MLM-MU-89-64-0013

**DESIGN CRITERIA
FOR
SW-205 CAPILLARY SYSTEM**

APRIL 1989

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MIAMISBURG, OHIO 45343-0987

513-865-4020

operated for the UNITED STATES DEPARTMENT OF ENERGY

Contract No. DE-AC04-88-DP43495

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JR

MASTER

DESIGN CRITERIA
FOR
SW-205 CAPILLARY SYSTEM

DEPARTMENT OF ENERGY

MOUND PLANT

MIAMISBURG, OHIO

APRIL, 1989

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TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
I	Purpose and Physical Description.....	I-1
II	Architectural-Engineering Requirements.....	II-1
III	Reference Document.....	III-1
IV	Civil.....	IV-1
V	Architectural.....	V-1
VI	Structural.....	VI-1
VII	Mechanical.....	VII-1
VIII	Electrical.....	VIII-1
IX	Fire Protection.....	IX-1
X	Occupational Safety and Health.....	X-1
XI	Quality Assurance.....	XI-1
XII	Security.....	XII-1

Appendix

A	Criteria Drawings
B	AES Work Package Checklist Purchase Requisition
C	Proposed Schedule

SECTION I. PURPOSE AND PHYSICAL DESCRIPTION

SW-205 CAPILLARY SYSTEM

A. PURPOSE

1. The purpose of this project is to remove the existing capillary system and its associated controls from a fumehood operation and install them in a sealed glovebox. This will provide greater safety and environmental capability as well as automation of the present manual operation.

B. PHYSICAL DESCRIPTION

1. This Design Criteria is intended to be a general guide for the A/E. The criteria drawings in Appendix A are included to show what has been done at another location for a similar process. It remains the responsibility of the A/E to analyze and develop the process requirements as provided by Mound and arrive at the most functional and economic design.
2. This project includes the installation of a control console in SW-205. This console will be custom designed by Mound and built to contain instrumentation for automatic operation. SW-204 will contain the new glovebox and control cabinet housing the electrical controls for the glovebox. Cabletray to contain all necessary signal and instrument wiring will be required in both rooms. Enclosed wireway will be required to contain all electrical wiring for both rooms.

C. EXECUTION

1. The project phasing shall be such that the existing system in SW-205 shall remain operative until the new system has been installed, leak-checked and is ready for operation. At this point capillaries will be transferred and the existing mass spectrometer connected.
2. The A/E shall have the following responsibilities:
 - a. Complete design of the electrical and electronic demolition of SW-205/204.
 - b. Complete electrical design and drafting of the capillary system in SW-205/204.
 - c. Complete electrical specifications for equipment and ratings.
 - d. Material will be identified by Vendor, part number, and price for purchase by Mound. See Appendix B for purchase requisition.

SECTION II. ARCHITECT-ENGINEER REQUIREMENT

A. GENERAL

1. The A/E will provide the complete Title I and Title II Electrical design and construction services for the Capillary Control System Project, including all electrical systems, and support utilities for a complete and usable installation. The A/E will provide an estimate for Title III services which will not be performed on this contract but may be required at a later date. The A/E will utilize state-of-the-art concepts and design to obtain the overall objective at the lowest cost consistent with a high quality facility. The narrative and drawings included herein are intended to be guidelines for the design effort and should not be construed to limit the A/E from proposing more cost-effective alternatives. It remains the responsibility of the A/E to develop and economically justify final functional solutions within the prescribed budget and space allocations.
2. Specifications shall follow the CSI format using Mound Master Specifications as a guide. Since Mound's trades personnel will be installing the project, formal installation specifications (such as those for a formal bid package) will not be required. Any special or noteworthy specification should be put on the drawings.
3. All drawings shall be standard "D" size and conform to the Mound standard format. Master drawings will be made on AUTOCAD floppy disks supplied by the A/E.
4. The A/E will be responsible for updating the master AUTOCAD drawings to their "As Built" condition upon completion of Title III work. Final construction drawing disks will become the property of the Government upon completion of construction.
5. The A/E shall, during design, field verify existing building site, utility conditions and any critical field conditions.
6. The A/E shall furnish the appropriate plans, specifications, sections, isometrics, profiles, details, and engineering diagrams, schedules, notes and legends to accurately convey all pertinent information to the Mound Planner and Foreman. Use the scale and arrangement selected by Mound and approved by Mound.
7. The A/E, upon final design review and approval, will prepare bound specifications and drawings in specified quantity for Mound.
8. The A/E shall investigate and employ the most efficient methods of engineering and drafting possible (i.e. overlays, computer aided drafting, photo drafting, etc.)

9. The A/E shall provide in his proposal an estimated cost of construction, estimate of manpower, material lists, and work package for the project. The Work Package shall be assembled per the Mound AES Work Package Checklist. See Appendix B.

B. TITLE I - 40% TO 50% COMPLETE

1. Field work shall be complete to include conduit, cabletray, and wireway run investigations, location of existing conduit and equipment, location of new equipment, control cabinet layout, and breaker sizing and ratings.

Temporary electrical supply needs shall be addressed.

2. Preliminary drawings shall be complete. These may be in sketch form, but must be sufficient to convey the concepts to be carried forward into definitive design drawings.
3. Specifications shall be in outline form with all sections covered which are applicable to the completed document.
4. Design calculations shall be completed and in a form to permit detailed review by Mound.
5. Alternatives specifically required and those suggested by the A/E and economic analysis supporting the alternatives should be completed and submitted for approval.
6. Component cost analysis shall be complete for Title I submittal of the complete building phase.
7. Electrical line diagrams portraying the sizing of the electrical system will be complete.
8. Based on the submitted economic analysis, a master equipment list will be submitted with the detailed data and calculations supporting the equipment sizing.
9. Specification of equipment and materials of construction shall be complete in a form to provide a preliminary estimate of construction costs.

C. TITLE II - 100% COMPLETE

1. Contract documents for the project shall be complete and ready for signatures. Only minor corrections shall be required after this review.
2. All corrections to drawings, specifications, calculations to be accomplished after Title I and subsequent intermediate reviews shall be complete.

3. The A/E shall provide a detailed Logic Bar Chart schedule for project construction and identify the critical path. The schedule shall include purchase and delivery activities and durations for all major equipment and building components.
4. Revised, detailed construction and manpower cost estimates shall be submitted.
5. The A/E shall provide all specifications, drawings, and any amendments.

D. TITLE III - CONSTRUCTION SERVICES

1. The A/E will provide design input on changes during construction and ensure the timely updating of drawings for "As Built" purposes.
2. The A/E will participate in the final construction checkout and punchlist.
3. The A/E will provide assistance in the design and cost estimating of proposed construction changes when necessary, and will assist in answering questions concerning design during construction.
4. Title III services will be bid on a time and material basis with a "not-to-exceed" amount at the completion of Title II.

E. SCHEDULES AND REPORTS

1. The A/E will provide Mound with design schedules in bar chart form. Backup for these schedules shall include a preliminary list of required drawings and estimated engineering and drafting hours for each drawing.
2. Title I services shall commence at award of the contract. One week for review by DOE and Mound shall be allowed.
3. Title II services shall commence upon approval of Title I design. Include one week for review by DOE and Mound.
4. Title III engineering services shall commence with the start of construction and continue until start-up.

F. MEETINGS AND DESIGN REVIEWS

1. Title I Design:
 - a. Design Progress Reviews: Bi-weekly progress reviews during Title I will be held with the Mound Construction Manager. The purpose of this meeting is to review design progress in accordance with the approved schedule and to resolve issues that require team management decisions beyond the normal one-on-one telephone communications.

This will be the forum for major design issue discussion and solution. Formal minutes will be published by the A/E with clear delineation of unresolved issues, the individual(s) responsible for resolution, and target date for resolution. The A/E Project Manager will provide a formal status briefing for the team.

- b. Additional informal reviews will be held as required by the project status.
- c. Title I Design Review Meeting: Upon completion of Title I review, changes will be made during Title II design. One week will be required for review by Mound.

2. Title II Design:

- a. Design Progress Reviews: Bi-weekly progress reviews during Title II will be held with the Mound Construction Manager. The purpose of this meeting is to perform a comprehensive review of project status including schedule and cost. Major unresolved issues will be discussed. Formal minutes will be published by the A/E with clear delineation of unresolved issues, the individual(s) responsible for resolution and the target date for resolution.
- b. Additional informal reviews will be held as required by the project status.
- c. Final Design Review Meeting: Upon completion of Mound reviews of Title II design a final meeting will be held to review all design plans, specifications, and construction documents. One week will be required to permit timely review and assembly of discipline comments prior to the meeting. At this point, the A/E will have a work package completely assembled.

4. Design Changes:

Design changes may be proposed by the A/E or directed by Mound at any time during the design. These changes shall be fully discussed to determine their impact. All deviations from the design criteria or "Title I Design Summary" must be approved by the Mound Construction Manager. A sequentially numbered Change Order Log will be kept by the A/E to show a description of change, date, cost, and schedule impact.

5. Issue Lists:

The A/E shall issue and continually update a list that indicates outstanding issues to be resolved, by whom, and the target date for resolution (both original and current). This list shall be a main force of discussion at the bi-weekly design progress meetings and shall be maintained during the life of both Title I and Title II design phases of the project. It will be updated continuously as new issues arise and others are resolved. A separate list will be maintained by the construction Manager during the Title III phase.

6. Document Issue Requirements:

Specifications, estimates, drawings, and time schedules shall be prepared in such form and furnished in such quantity as directed by Mound. Minimum requirements are:

	<u>Title I</u>	<u>Title II</u>	<u>Work Package</u>	<u>Comp.</u> <u>Proj.</u>
Specifications	4	4	6	-
Drawings	8	8	6	-
Origs.	-	-	-	AUTOCAD*
Cost Estimates	3	3	3	-
Schedules	3	3	3	-
Design Calculations and Studies (Des. Basis Report)	3	3	-	-

NOTE: Copies of drawings shall be provided for design progress reviews and informal reviews as required.

* In "As Built" condition.

SECTION III. REFERENCE DOCUMENTS

A. DEPARTMENT OF ENERGY

1. General Design Criteria Manual, DoE Order 6430.1A
2. Project Management System, DoE Order 4700.1.
3. Environmental Protection, Safety and Health Protection Program for DoE Operations. DoE 5480.1B, Chapter VII, Fire Protection.
4. Environmental Protection, Safety, and Health Protection Program for DoE Operations. DoE Order 5480.1B, Chapter I, Environmental Protection Safety, and Health Protection Standards.
5. Handbook for Preparation of Specifications for Construction Contracts.
6. Physical Protection of Security Interests, DoE Order 5632.4.

B. MOUND

1. Master Construction Specifications - Mound
2. Mound Engineering Design Standards.
3. Existing Mound drawings. (Note: It is standard for Mound drawings to have north pointed down).
4. Facilities Engineering Quality Assurance Manual 807.
5. General Requirements for A/E Work - Manual 808.

C. NATIONAL CODES, STANDARDS, AND GUIDES

Unless specifically noted otherwise, the edition in effect on the date of the design contract of the following documents shall apply to the design of this project.

1. State of Ohio Department of Transportation "Construction Material Specifications", and "Standard Construction Drawings", and Location and Design Manual.
2. Life Safety Code, NFPA Standard 101.
3. National Electric Code, NFPA 70-1987.
4. NFPA Standards 13, 14, 24, 72A, and 78.
5. Uniform Building Code for seismic and masonry calculations only.

6. American National Standards Institute, ANSI A58.1, Building Code Requirements for wind, snow and Minimum Design Loads in Buildings and Other Structures.
7. Ohio Basic Building Code (OBBC)
8. Factory Mutual (FM) 1-28.
9. American Society for Testing Materials (ASTM)
10. American Society of Mechanical Engineers (ASME).
11. AWWA 600 Cast Iron Piping and 603 Asbestos-Concrete Piping.
12. American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members".
13. American Institute of Steel Construction, Manual of Steel Constructions.
14. American Concrete Institute Building Code Requirements for Reinforced Concrete, ACI 318-83.
15. American Welding Society, Structural Welding Code D1.1.-80.
16. EPA Erosion Control for Construction Sites.

D. OSHA

1. Occupational Safety and Health Standards of the Occupational Safety and Health Administration, Department of Labor, Federal Register, Title 29, Chapter XVII, Part 1926 during construction and Part 1910 for design.

E. OTHER

1. Federal Regulation 40 CFR part 112 - Oil Pollution Prevention.
2. Federal Regulation 40 CFR part 261 - PCB's
3. IEEE 142: Recommended Practice for Grounding Industrial and Commercial Power Systems.
4. IEEE 242: Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
5. ANSI C2 NESC
6. IEEE C37 Standards: Circuit Breakers, Switchgear, Relays, Substations, and Fuses

SECTION IV. CIVIL

NOT APPLICABLE

SECTION V - ARCHITECTURAL

NOT APPLICABLE

SECTION VI - STRUCTURAL

NOT APPLICABLE

SECTION VII - MECHANICAL

NOT APPLICABLE

SECTION VIII ELECTRICAL

The following information is provided as a guide in establishing the electrical requirements associated with this project and should not be construed to limit the Architect-Engineer and Mound Engineering from proposing more cost effective alternates. This information is subject to review and change during the design process.

A. GENERAL REQUIREMENTS

Provide the electrical design for this project in accordance with the General Design Criteria, DoE Manual Appendix 6430.1A utilizing Mound Master Specifications and specific criteria included herein.

B. CODES AND STANDARDS

1. All electrical work shall be in accordance with the requirements of the National Electrical Code (NEC), ANSI/NFPA-70, and other applicable references as included in Section III.
2. All electrical equipment and materials furnished and installed shall bear the Underwriters' Laboratories Label of Approval for the particular service fitted.

C. IDENTIFICATION

1. Installation for permanent identification of electrical equipment and systems shall be specified per Mound standards:
 - a. Panels at 480 and 240 V, 3 phase: PP
 - b. Panels at 208/120 V, 3 phase and 240/120 V, 1 phase: LP
 - c. Room number shall follow the above designations.
 - d. Multiple panels in a single room shall be labeled as above with the added suffix A,B, or C... starting with the second panel.
 - e. A panel in a corridor shall be assigned the number of the room on the other side of the wall from the panel.

f. Special cases shall add a designated prefix to the PP and LP identification:

- E - Emergency Power
(cover shall be painted yellow)
- U - Uninterruptible Power Source
- C - Conditioned Power
- D - Direct Current

g. The format shall be: $\frac{\quad}{1} \frac{\quad}{2} \frac{\quad}{2} \frac{\quad}{3} \frac{\quad}{3} \frac{\quad}{3} \frac{\quad}{4}$

- 1=Prefix for special case (E, U, C, D)
- 2=PP or LP
- 3=Room Number (24, 106)
- 4=Additional Panels (A, B, C...)

2. Nameplates shall be made of sandwich type plastic with white letters on a black background. Letter size shall be 1/8" for control devices, push buttons, etc., and 1/4" for distribution panels, control panels, etc., unless otherwise directed. Nameplates shall be mounted on the outside surfaces of all equipment within easy sight of all personnel.
3. Wire markers shall be on waterproof cloth tape of high adhesion and tensile strength. Brady used as basis of design.
4. Distribution panels shall be provided with a typed or neatly printed directory. Circuits shall be identified as shown on the panel drawing layouts or as directed in the field. Directory shall indicate source of power, including building.

D. DISCONNECTS (MOTOR AND CONTROL)

1. General

- a. Motors and other equipment not within sight of their feeder overcurrent protection devices shall be fed from non-fusible type disconnect switches located at the motor. Exception to this criteria may be made on approval of Mound Electrical Engineering.
- b. Safety disconnect switches shall be of the non-fusible type unless otherwise indicated.
- c. Fusible safety switches shall be heavy duty type with single-throw knife blade construction and fuse clips (class R preferred).
- d. Non-fusible safety switches shall be heavy-duty type with single-throw knife blade construction and no fuse clips.

CONDUIT

1. General

Conduit systems may consist of rigid galvanized steel, IMC, EMT (electrical metallic tubing), or a combination of the three as required by applicable codes and standards. EMT shall not be used outdoors, in wet locations, in crawl spaces, or below 5 feet AFF. Type EB PVC, encased in concrete, shall be used in all duct banks.

F. WIRES AND CABLES

1. Conductors and Cables, 600V or less

- a. Single conductor power and control wire shall be uncoated, class B or compressed stranded soft copper with NEC type THW or THHN flame retardant, moisture and heat resistant, colored PVC insulation. Insulated conductor shall conform to Underwriters' Laboratories Specification UL44.
- b. Power conductors shall be 12 AWG copper or larger.
- c. Control conductors shall be 14 AWG copper.
- d. Specify type THW insulation for all wire sizes.
- e. Specify stranded wire for #8 AWG and larger and solid for #10 AWG and smaller.

2. 15KV Single Conductor Cable:

Single conductor power cable shall consist of Class B stranded copper, rated at 90 degrees C, tinned copper semiconducting tape, ethylene-propylene insulation, lapped bare copper shielding tape, and an overall polyvinyl chloride (PVC) jacket of 80 mils.

3. Color code shall be as follows:

	480 And Greater	277 and lower
A	BROWN	BLACK
B	ORANGE	RED
C	YELLOW	BLUE
NEUTRAL	WHITE	WHITE
GROUND	GREEN	GREEN

4. Phase rotation on 12,470 volt systems shall be ABC.

5. Connectors and Devices:

- a. Conductors larger than #10 AWG shall be joined by compression type connectors. Terminal connections shall be made using solderless pressure lugs, except when factory installed set screw connections are supplied.
- b. Conductors #10 AWG and smaller may be joined with electrical spring connectors with vinyl tape or insulated wire nuts.
- c. Cable ties shall be nylon self-locking type suitable for the environment in which they are installed.

G. PANELBOARDS

1. Provide panelboard schedule showing all power distribution panelboards, lighting and receptacle panelboards including type and ratings. Identification of panelboards shall conform to Mound standard criteria as noted in previous section.
2. Panelboards shall be of the dead-front safety type constructed and labeled in accordance with UL Standard for Panelboards, UL67.
3. All panelboards shall be constructed using non-tapered, full length bus and be mounted in an enclosure constructed in accordance with UL Standards for Cabinets and Boxes, UL50.
4. All new power distribution panelboards and power panelboards shall be fused switch type and shall be 480 V, 3 phase, 3-wire, 60 HZ service, and be provided with the quantity and rating of main and branch circuit protective devices as indicated on the panelboard schedule and one-line diagrams. If physical space prohibits the use of fused switches, then Square D, I-Line circuit breaker panels can be used. Short circuit withstand rating shall be at least 25,000 amperes symmetrical at 480 volts.
5. All new lighting and receptacle panelboards shall be suitable for 208/120 V, 3 phase, 4-wire, 60 HZ service, and be provided with a minimum of 24 branch circuit breakers and a 100 ampere main breaker.
6. Where, feasible, all panelboard front covers shall be constructed with the opening on the left edge. A continuous hinge shall be riveted or welded to the right edge if opening is on the left, otherwise hinge shall be on the left.

7. All low voltage (480 volt) protective devices at unit substations shall be of the switchgear type, with a minimum number of breakers. Switchgear shall feed power distribution panels and Motor Control Centers (MCC) rated for 600 Amps or more and motors rated 200 HP or greater. Switchboards are not allowed.
8. Motor Control Centers shall be of the fused switch type and shall serve HVAC loads and other 3 phase motors. Provide space for power factor correcting capacitors for motors rated 20 HP or greater. Allen-Bradly model 2100 used as basis.
9. Unless otherwise noted, basis of design for this section is Square D Co.

H. WIREWAYS

1. Indoor type wireway shall be restricted to indoor use only.
2. Finish sheet metal parts shall be of 12 gage steel construction, flangeless design, with removable hinged cover. Wireway shall be without knockouts.

I. MOTORS

1. All 480 volt, 3 phase motors shall be high efficiency.
2. Generally, all motors rated 3/4 horsepower and greater shall operate at 480 volts, 3 phase, and will be equipped with capacitive power factor correction to 0.90 or better. Motors less than 1/2 horsepower shall operate at 115 volts, single phase. Consult Mound Electrical Engineering for deviations from this criteria.
3. Generally, HVAC motors shall be fed from Motor Control Centers (MCC).

J. MOTOR CONTROLS

1. Equipment and Materials
 - a. General- Starters shall be designed with "Hand-Off-Auto" selector switch for starting from an automatic controller or manually. All starters shall have a locking attachment. On-Off to be designed on switches not needing auto feature.

- b. Use combination AC three-pole magnetic starters, FVNR with motor circuit protection in NEMA 1 enclosure. All control circuits shall be 115 volt or lower, supplied by a control transformer energized from the power supply of the equipment controlled, unless otherwise noted. Starters shall be complete with three melting alloy overload relays. The starter doors shall be interlocked with the associated disconnect switch to prevent opening unless the switch is in the "OFF" position.
- c. Manual starters for 115 volt, single phase, fractional horsepower motors shall be single pole, manually operated toggle-type, with one thermal overload element and flush or surface mounted.
- d. Wiring in control panels shall be arranged in a neat and orderly manner and conductors shall be grouped and laced or enclosed in a plastic duct designed for the application.
- e. Terminal strips shall be provided for all wires running from the panel to other equipment. The design shall include a terminal strip layout schedule.

K. ELECTRICAL TIE-INS

1. General:

- a. This section outlines contractor responsibility and procedure for energizing equipment for the first time and for tie-in into existing electrical lines or equipment for additions or expansions to Mound facilities.
- b. Ratings - Mound's distribution voltage is 12,470 volts; utilization voltage is 480 volts.
- c. Unless otherwise stated, the Contractor is responsible for all labor and materials for making electrical tie-ins.
- d. Phase Rotation and Polarity:

480 volt - Mound has no polarity or phase rotation standard for 480 volts (or lower voltage)

12,470 volt - Mound has a fixed polarity and rotation standard for its distribution voltage. The Contractor shall, through the Mound Construction Manager, contact Mound Electrical Engineering Group for instructions on all terminations and tests for polarity.

- e. There shall be no splices made in any 15 KV rated cables.

2. Power

Electrical characteristics for this project shall be 240/120 volts single phase or 208/120 volts three phase, four wire, 60 HZ.

3. Grounding

- a. Building columns, roof steel, and footer steel reinforcing shall be made electrically continuous for grounding purposes. Driven grounds shall not be specified where soil conditions consist of rock. In such conditions, use a counterpoise system of no less than 4/0 bare copper cable.
- b. Water lines, building steel, and a grounding conductor from existing building shall be bonded together.
- c. Include a green insulated ground wire in all conduits, for equipment grounding.

4. Lightning Protection

Lightning protection shall be installed in accordance with AMCR 385-100, Chapter 8, for an integrally mounted system on masonry building and in accordance with NFPA No. 78. All equipment on roofs shall be provided with lightning protection. Underwriters' Laboratories, Inc. certification shall be obtained for all new systems and modifications to existing systems. Maxwell Lightning Protection Company used as basis.

L. INTERIOR

1. Distribution

- a. Distribution of power, lights, fire alarm, telephone, and miscellaneous signals shall be in metallic conduit. EMT is suitable for all raceway, except rigid conduit shall be utilized where it emerges from concrete or where the conduit may receive physical abuse. EMT shall not be used outdoors or in wet locations.

2. Lighting

- a. Provide illumination levels in accordance with IES for the various tasks and activities. In general, provide 50 footcandles at work stations, 30 footcandles in work areas, and 10 footcandles in non-work areas. Utilize the highest efficiency light sources (usually fluorescent with high efficiency ballasts, high pressure sodium, and metal halide).
- b. Provide local switching for all lighting. Offices, halls, equipment rooms, etc. shall be provided with separate switches except for night lights.
- c. Provide exit lights and emergency lights (local battery pack type) in accordance with the Life Safety Code. Emergency lighting shall be DUAL-LITE Spectron Series AS-BC SERIES I. Exit light fixtures shall be DUAL-LITE Spectron Series, EXCITE SERIES I.

M. FIRE ALARM SYSTEMS

- a. Codes and Standards: Unless otherwise noted on the Drawings, the equipment, devices, materials, and installation shall meet National Fire Code for Proprietary Protective Signaling Systems, Part 72D and the National Electrical Code.
- b. Mound uses a multiplexed, computerized proprietary fire alarm system, Kidde Model SDS/10-24. Alarms and coded bells shall operate from a data gathering panel (DGP).
- c. Products:
 - (1) Fire alarm devices must be compatible in all respects, including appearance, with the Mound site fire alarm devices. No substitution will be permitted.

4. Smoke Detectors

- a. Design shall include an equal mix of ionization and photo-electronic type, duct smoke detectors, smoke detector panel, and zone annunciator panels. Basis of design is Pyrotronics, System 3.
- b. Design shall include provisions for HVAC duct smoke detection and connections to the Mound Direct Digital Control (DDC) system.

N. SECURITY ALARMS

- a. Requirement for security alarms shall be determined by Mound's Computer and/or Technical Security department.
- b. If security alarms are required, the A/E shall be responsible for locating these alarms on the appropriate drawings as per Mound's instructions.
- c. Installation of security alarms shall be as per Mound's existing standard drawings.

O. TELEPHONE/HVAC

- a. Telephone services shall be provided to the equipment room for the communication link of the DDC system. Distribution panel and outlet provisions shall be in accordance with the recommendations of the AT&T Company.
- b. The individual control systems will be served through conduit, from the associated telephone cabinet to a location in the vicinity of the task work.
- c. Telephone service will be required for each new Master HVAC control panel being installed.

P. EXTERIOR

1. Lighting

- a. Provide outside lights at all exterior doors with switches inside the doors.

Q. TESTING

1. Specify that the contractor is responsible for all testing, removal for testing, reinstallation, and deficiency correction.

2. Tests to be performed include:

Insulation resistance tests

Circuit breaker tests on all 225 ampere frame size or larger.

Motor overload tests on size 2 starters and larger

Rotation tests

Motor load tests

Outlet hot, neutral, and ground tests

Operational demonstrations including control schemes and interlocks

SECTION IX. FIRE PROTECTION

NOT APPLICABLE

SECTION X. OCCUPATIONAL SAFETY AND HEALTH

- A. All aspects of the project shall be designed in accordance with the requirements of the Occupational Safety and Health Administration (OSHA).
- B. During construction the contractor shall follow the recommendations of the National Electric Codes and OSHA Part 1926.
- C. Provide means, in the functional design, for the safe and orderly evacuation of all areas.

SECTION XI. QUALITY ASSURANCE PROGRAM

- A. The A/E will be required to implement a quality assurance program commensurate with the types of construction. All pertinent design data and specifications will be reviewed for compliance to the criteria by the Mound project team members, as well as the A/E. The A/E will - in preparing design specifications - include a subsection in each specification section entitled: Quality Assurance, and will list all applicable codes and quality requirements including testing and reporting of quality by the contractor. The QA plan will contain the necessary elements and controls to assure compliance with the Design Criteria, internal coordination of features and dimensions, internal checking and cross-checking between drawings and specifications, and tracking to assure incorporation of review comments from Title I and Title II reviews.
- B. During construction, submittals will be directed through the Mound Inspector to the A/E for review to determine compliance with the specifications. The inspection functions will include working jointly with the Mound Construction Manager through the project team. The project team includes Safety, Loss Prevention, and Environmental Control and other specialists who will review drawings, specifications and critical submittals to insure compliance with quality requirements.
- C. Areas of the project that require special attention will be reevaluated jointly during Title I design. The extent of application of general and special quality activities will be consistent with the engineering practices, systems, materials or components to assure needed reliability.
- D. The A/E shall, in conjunction with the Mound, maintain a set of "as-built" records which define:
- Location of any lines, utilities and services which do not correspond with those shown in the reference materials.
 - Location with elevations, of any lines, utilities and services moved to a new position from the original location.

(The locations shall be determined with the assistance of a licensed surveyor).

These records shall, at the conclusion of the project, be transferred to a set of "as-built" drawings which will be turned over to the buyer as a permanent record.

SECTION XII. SECURITY

- A. Security escorts will be used with any uncleared personnel employed in the construction of these facilities when work is within the main security island, but outside of temporary construction fencing. Work in these areas will be subject to scheduling in order to assure adequate escort service by Mound Security personnel.
- B. Parking will not be permitted within the construction site. A contractor parking lot is located with access off Benner Road from which the contractor will be required to ferry personnel to the job site.

APPENDIX A

FSE 851956	SHT 1	EQUIPMENT LAYOUT T-41
FSE 851957	SHT 1	CABINET #5 CONTROL T-41
FSE 851958	SHT1-2	CABINET #5 PANELS T-41
FSE 860350	SHT 1-10	ELECTRICAL SERV./CONTROL WIRE T-41
FSE 850456	SHT 1-11	G.B. "A" T-41
FSE 851646	SHT 1-2	FLOW DIAGRAM T-41
FSE 851649	SHT 1-2	G.B. PURGE T-41
FSD 851959	SHT 1-3	CONSOLE MASS SPEC T-41
FSE-890598	SHT 1-10	G.B. "A-D" SW-204
		SW-204/205 FLOOR PLAN
		SW-204/205 EXISTING EQUIPMENT LAYOUT
		SW ONE LINE

APPENDIX B

AES WORK PACKAGE CHECKLIST

AES NO.: _____ ENGINEER: _____ DATE: _____

PACKAGE: COMPLETE

PHASE NO.: OF

CONTENT REQUIREMENTS	CHECK CONTENTS ATTACHED	NO. OF COPIES
MSR (Always Required)		All but Pink Copy
JOB SCOPE		3
• DESCRIPTION		In Job Scope
• SPECIAL INSTRUCTIONS/SPECIFICATIONS		In Job Scope
• SPECIAL SCHEDULING INSTRUCTIONS		In Job Scope
COST ESTIMATE SUMMARY (REQUIRED)		1
MATERIAL LIST (1 Copy to Material Control Clerk)		1
FORMAL DRAWINGS APPROVED SYSTEM DRAWING		3
SKETCHES		3
VENDOR DATA FOR EQUIPMENT		1
PROJECT SCHEDULE		1

DO YOU WANT A PRECONSTRUCTION MEETING? ☐ Yes ☐ No

REMARKS:

ASSIGNED PLANNER _____ FIRST MRP MONTH _____

SUPERVISOR'S APPROVAL: _____ DATE: _____

NOTE: FOR: MAINTENANCE WORK SEND TO: BRENDA SHAFNER, W BLDG. - 2ND FLOOR
 MACHINE SHOP WORK M-3A
 ELECTRONICS WORK M-225

Refer to Instructions on back of last page.

Shaded areas are for Purchasing use only.

MONSANTO RESEARCH CORPORATION

MRC-MOUND

MIAMISBURG, OHIO 45342

PURCHASE REQUISITION

BUYER HP NO.	PURCHASE ORDER NO.
--------------	--------------------

See Instruction
No. 1

ITEM	QUANTITY	U/M	DESCRIPTION	EST. UNIT PRICE	ACCOUNTING INFO.	
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC
					W/O	LEDGER
					CC	EC

DELIVERY INFORMATION								
REQ. DATE	MAT'L REQ. BY	DOCK	BLDG.	ROOM	HP NO.	REQUISITIONER	PHONE	MAIL STATION
EST. TOTAL AMOUNT	PRIORITY	☐ DOE2 ☐ DXE2			SOLE SOURCE (REFER TO INSTRUCTION NUMBER 3) ☐ YES ☐ NO		PROPERTY NO.(S)	

APPROVALS		
SUPERVISOR	FUNCTION MANAGER	OTHER
MANAGER, FUNCTION	DEPARTMENT DIRECTOR	OTHER
ACCOUNTING APPROVAL	PRESIDENT, DIRECTOR	OTHER

SUGGESTED SUPPLIERS:

(1) _____

 Phone: _____

(2) _____

 Phone: _____

(3) _____

 Phone: _____

ORDER DATE	DELIVERY DATE	STAT. CODE
VENDOR		SHIP VIA
FOB		TERMS
CONFIRMING WITH:		
OTHER		

MRC-ML-7336A (7-86)
STOCK NO. 17-1370

☐ HARD COPY

Printer No. _____

Req. No. **469050**

APPENDIX C

PROPOSED SCHEDULE

MAY 1, 1989
JUNE 1, 1989
JULY 1, 1989

TITLE I START
TITLE II START
CONSTRUCTION START