-4.16-4.

The piping shall be consistent with Technical Specification P-1.1, Subsection 101 (except that screwed joints shall be minimized and constructed with Schedule 80 pipe). All new condensate piping shall be insulated consistent with Technical Specification P-2.1, Subsection 2.

4.4 Electrical

Electrical power of 480V, 3-phase, 60 hertz power shall be furnished from the nearest power panel with spare capacity to the new condensate return pumps. Electrical power of 120V, single-phase power to operate the local high-level alarm light shall be furnished from the nearest lighting panel. The pump controls shall be duplex motor controllers with 120V control circuit, hand-off-automatic selector switches and pilot lights mounted in the controller covers to allow manual control of the pumps.

A local alarm shall be provided for high condensate level.

5.0 OTHER STRUCTURES

None

6.0 SPECIAL FACILITIES

None

7.0 OUTSIDE UTILITIES

7.1 Demolition

The old underground steam distribution system piping and underground compressed air piping will be demolished and removed where it interferes with the new construction. All old underground pipe which is abandoned will have the ends sealed and will be abandoned in place. Existing concrete manholes will be demolished to the extent required to be adapted to the new construction. Existing underground utilities that interfere with the new construction will be demolished to the extent required to be rerouted to allow for the new construction.

Site layout drawings will show location and extent of demolition of pavements, curb and gutters, walks, structures, and such. Edges at limits of demolition area will be cut such that a smooth straight joint results when repair is completed. Cut edges and items damaged during construction shall be cut back to a neat line prior to repair.

Earthwork shall be in accordance with Technical Specification CV-1.3, Subsection 3.

Above ground steam piping insulation and jacketing will be removed prior to replacement.

Existing underground utilities that interfere with the new construction will be demolished to the extent required to be rerouted to allow for the new construction.

7.2 Structural and Architectural

7.2.1 General

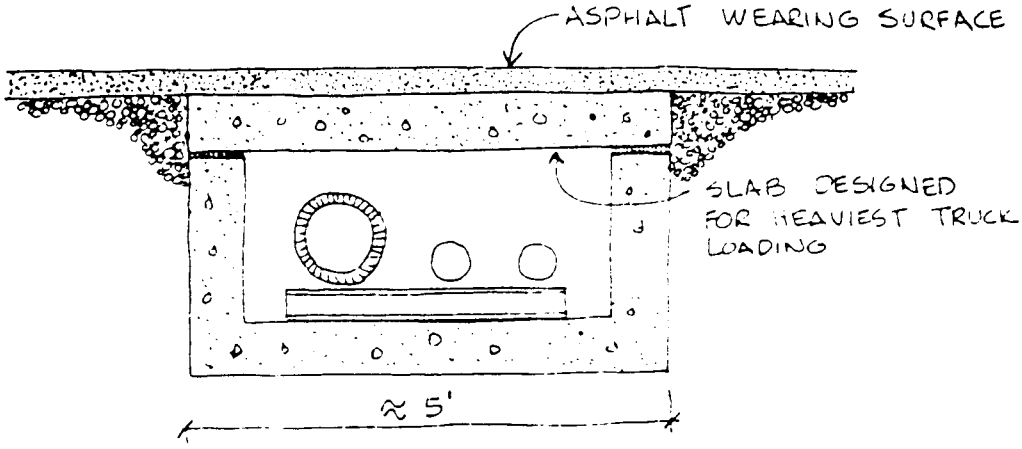
Shallow concrete trenches will be constructed to contain the new underground piping. Figure 7-1 shows typical cross-sections for the trench covered with grating, concrete slab and asphalt. Existing manholes will be reworked to complement and adapt to the new construction. New manholes will be provided as required for the new underground piping and drainage of the shallow concrete trenches.

Other structure repairs will be designed and detailed so as to maintain integrity of structure.

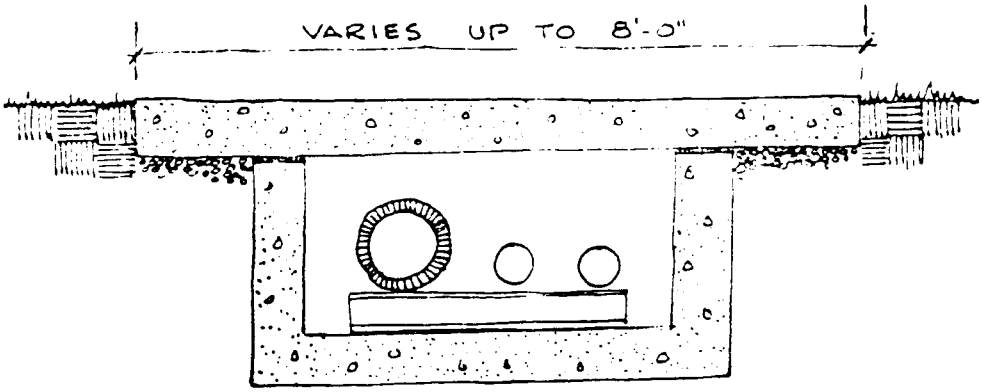
New above ground piping will be supported on existing piping supports to the fullest extent possible. The existing piping supports will be reinforced as required to carry the additional load. New above ground piping supports shall be similar to those shown in Engineering Standard ES-4.5-2.

7.2.2 Loads

The design of general, non-reactor, non-nuclear, and non-hazardous structures defined by ANSI Standard A58.1-1982 as being Category I or IV shall conform to the requirements of UBC-1988 and ANSI A58.1-1982. Loading combinations shall be in accordance with UBC requirements. Allowable stresses and strength requirements shall be in accordance with UBC requirements. Allowable stresses and strength requirements shall be as stipulated in the UBC. Either the allowable stress design or



TYPICAL SLAB COVERED TRENCH
USED IN ROADWAYS



TYPICAL SLAB COVERED TRENCH
USED AS A WALKWAY

Figure 7.1

a strength design method (e.g., the ACI method for concrete, plastic, or LRFD methods for steel) are acceptable.

The structural frame and exterior components of all buildings, towers, and other exposed structures shall be designed to resist pressures due to wind assumed to act from any direction. Partial wind loading shall be considered if it produces a more severe effect.

Wind load design for buildings and other structures shall be determined in accordance with procedures in ANSI A58.1, using a basic wind speed of 70 mph and exposure level "C".

Earthquake load design for buildings and other structures shall be determined in accordance with the procedures contained in the UBC and UCRL 15910.

Combination of loads, allowable stresses, and strength requirements for buildings and other structures shall be as stipulated in the UBC.

7.2.3 Foundations

Pits shall be reinforced concrete, water proofed, water stopped, and provided with drains or pumps. Backfill against pit walls shall be crushed rock to within one foot of finished exterior grade.

7.2.4 Concrete

Concrete materials, design, and construction for buildings and other structures shall comply with ACI 318, 40 CFR 249, Engineering Technical Specification A-3.1, and ACI 350R (sanitary engineering structures).

Reinforcement materials for concrete shall comply with ACI 318. Reinforcement details shall comply with ACI 352R, SP-66, and ACI 318.

Materials, testing, and quality control for cast-in-place concrete shall comply with ACI 318 for buildings and structures. Tolerances for formed concrete shall be as listed in ACI 347.

The selection of proportions for concrete mixes for normal, heavyweight, and mass concrete shall comply with ACI 211.1. Structural, lightweight concrete shall be proportioned to comply with ACI 211.2.

The mixing, transporting, and placing of cast-in-place concrete shall comply with ACI 304.

Hot weather concreting and cold weather concreting shall comply with ACI 305R and ACI 306R, respectively.

In addition to the previously stated requirements, the PTI Post-Tensioning Manual may be used for the design and construction of post-tensioned concrete structures.

Concrete bases for equipment shall conform to Engineering Standard ES-7.14-5. Installation of anchor bolts in existing concrete shall conform to Engineering Standard ES-7.14-6.

In addition to the requirements listed in the General subsection, precast concrete shall comply with PCI MNL-116. PCI MNL-120 and the PTI Post-Tensioning Manual may also be used as guides for the design and construction of precast concrete structures.

7.2.5 Metals

Fabrication and erection of structural steel shall comply with UBC, AISC, and Engineering Technical Specification A-7.1.

7.3 Piping

Routing of the new steam piping to be constructed is shown on Figure 2-1. All new steam piping, above ground and underground in concrete trenches, shall be constructed consistent with Technical Specifications P-1.1, Subsection 101 and 102. All new and existing steam piping, above ground and underground in concrete trenches, shall be insulated consistent with Technical Specification P-2.1, Subsection 1 or Subsection 2. Steam piping insulation thicknesses shall be consistent with Engineering Standard ES-4.13-7. All new and existing steam trapping stations shall be constructed consistent with Engineering Standard ES-4.16-4 except that two shut-off valves shall be installed at the trap inlet for safe isolation during replacement. All steam traps shall be insulated with prefabricated removable covers.

Due to the need to maintain steam service during construction, a suitable sequence of construction for the contractor will be required. This sequence must provide for tie-ins during non-heating seasons in certain areas and for cross ties and isolation valve installations to provide for alternate supply routes for other areas. The heating season at ORNL is from October 1 to April 30. These same cross ties and valving will provide increased reliability in the upgraded system. Consideration of weather and sequencing is important in maintaining the desired schedule.

Routing of the new compressed air piping is shown on Figure 2-2. All new compressed air piping, above ground and underground in shallow trenches, shall be constructed consistent with Technical Specification P-1.1, Subsection 136.

Figure 2-3 shows the proposed routing of the new steam condensate return piping to be constructed. All new condensate piping, above ground and underground in shallow concrete trenches shall be constructed consistent with Technical Specifications 101 and 102, except that all piping and fittings shall be Schedule 80.

All new condensate piping, above ground and underground in concrete trenches, shall be insulated consistent with Technical Specification P-2.1, Subsections 1 and 2. Steam condensate pipe insulation thickness shall be consistent with Engineering Standard ES-4.13-7 or as determined by a life cycle cost analysis.

All piping shall be cleaned, tested, inspected, and identified consistent with Technical Specifications P-3.1, P-4.1, and P-5.1.

Piping hangers shall be detailed and located on the drawings for all piping over 2 inches in diameter. Hangers shall be similar to those shown in Engineering Standard ES-4.5-2. The spacing of hangers shall be consistent with Engineering Standard ES-4.5-3.

7.4 Electrical

Power for portable sump pumps will be G.F.C.I. duplex receptacles (120V, single-phase, 60 hertz) mounted approximately 6" to 8" below the cover in each of the manhole locations that need sump pumps, and powered from the nearest building lighting panel with available circuits. Conductors for these receptacles shall be type U.F.

8.0 REFERENCE DRAWINGS

8.1 Reference Drawings - General

DRAWING	TITLE
Index Sheet	ORNL Area Atlas
Sheet W-4-A	ORNL Area Atlas
Sheet W-5-A	ORNL Area Atlas
Sheet 4	ORNL Area Atlas
Sheet 5	ORNL Area Atlas
Sheet 9	ORNL Area Atlas
Sheet 10	ORNL Area Atlas
Sheet 11	ORNL Area Atlas
Sheet 12	ORNL Area Atlas
Sheet 16	ORNL Area Atlas
Sheet 17	ORNL Area Atlas
Sheet 18	ORNL Area Atlas
Sheet 19	ORNL Area Atlas
Sheet 19, Supplement 1	ORNL Area Atlas
S3E-20007-B001, Rev. 1	Upgrade Steam Trench Distribution System Trench and Pit Details
C3E-21458-A001	Measurements and Control Support Facility - Conceptual Site Preparation Grading Plan
C3E-21458-A002	Measurements and Control Support Facility - Conceptual Site Preparation Utility Plan
E3E-21458-A002	Measurements and Control Support Facility - Exterior Electrical Plan
C3E-21376-A001	West Office Building - Site Plan
E3D-20003-D079	Conduit Additions X-10 Area Dwg. 16 of 31
E3D-20003-D080	Conduit Additions X-10 Area Dwg. 17 of 31
E3D-20003-D081	Conduit Additions X-10 Area Dwg. 18 of 31
E3D-20003-D082	Conduit Additions X-10 Area Dwg. 19 of 31

8.2 Reference Drawings - Building

DOCUMENT NUMBER	TITLE
Building 1503	
H20109Y-101-D	Mechanical Floor Plan & Details
H3E-20109SK-01	HVAC Demolition Plan
P3E-20109-C004	Service Piping Plan
P3E-20109-C005	Piping Diagram & Details
Building 1504	
P21224EC-007-D	Steam & Air Piping Plan & Sections
P21224EC-008-D	Steam & Air Piping Plan & Profile Sheet 1
P21224EC-009-D	Steam & Air Piping Plan & Profile Sheet 2
P21224EC-010-D	Steam & Air Piping Plan & Profile Sheet 3
P21224EC-011-D	Steam & Air Piping Plan Sections and Details
P21224EC-012-D	Steam & Air Piping Plan Valve Pit & Manhole
P21224EC-042-D	Process & Service Piping Plan
P21224EC-043-D	Process & Service Piping Sections & Details
P21224EC-045-D	Steam & Tempered Water Piping Sheets
P21225EC-001-D	Service Pit Piping Plan
P21225EC-002-D	Service Pit Piping Sections
P21225EC-003-D	Service Pit Piping Details
P3D-21224-C072	Heat Reclaim System Piping Arrangement
P3D-21224-C073	Heat Reclaim System Pit Piping Sec. & Structural Details
P3E-21224-C066	HVAC Piping Plan
P3E-21224-C069	Piping Plan, Section & Details
P3E-21114-C005	Service Pit Piping Plan
P3E-21225-C006	Service Pit Piping Sections
Building 1505	
P21249YC-501-E	Site Utility Plan
P21249YC-539-E	Steam Main Plan & Details
P21249YC-540-E	Site Utilities Partial Plan & Profiles
P21249YC-541-E	Site utilities Partial Plan & Profiles
P21249YC-542-E	Site Utilities Partial Plan & Profiles
P3E-21249-C002	Condensate Heat Recovery Piping Plan
P3E-21249-C003	Condensate Heat Recovery Piping Section and Details
Building 1506	
P21249YC-535-E	Piping Sections & Details
P21249YC-536-E	Piping Sections & Details

P21249YC-537-E	Piping Sections & Details
P21249YC-538-E	Piping Greenhouse Plans
P3E-21250-C001	Controlled Fumigation Facilities Piping Plan

Building 2010

D-10918	Heating & Ventilating Details
D-10919	Steam Pipe Diagram for Kitchen Equipment
D-10927	Heating & Ventilating Plan
P20136XF-016-E	Service Piping Plan Alt. to Cafeteria
P20136XF-017-E	Service Piping Details Alt. to Cafeteria

Building 2013

CL-719-22	Addition to East Wing Service Piping & Heating
D-3683	Alterations to Heating Plan
E-3684	Alterations to Heating
P20145EC-001-D	Piping Change Permanentize Building 2013
W-68377	Service Piping Plans & Details
W-68900	Heating System

Building 2518

H20213EG-003-D	A/C System Steam Piping Plan & Schematic Layout Alt. P&E Off.
H20214X-009-D	Reactor School Sect. Det. Study Room Air Cond.

Building 2523

D-19462	Utility Plot Plan
D-19464	Piping Layout
D-19466	Heating & Ventilating
D-32043	Reloc. of Water Heater Plan of New Heater Room
P20225EF-002-D	Office Addition Piping Electrical Plan Section Details

Building 2525

C-30957	New Reheat Coils for Air Conditioning System
H-56-514	Condensate Receiver
H-20228EG-003-D	Make-Up Air Heat. Pln & Notes Plating Shop Air Sys.
H20228EG-005-D	Make-Up Air Heaters Steam & Condensate Details Air System
P20007EC-010-D	Pnl. Elev. & Dets. Out. Stm. & Air Lines - Steam LI

Building 2621
D-37611

Outside Steamlines & Sections & Details

APPENDIX I

SCHEDULE

This project is scheduled for design-only funding in fiscal year 1992. Construction funding is expected to be split between FY 1993 and FY 1994, with approximately 60 percent of the construction funds available in FY 1993. The design shall consist of suitable "stand alone" packages so that a maximum award may be made in FY 1993, with the balance of the construction awarded in FY 1994. The FY 1994 award may be accomplished by a delayed option to the original award or by a separate bid and award.

APPENDIX II

INSULATION AND COVERING

DOE Order 6430.1A, "General Design Criteria," requires that "all insulation installed above ground, in tunnels, and in manholes shall be provided with a metal jacket, either factory or field installed, or provided with a hard cement finish." These criteria required that insulation be consistent with Technical Specification P-2.1, Subsection 1 (Calcium Silicate) or Subsection 2 (Fibrous Glass). The attached letter, Fibrous Insulation Handling Procedure requires precautionary safety measures well in excess of federal regulations when handling fibrous insulation at ORNL.

The A-E shall perform a cost study and recommend the most effective insulation/covering system, consistent with all of the above, for use in the shallow trenches.

The desired insulation/covering system in valve pits, above ground, and in buildings is calcium silicate with an aluminum covering.

The A-E shall obtain Material Safety Data Sheets for all recommenced insulations and submit them for review. Required safety measures will be provided to the A-E.

APPENDIX III

LESSONS LEARNED FROM THE PREVIOUS PROJECT

The following "lessons learned" from the previous steam line project shall be addressed during this project:

Pits should be complete (insulation, sump pump, etc.) before steam is put back in service.

No lever-operated valves shall be used for the steam system.

Put access hatches in grating. Even though we can operate valves from top, we still have to get into pits.

If ladders have to be removed for new installation, replace them with new ones. Provide ladders in new pits.

If steam outage is more than 10 days at any one location, make arrangements for a temporary line to feed the building.

Temporary air supply must be supplied to all facilities during air tie-in work. If it is essential to turn off building air, it must be done during off shift.

Make end date of contract to be before October 1, or include air outages and condensate tie-ins in mandatory time frame.

We must have 36 hours from the time one new pit is placed into service until the next pit in sequence is shut down.

Pits need to be done in sequence (one finished before the next one is started).

Specify the size of the temporary lines run for steam.

Do not reuse any pressure reducing stations or valves.

Provide enough valves in the air system so that we can isolate each service point independently.

Come up with a method of warming up the lines and valves and then retorquing the bolts on valves and flanges in steam lines.

Spiroflex-type gaskets hold up much better than cut gaskets.

Install pressure gauges on main header in all pits and on each branch line off of header. Also, specify type of gauge and that it has suitable protection from pressure fluctuations.

On all loop tie lines, install valves on all three legs of the Tee.

Specify that October 1 is critical, even with changes and delays.

At all condensate pump stations, an alternate method of getting rid of condensate is required (each condensate pumping station needs the required piping so that we can dump condensate to a storm drain in the event of a power failure or if isolation of the system is required for maintenance).

To the extent feasible, valve pits should be 4' or less in depth.

More effort needs to be made to limit water entry into the shallow trenches, especially surface water run-off during storms.

APPENDIX IV

CAD DRAWINGS

All new drawing shall be prepared using a computer-aided design (CAD) system. The CAD system in use at Energy Systems in Oak Ridge for facility design is the Computer-Augmented Design and Manufacturing (CADAM) system originally developed by Lockheed Corporation and now owned by IBM. Therefore, CADAM is a preferred CAD system for facility design; however, other CAD systems may be used if they provide complete bi-directional translation capability to and from CADAM via the Initial Graphics Exchange Specification (IGES) or the Autodesk Data Exchange Format (DXF).

Computer-Aided Design Deliverables

At project completion, all new design drawings hall be provided in a computer sensible format as well as in hard copy (reproducibles). These deliverables shall be submitted in the A-E firm's CAD system format and in either a neutral file format (IGES Version 3.0 or later or DXF as specified by Energy Systems) or in CADAM NURESTOR format. The medium for the data transfer is specified in Y/EN-2678, "Martin Marietta Energy Systems, Inc., CAD Design Change Practices."

Computer-Aided Design Drawing Structure

The CAD drafting standards and drawing structure, as outlined in the latest revision of Y/EN-2678, "Martin Marietta Energy Systems, Inc., CAD Design Exchange Practices," shall be followed.

Validation of Computer-Aided Design Translation

If the design is done by an A-E who uses a CAD system other than CADAM, a validation of the bi-directional translation of computer sensible data must occur as early as practicable in the project. Energy Systems has worked with some A-E firms to develop data for certain CAD system(s) that facilitate the translation into the CADAM format. Where applicable, Energy Systems will provide these data for the A-E's use. Additionally, a set of test files, along with hard copy plots, representing typical discipline design drawings (less than ten) will be prepared by Energy Systems using CADAM and submitted to the A-E in an IGES (or DXF) format for the purpose of testing the translation requirement. The A-E will convert the files into their CAD system, produce hard copy plots, analyze the differences, and document the results. The A-E will convert a similar set of existing CAD drawings, representative of the disciplines and details anticipated for the project, to IGES (or DXF). a hard copy set of these drawings, along with the data files, will be submitted to Energy Systems for analysis similar to that performed by the A-E.

Following the evaluation of the sample drawings, the A-E and Energy Systems will work together to analyze the results and develop recommendations for implementation of procedures necessary to

ensure successful interchange of CAD data. Those elements not transferring acceptably will be documented and their use by the A-E shall be avoided.

At 30 percent design review, the A-E shall convert a similar set of representative project drawings to IGES (or DXF) and submit them along with corresponding hard copies to Energy Systems for review and evaluation.

APPENDIX V

COST ESTIMATING

Statement of Work

May 14, 1991

Cost Estimate

The A-E shall prepare the total estimated cost (TEC) for all construction work to be performed for the project. The A-E shall prepare and submit an estimate for each of the design reviews. The estimate, which reflects the final design, shall be used for analyzing contractor's bids. The design review estimates are expected to contain detail material and labor estimates commensurate with the completeness of design and to contain conceptual material and labor estimates for the remainder of the work.

All estimates shall be structured and summarized in accordance with the Project's Work Breakdown Structure (WBS) and DOE Primary Cost Codes as outlined in the Design Criteria.

The estimates shall be prepared in accordance with the DOE-OR Estimating and Cost Control Manual, dated April 1981, except as noted below:

> The A-E is not required to apply the DOE cost codes below the primary level (1000, 2000, etc.), nor shall the A-E be required to label any document with the DOE cost code as shown in Annex 6.
>
> The A-E will not be required to track field changes, as mentioned on pages 5-6.
>
> The A-E shall summarize the estimate for each level of the WBS in accordance with the instruction in Section 5.4.1. If the A-E chooses to use the Automated Estimating System (AES), the summaries by General Subcontract (c) and the General Contract (d) shall not be required.
>
> Annex 3, Cost Estimate Computer Application Instruction, is replaced with the AES User's Manual. However, if the A-E does not use AES, the detail estimates he provides must provide similar information as shown on Annex 3, pages 5-22.

The A-E's estimates shall provide both un-escalated and escalated costs as presented in Section 6. Energy Systems will provide the A-E with the current DOE-OR Escalation Multiplier table and the overall project schedule. If the A-E chooses to use AES, the system incorporates the escalation requirements with minimal additional effort.

Energy Systems will provide the A-E with current DOE-approved construction labor rates and indirect rates.

Should the A-E choose to use AES, Energy Systems will provide, without charge, at the A-E's site, an instructor for 8 hours who will teach the A-E to use AES. AES is designed for use with the IBM PC, PC-XT, PC-AT, PS/2 or any true IBM PC-compatible microcomputer using DOS 3.0 or higher with the following minimum configuration: 640KB of random access memory, color monitor, one diskette, 2 MB of hard disk space, and a letter-quality printer capable of printing 17 characters per inch.

Cost Estimating

Statement of Work

May 14, 1991

30% REVIEW	60% REVIEW	90% REVIEW	CFC ESTIMATE
Basis of Estimate	Update as required	Completed	Final comments incorporated
Construction craft rates and indirects applied	Completed	Completed	Final comments incorporated
Direct cost additives applied	Update as required	Completed	Final comments incorporated
Cost Codes applied	Update as required	Completed	Final comments incorporated
Detailed cost estimating completed commensurate with the completeness of design	Commensurate with the completeness of design	Completed	Final comments incorporated
Conceptual cost estimating completed commensurate with the completeness of design	Commensurate with the completeness of design	Completed	None

xcys: M. N. LaKund
E. P. Sothman

ATTACHMENT 1

MARTIN MARIETTA

Internal Correspondence

EK - Discussed w/ Dan Kirby 10-2-91

MARTIN MARIETTA ENERGY SYSTEMS, INC.

ORNL PROJECT MANAGEMENT STAFF - PLS. NOTE WHEN PLANNING / ESTIMATING FUTURE JOBS!

September 20, 1990

M. M. Brown
E. H. Krieg
B. L. Morgan

Ed Krieg
2-18-91

Fibrous Insulation Handling Procedure

The assure the implementation of the recent Martin Marietta Energy System Policy on the handling of fibrous insulation (see attached memo), I am including the following recommended handling procedures so that they may be reflected in future engineering project documents. These are precautionary safety measures taken by Energy Systems in response to growing evidence that fibers other than asbestos also present potential health hazards. These safety measures are not required by federal regulations. They are, however, considered necessary to ensure that workers in the immediate breathing zone of these fibers have adequate protection.

The following precautions will be taken for work involving fibrous insulation (removing or installing):

1. Respirators equipped with HEPA filters are to be worn by workers who handle the fibrous insulation.

2. Workers are to wear a disposable suit with head and eye protection when working.

3. Workers are to vacuum the disposable suits and respirators with a HEPA-filtered vacuum cleaner prior to leaving the work area.

4. Workers are to shower at the end of the day (for extremely dusty jobs, shower immediately after the job).

5. Where feasible, abrasive cutting, sawing, or similar removal activities will be done using a HEPA-filtered vacuum cleaner or a system to ensure that dust will be captured by the vacuum.

6. There will be no dry sweeping in the segregated areas (sweeping with the use of a dust-suppression compound is acceptable).

7. All debris created during any fibrous insulation removal or installation will be bagged or contained and labeled.

8. The work area will be segregated by construction flagging.

If you have any questions regarding this procedure or other concerns involving fibrous insulation materials, I can be reached at 4-6164 or you can call Betty Wilson at 6-8218.

D. L. Kirby

D. L. Kirby, ~~2621~~ 3550, MS/6321 (4-~~6164~~) 4-6164

DLK:kc

Attachment

cc/attach: D. T. Duncan
G. L. Love
R. B. Ogle
B. D. Wilson