EG&G MOUND-04-10----9606100053

MLM-ML-86-52-0004

COORDINATED ANSPD (NE) AND OMA DECONTAMINATION AND DECOMMISSIONING (D&D) PROGRAM PLAN

March 31, 1978

REVISED: December 23, 1986

MOUND
Miamisburg, Ohio 45342

operated by
MONSANTO RESEARCH CORPORATION
a subsidiary of Monsanto Company

for the
U. S. DEPARTMENT OF ENERGY

Contract No. DE-AC04-76-DP00053

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Reviewing Official: J. A. NESHEIM
EMCBC Classification Officer
Date: 08-05-09

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By: Janet Nesheim, Derivative Classifier
DOE, EMCBC Class'n Office
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Confirmed Unclassified, Not UCNI/Not OUO
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COORDINATED ANSPD(NE) AND OMA

DECONTAMINATION AND DECOMMISSIONING (D&D) PROGRAM PLAN

Prepared by: W. P. Davis
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Submitted by: V. E. Castleberry

March 31, 1978

Revised December 23, 1986

MONSANTO RESEARCH CORPORATION

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SUMMARY

EXECUTIVE SUMMARY

The latest Monsanto Research Corporation (MRC) Program Plan for the extensive decontamination and decommissioning (D&D) of the inactive Advanced Nuclear Systems and Projects Division [ANSPD(NE)] (now under Nuclear Energy - Office of Remedial Action and Waste Technology) and Office of Military Applications (OMA) areas at Mound is presented in this document. These inactive areas include:

- Portions of the Plutonium Processing (PP) Building -- both ANSPD(NE) and OMA areas
- Portions of Research (R) Building -- both ANSPD(NE) and OMA areas
- All the Waste Transfer System (including Building 41) between the PP and WD (Waste Disposal) Buildings -- ANSPD(NE) areas

This current Plan updates the previous "Coordinated ANSPD(NE) and OMA Decontamination and Decommisioning (D&D) Plan" revision issued July 1, 1985.

Included in this document are sections on objectives, descriptions, schedules, costs, controls, organization, responsibilities, uncertainties, the individual projects, and current status. Specific sections on the Plutonium Processing (PP) Building, and Research (R) Building, and the Waste Transfer System (WTS) projects have been included to provide additional details on schedule, costs, and contingency. A sophisticated project scheduling program ("Project 2") was used to generate a more accurate cost estimate and schedule which denotes the critical path. Appendix G has been included to provide additional details on the proposed baseline compared to the previous FY 1980 baseline.

This document will be used as the Engineering Plan for the D&D Operations at Mound and will be revised annually to reflect changing status and parameters.

PROGRAM PLAN SUMMARY

Mound ANSPD(NE) and OMA Areas are located at the Mound Site in Miamisburg, Ohio. Mound is owned by the Department of Energy and operated by Monsanto Research Corporation. The 303 acre site is located in the suburban Dayton, Ohio, area. Land to north, east, and west of the site is residential housing and agricultural to the south. Mound is operated for both civilian and defense DOE programs.

Because of DOE's concern for the presence of large quantities of unencapsulated plutonium-238 in facilities that do not meet current plutonium facilities design criteria near a large metropolitan area, a directive was issued to remove large quantities of unencapsulated plutonium-238 from Mound.

Advanced Nuclear Systems and Projects Division (ANSPD) had plutonium operations at Mound in portions of the Plutonium Processing (PP) Building, the Research (R) Building, and the Waste Transfer System (WTS). The plutonium-238 was processed for use as heat sources in the NASA space program. Operations ceased in FY 1977 and decommissioning operations were initiated in FY 1978 and are expected to be completed in FY 1988.

The Office of Military Applications (OMA) also processed plutonium-238 in the Plutonium Processing (PP) and Research (R) Buildings utilizing common process-

ing facilities with ANSPD. Since the processing operations also ceased, decommissioning operations were coordinated and funded jointly by ANSPD and OMA in areas of joint ownership to minimize duplication of efforts; effectively utilize resources; minimize environmental safety, and health risks; follow a logical decommissioning sequence; and prevent shifting of last user cost responsibilities as agreed to in the NE/OMA Memorandum of Understanding. The responsibility for the inactive ANSPD areas was assumed by the Office of Nuclear Energy - Waste Management in FY 1981.

The decommissioning effort in the PP and R Buildings is two-phased: 1) clean and remove equipment and services from affected gloveboxes, seal contamination, disconnect, and package the empty gloveboxes in approved waste containers for shipment and burial; and 2) perform extensive structural decontamination of the affected areas to remove or seal residual contamination.

The decommissioning effort on the Waste Transfer System (WTS) involves removal of approximately 5,100 linear feet of below-grade contaminated piping, dismantlement of an associated storage and pumping facility (Building 41) and the removal of contaminated soil.

The intent of DOE's quality assurance program is met with independent radiological verification.

The funding projections contained in this document are balanced to minimize resource increases or decreases. This projection is coordinated with a level funding effort from NE and OMA, so that, the combined projects will satisfy the intent of DOE by maximizing the effort and maintaining a safe and efficient decommissioning program.

Funding forecasts are based on the assumption that NE and OMA continue to fund the coordinated decomissioning efforts at program plan levels to prevent shifting of last user responsibilities and associated program costs and to continue to meet the intent of DOE directives to remove large quantities of unencapsulated plutonium-238 from Mound.

Continued program plan funding eliminates an estimated $1,350,000 per year surveillance and maintenance cost and radiological risks to personnel and the environment associated with inactive contaminated areas. The decommissioned areas of PP and R Buildings would provide approximately 20,000 ft^2 of open areas for new or expanded laboratory/processing operations versus construction of new laboratories and buildings. In addition, part of the 25,000 ft^2 of building service and support equipment areas in PP and R Buildings that are being decommissioned would be available for new services and building support equipment (approximately 10,000 ft^2).

Some of the previously decommissioned laboratories are currently being reused by other DOE programs. Current uncommitted laboratory space at Mound is minimal.

PROGRAM PLAN ASSUMPTIONS

1. The Total Estimated Cost (TEC) assumes a stable level of funding at the program plan level. It also assumes that Nuclear Energy (NE) and the Office of Military Applications (OMA) will continue coordinated program plan funding in order to: effectively utilize resources in areas of joint

ownership; follow a logical sequence of decommissioning activities, meet the intent of DOE directives to remove unencapsulated plutonium-238 from Mound; and to prevent shifting of last-user cost responsibilities as agreed to in the NE/OMA Memorandum of Understanding.

2. Removal of internal glovebox equipment and services prior to packaging.

3. Contamination in the PP&R Buildings' inactive areas reduced to "as low as reasonably achievable" (ALARA)[1] for reuse with minimal restrictions (restricted release). As complete demolition is planned for the Waste Transfer System, it should be possible to reduce contamination to near unrestricted levels[2] for soil (conditional release).

4. The TEC is based on an engineering assessment of techniques to be employed and the physical conditions of the buildings and laboratories. It assumes that contamination at the gloveboxes will be limited to the grouting under the gloveboxes; that removal of a single layer of the concrete floor slab, followed by sealing, will contain any remaining low-level contamination; and that the final level of contamination will meet DOE criteria.

---

[1]The final exposed average contamination levels in these facilities after decontamination and sealing will be:
Wipe - ≤20 dis/min/100 cm^2
Direct - ≤1500 dis/min/100 cm^2
External Radiation -≤ 1 mr/hr at surface
The lower limit ALARA goal for final exposed average contamination levels in these facilities <u>after</u> decontamination but <u>before</u> sealing will be:
Wipe - ≤20 dis/min/100 cm^2
Direct - ≤850 dis/min/100 cm^2
External Radiation - ≤1 mr/hr at surface

[2]A level of 100 pCi/g is the goal of remedial action of near surface (first 12 inches) soil. A lower limit of 25 pCi/g is the goal for ALARA evaluations.

5. No significant (which requires removal) contamination (radioactive or hazardous) exists under the buildings.

6. The removal of contaminated soil associated with previous leakage of contamination from the underground piping of the Waste Transfer System (WTS) assumes that contamination is limited to radioactive contamination and no hazardous soil contamination is involved; removal of radioactive contamination is limited to the vicinity of the underground piping and the hillside between the Waste Disposal (WD) Building and Building 41; that other radioactive contamination (on site and off site) associated with previous leakages of the underground piping do not require removal, and that current soil removal criteria remains unchanged. The current estimate does not provide for pursuing contamination into the bedrock, nor in the soil along the top of the bedrock for any distance. Identification of such a need would require additional funds beyond those requested.

7. The general qualifications and assumptions apply concerning: the use of existing transportation modes for the waste; the acceptability of waste containers (form and size); the acceptability of packaging materials and waste form within containers; the acceptability of existing radiation and emission standards relative to the increased emphasis on "as low as reasonably achievable" (ALARA); and the availability of burial sites.

8. No funding is required for specific NEPA compliance, as a site-wide Environmental Impact Statement is applicable to this work.

9. Contingency is included at approximately 18.6% of the remaining costs. Contingency for the Research (R) Building project is assumed to be adequate at 15.0% based on historical decommissioning information. Contingency for the Plutonium Processing (PP) Building project is assumed to be adequate at 17.5% based on the complexity of future structural decontamination. Contingency for the Waste Transfer System (WTS) project is assumed to be adequate at 20.0% based on the uncertainties in predetermining the extent of nonhomogeneous underground soil contamination. Current estimates of remaining soil contamination (166,000 $ft.^3$) are based on radiological characterization data (128,000 $ft.^3$) and a 30% expansion factor (38,000 $ft.^3$) based on historical decommissioning information.

10. The TEC does not include maintenance and surveillance costs beyond the project completion date of FY 1990 because it is anticipated that these buildings will be utilized in other DOE programs.

CURRENT STATUS

Significant progress has been made to date in the Decontamination and Decommissioning of the inactive areas of PP and R Buildings and the Waste Transfer System (WTS). The D&D objectives have been accomplished as planned with:

- No hazards to personnel, facilities, or environment (no significant injuries, radiation exposures, or releases).
- Continued identification and reduction of unencapsulated Pu-238 inventory at Mound (1783 grams or approximately 30,000 curies measured and removed through FY 1986).
- Areas are being completed (R127, R128, R130, R131, R143, R145/147, R159B, and R198 Laboratories released for reuse and 282 gloveboxes (1,100 linear feet) stripped, removed, packaged, and sent for disposal with an additional 8 gloveboxes cleaned and stripped for reuse to date).
- Removal of the PP Conveyor System completed (930 linear feet removed).
- Removal of underground lines completed (5,130 linear feet removed).
- The overall project was approximately 75% complete at the end of FY 1986.

FY 1986 ACCOMPLISHMENTS

A. ANSPD (NE) D&D PROGRAM

- REMOVAL OF CONTAMINATED SOIL ASSOCIATED WITH WTS UNDERGROUND LINE CONTINUED.
- WTS UNDERGROUND LINE REMOVAL PHASE COMPLETED (244 linear feet removed-5129 linear feet LTD).
- WTS BUILDING 41 UNDERGROUND TANKS REMOVED.

B. OMA NEW GENERAL AND COMMON SUPPORT AREAS

- STRUCTURAL DECONTAMINATION PHASE INITIATED AND COMPLETED IN FIFTEEN PP BUILDING LABORATORIES AND SUPPORT AREAS (PP-6W, 51, 52, 102, 103, 105, 106, 119, 121, 122, 135, 140, 143, 144 and 145).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.
- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, service line removal, size reduction, soil removal, and waste packaging).
- CONTACT BEING MAINTAINED WITH LEAD D&D CONTRACTORS (NATIONAL AND INTERNATIONAL) ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.
- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN AND BASELINE UPDATE INITIATED.

FUTURE PLANS

As the structural decontamination phase is completed in each of the laboratories in R Building, these areas become available for new occupants (beginning in FY 1981).

Since the D&D Program involves almost all of the areas in PP Building (as opposed to isolated rooms in R Building), the D&D areas will not be ready for new occupants until the end of the Program. The following two figures show conceptually what the building will look like when D&D is completed.

The continuing radioactive operations on the second floor of PP Building and the building's radiological support functions on the first floor will be located within an inverted U-shape low-risk or normal radiological control area. The remaining areas of the PP Building will be under minimum radiological control[1] and negative filtered ventilation in order to provide assurance of confinement of residual contamination should migration occur.

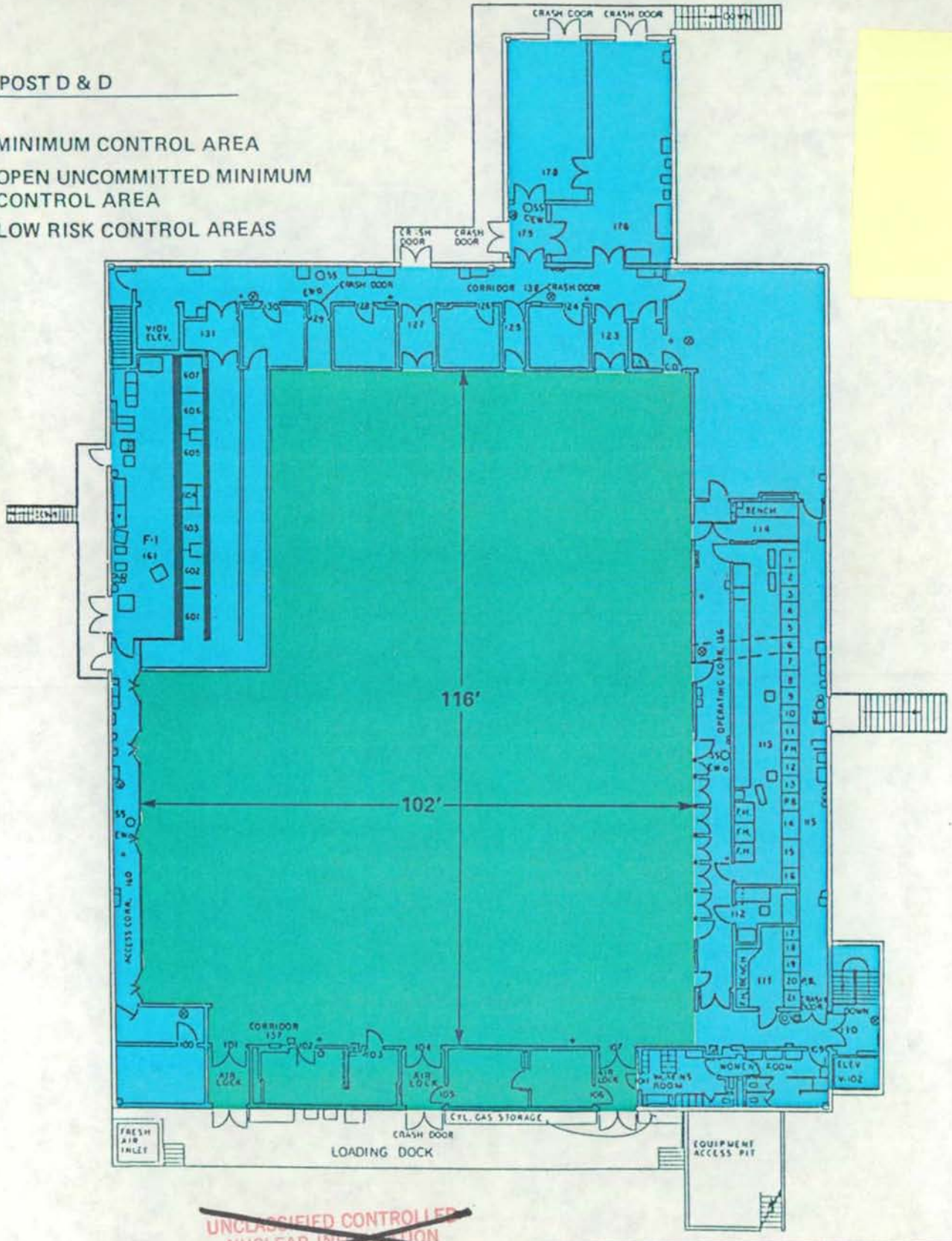
Most of the second floor minimum control area will be open and is uncommitted at this time. The area would be available for nonradioactive work or for radioactive work by connecting onto the inverted U or low-risk control area.

A large portion of the first floor equipment area will also be open for either radioactive or nonradioactive work.

[1]Minimum radiological control refers to air sampling, wipe and direct monitoring to verify that any residual contamination remains sealed. Special radiological clothing should not be required in these areas but personnel will monitor their hands and feet when exiting the building.

LEGEND - POST D & D

- MINIMUM CONTROL AREA
- OPEN UNCOMMITTED MINIMUM CONTROL AREA
- LOW RISK CONTROL AREAS



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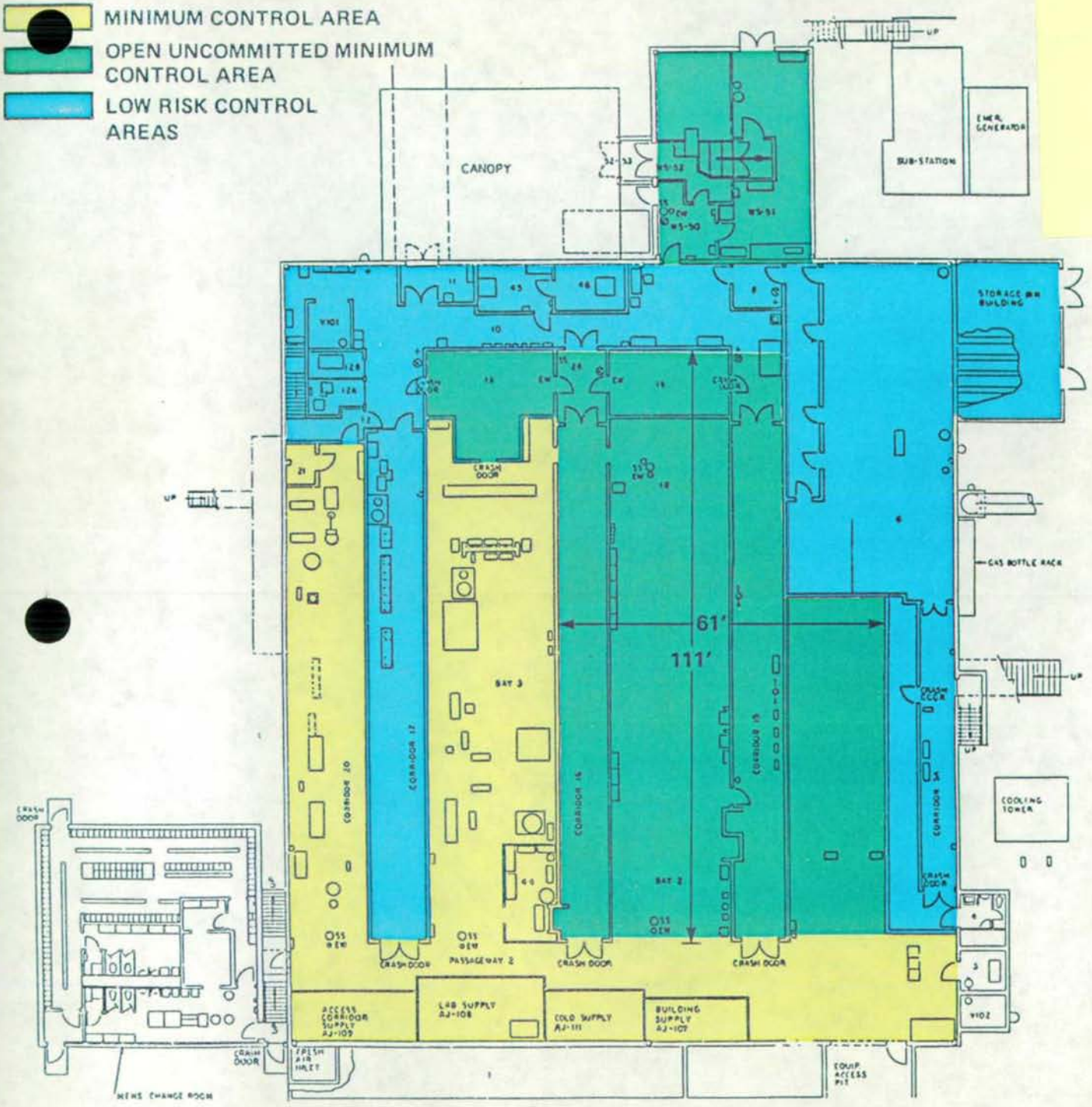
MONSANTO RESEARCH CORPORATION
MOUND
MIAMISBURG, OHIO

BLDG. 38
PLUTONIUM PROCESSING
2ND FLOOR

LEGEND

- MINIMUM CONTROL AREA
- OPEN UNCOMMITTED MINIMUM CONTROL AREA
- LOW RISK CONTROL AREAS



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BLDG. 38
PLUTONIUM PROCESSING
1ST FLOOR

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OBJECTIVES

COORDINATED ANSPD(NE) AND OMA

DECONTAMINATION AND DECOMMISSIONING (D&D) PROGRAM PLAN

MONSANTO RESEARCH CORPORATION

MOUND

I. PROGRAM OBJECTIVES

This program involves the coordinated funding and extensive decontamination and decommissioning (D&D) of inactive radioactively contaminated areas at Mound (Figure 1) that were last operated by Advanced Nuclear Systems and Projects Division (ANSPD) and the Office of Military Applications (OMA). The responsibility for the inactive ANSPD areas was assumed by the Office of Nuclear Energy - Waste Management (NE) in FY1981.

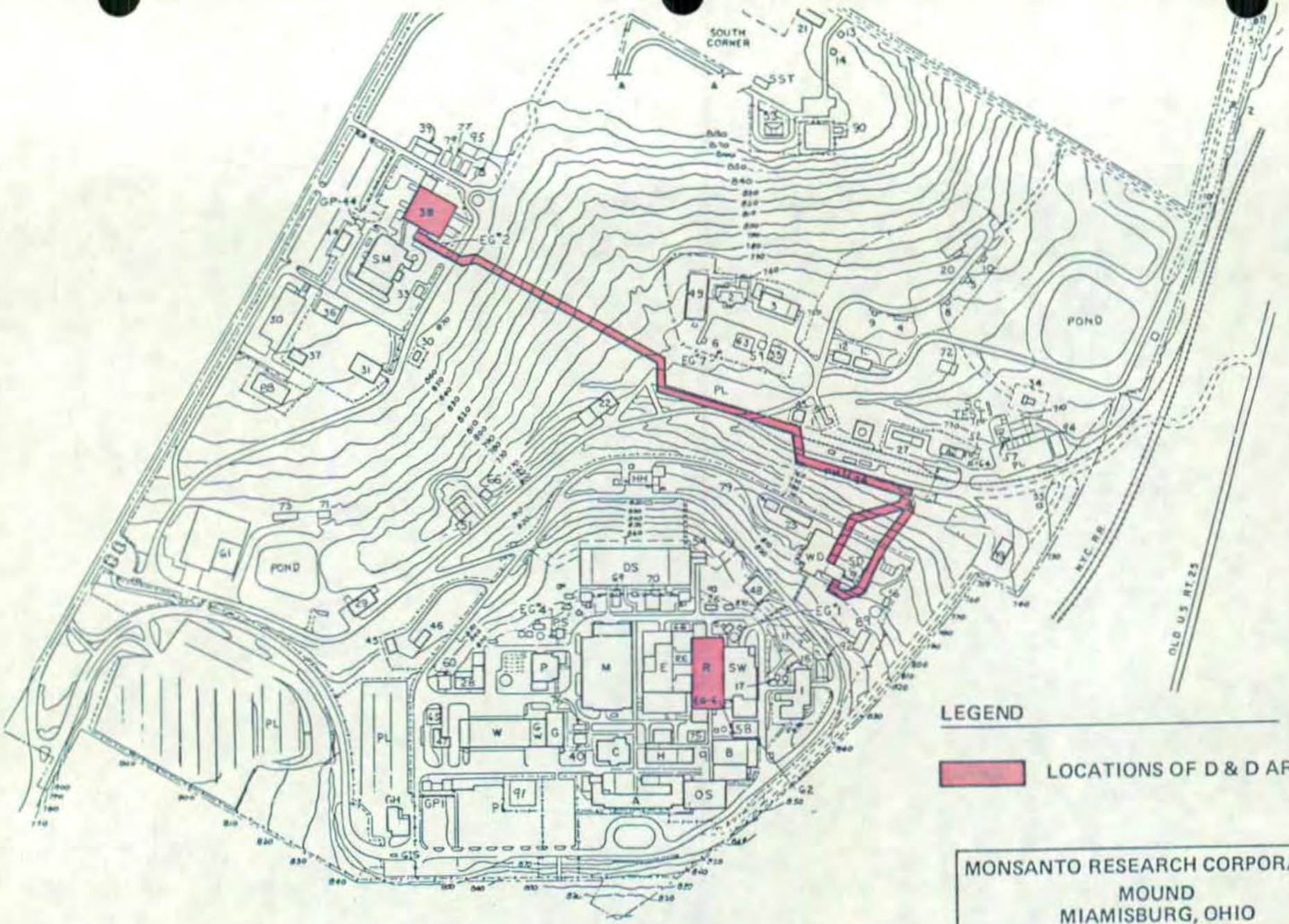
These inactive laboratories and related support laboratories and areas are:

ANSPD(NE) INACTIVE AREAS

- Plutonium Processing (PP) Building[1] -- Laboratories A1, A2, B1, C1, C2, C3. C4, E1A, F1 (part), F2, F3, F4, 122, 177, and 178 (Figure 2) and associated services located on the first (Figures 3, 4) and second floors of PP Building (approximately 330 linear feet of gloveboxes).

- Research (R) Building -- Laboratories 120, 127, 130, 131, 143, and 147 andassociated services (Figure 5) - (approximately 320 linear feet of gloveboxes).

[1]PP Building is also called Building 38



LEGEND

LOCATIONS OF D & D AREAS

MONSANTO RESEARCH CORPORATION
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SITE PLAN

Figure 1

LEGEND

- INACTIVE OMA AREA
- INACTIVE ANSPD (NE) AREA
- CONTINUING OPERATIONS

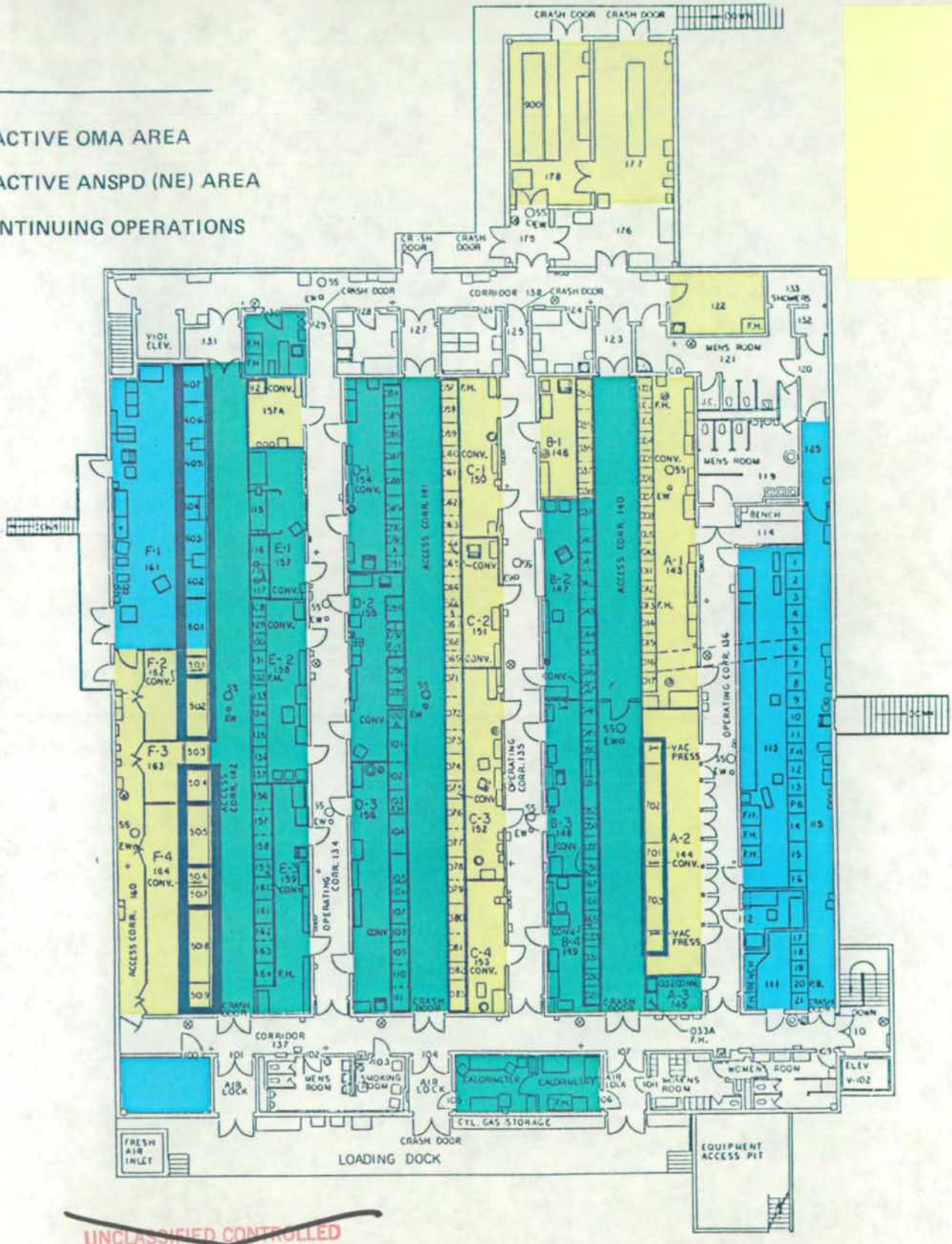

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FIGURE 2

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PLUTONIUM PROCESSING
2ND FLOOR

LEGEND

- INACTIVE OMA AREA
- INACTIVE ANSPD (NE) AREA
- CONTINUING OPERATIONS

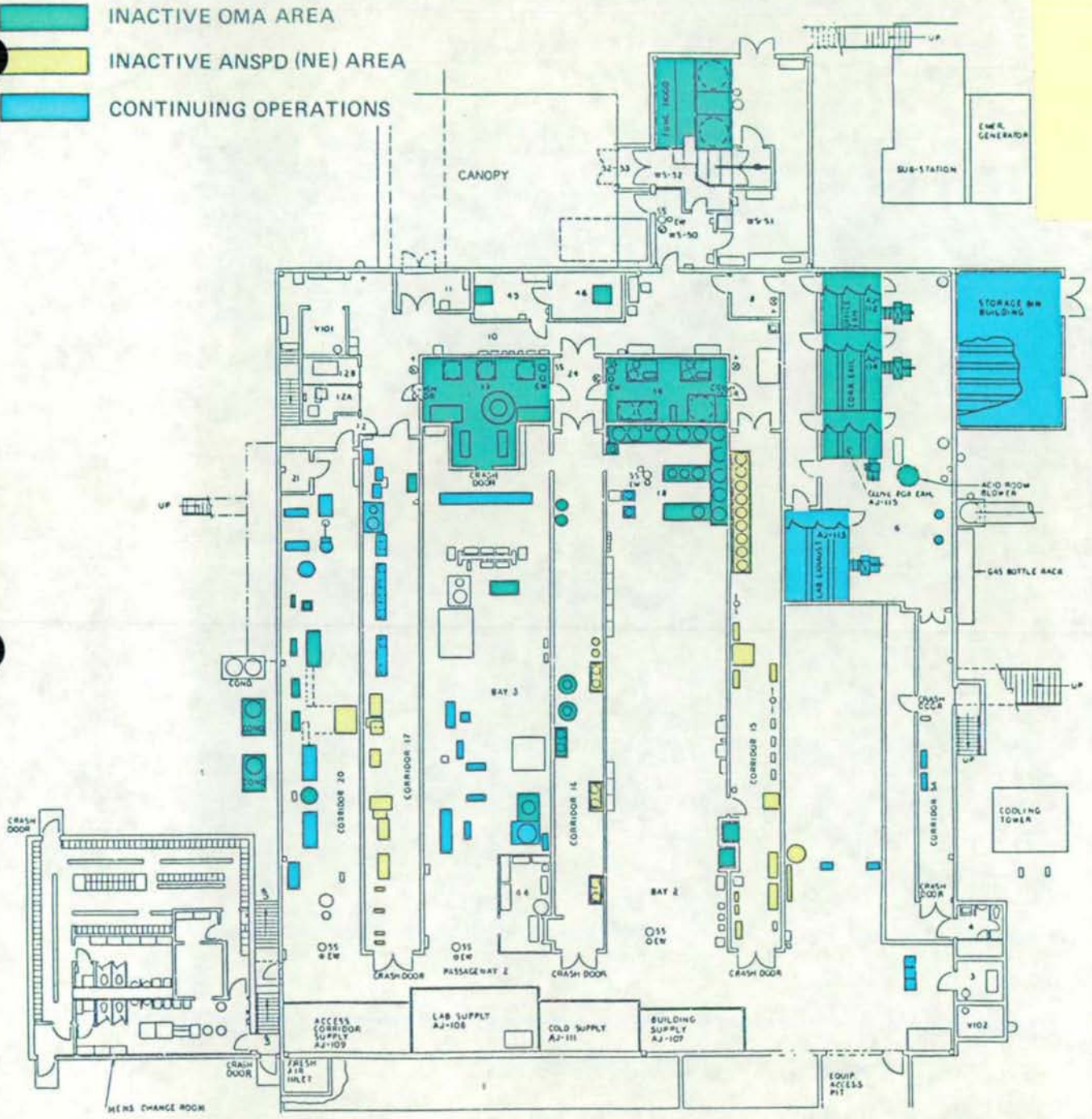

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FIGURE 3

I-4

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BLDG. 38
PLUTONIUM PROCESSING
1ST FLOOR

LEGEND

LOW RISK EQUIPMENT AREA

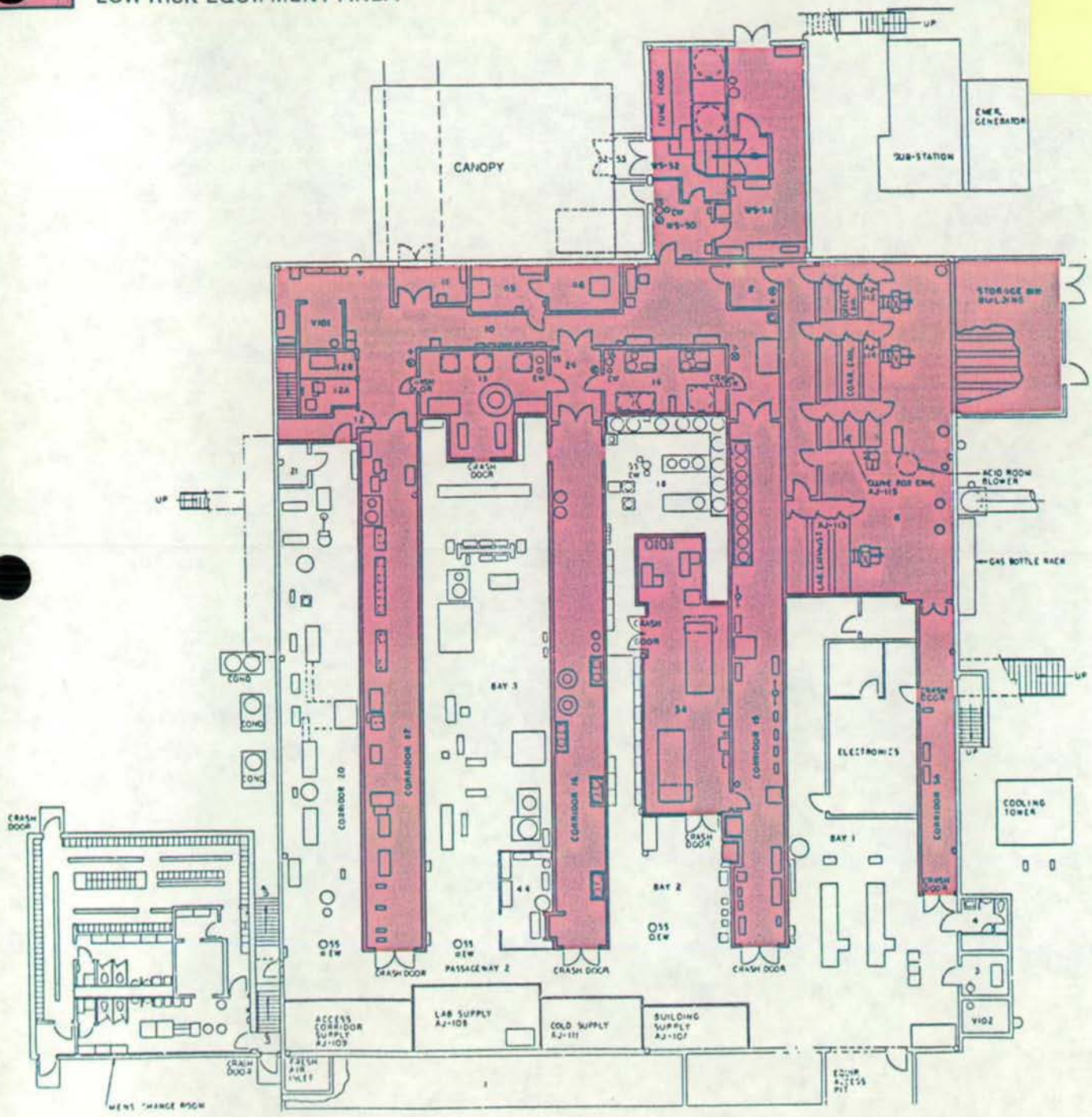

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Figure 4

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PLUTONIUM PROCESSING
1ST FLOOR

LEGEND

INACTIVE OMA AREA

INACTIVE ANSPD (NE) AREA

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FIGURE 5

I-6

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"R" BLDG.
1ST FLOOR

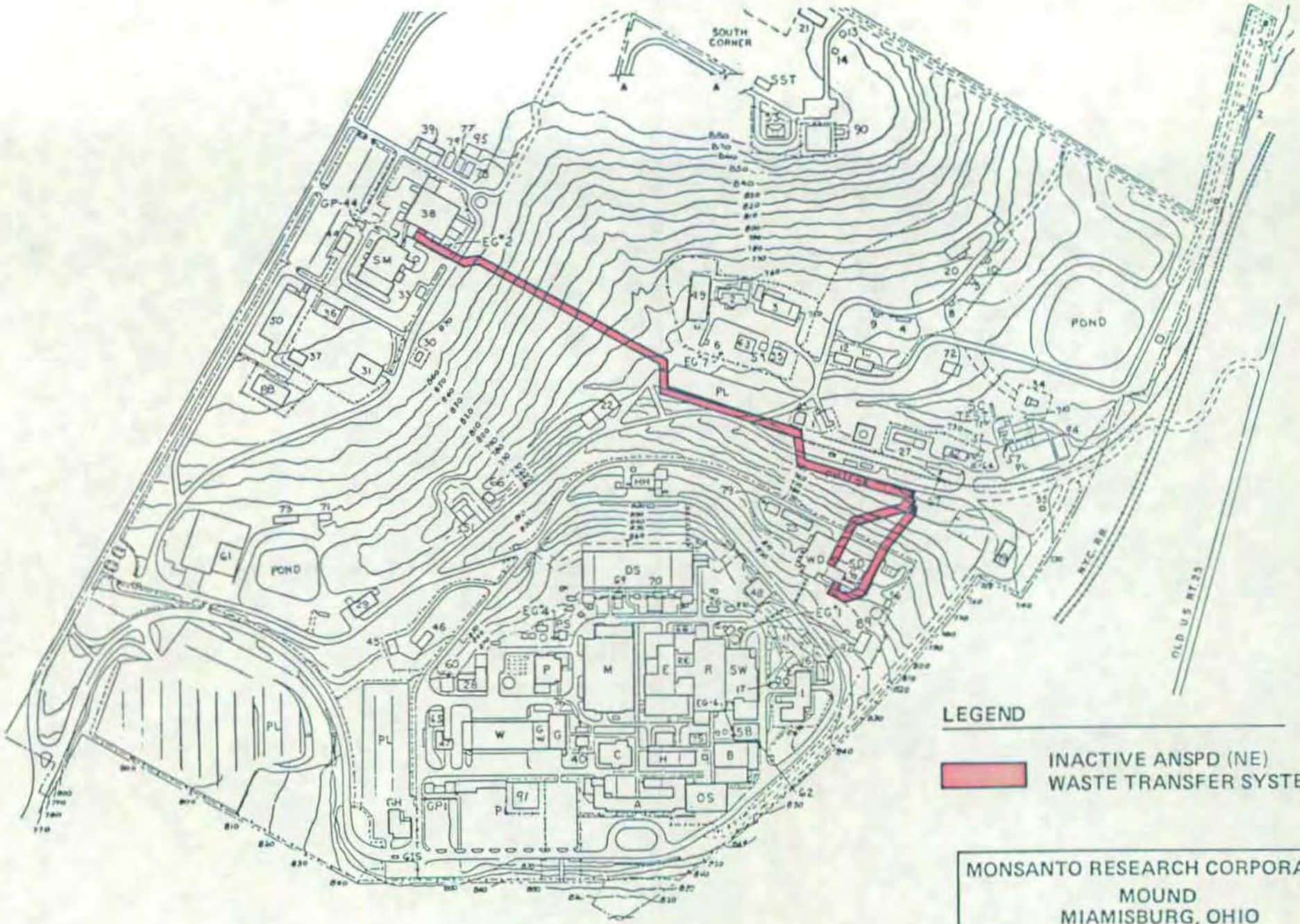

Figure 6

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MIAMISBURG, OHIO

SITE PLAN

- Waste Transfer System (WTS) -- Underground liquid waste transfer lines and lift station (Building 41) from PP Building to the Waste Disposal (WD) Building (Figure 6) - (approximately 5100 linear feet of underground lines).

The ANSPD D&D Program began in FY1978 in these areas.

OMA INACTIVE AREAS

- Plutonium Processing (PP) Building[1] -- Laboratories A3, B2, B3, B4, D1, D2, D3, E1, E2, E3, 111, and 130 (Figure 2) and associated rooms and services located on the first (Figures 3, 4) and second floors of PP Building (approximately 360 linear feet of gloveboxes).

- Research (R) Building -- Laboratory 159 and associated services (Figure 5) - (approximately 100 linear feet of gloveboxes).

The OMA D&D Program began in FY1980 in these areas from plans developed in FY1979.

EXTENSIVE DECONTAMINATION AND DECOMMISSIONING

The extensive decontamination and decommissioning of these inactive plutonium-238 contaminated areas includes the cleaning and removal of internal glovebox equipment and services, removal of the gloveboxes, removal of associated laboratory equipment and services, extensive structural decontamination and disposal of wastes from the PP and R Buildings. Contamination in the inactive areas would be reduced to an "as low as reasonably achievable" (ALARA) level[2], and remaining contamination would be permanently sealed so that the areas could be reused with minimal restrictions (restricted release).

---

[1]PP Buildings is also called Building 38

[2]The final exposed average contamination levels in these facilities after decontamination, and sealing will be:

Wipe - ≤ 20 dis/min/100 cm^2
Direct - ≤ 1500 dis/min/100 cm^2
External Radiation - ≤ 1 mr/hr at surface

As complete removal is planned for the Waste Transfer System and surrounding contaminated soil, it should be possible to reduce the contamination level to near unrestricted levels[1] for soil (conditional release).

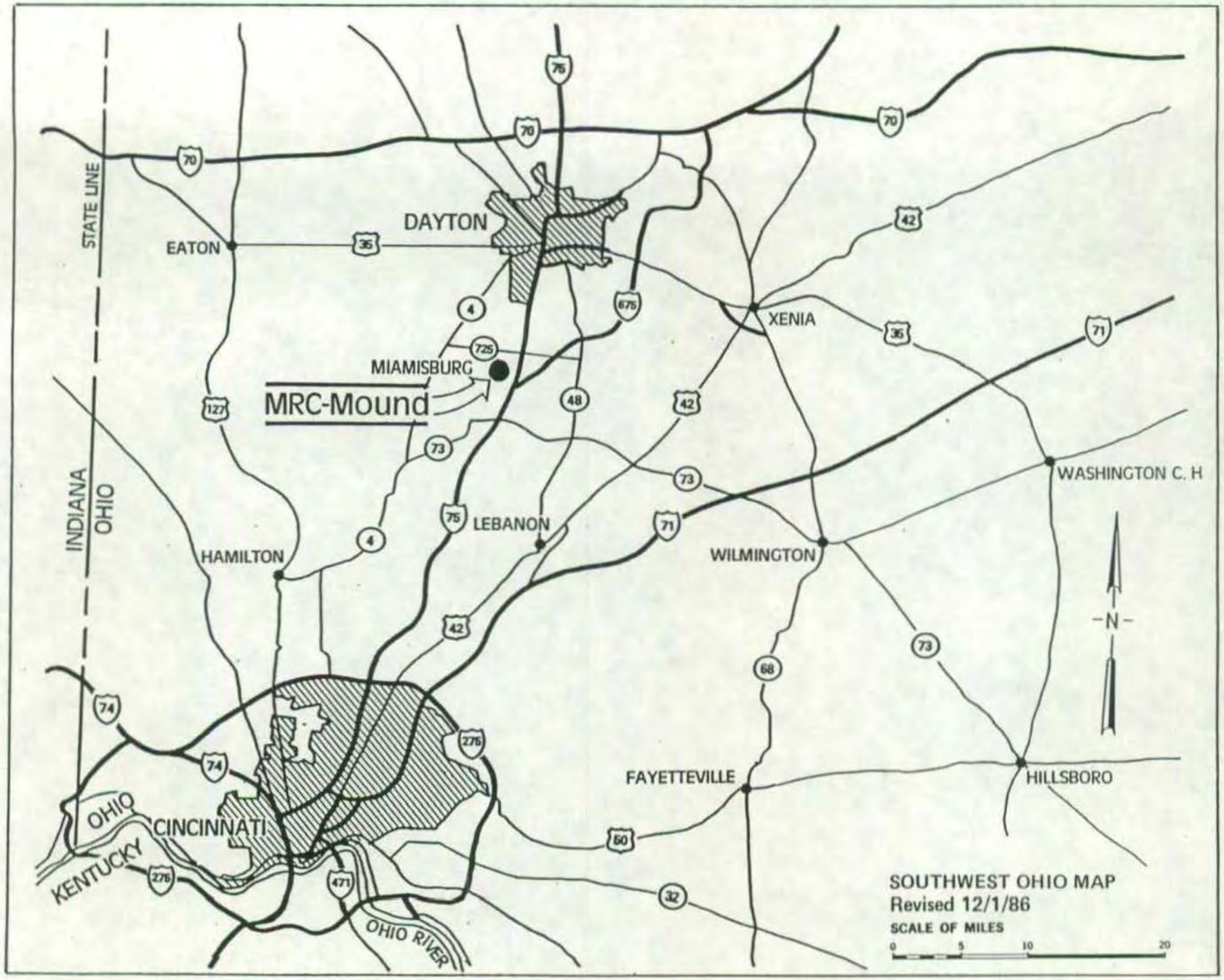
A. Justification

Because of a DOE concern for the presence of large quantities of unencapsulated plutonium-238 in facilities that do not meet current plutonium design criteria[2] near a large metropolitan area (see Figures 7,8), a directive was issued to remove all large quantities of unencapsulated plutonium-238 from Mound as soon as reasonably possible.

In order to meet the intent of this directive, the following actions were taken:

- Reprocessing (recovery) of large ANSPD unencapsulated plutonium-238 quantities ended in FY1975 and inactive areas were placed in standby in FY1976.
- Processing of large ANSPD unencapsulated plutonium-238 quantities ended in FY1977 with D&D of these areas and the reprocessing areas beginning in FY1978.
- Processing of large OMA unencapsulated plutonium-238 quantities ended in FY1979 with D&D planning initiated in FY1979 and actual D&D beginning in FY1980.
- D&D was initiated to remove the remaining large quantities of plutonium-238 in gloveboxes, equipment, and services and any significant structural contamination.

[1] A level of 100 pCi/g is the goal of remedial action of near surface (first 12 inches) soil. A lower limit of 25 pCi/g is the goal for ALARA evaluations.
[2] DOE Order 6430 "General Design Criteria Manual"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DAYTON
MIAMISBURG
MRC-Mound
XENIA
WASHINGTON C. H
HAMILTON
LEBANON
WILMINGTON
FAYETTEVILLE
HILLSBORO
CINCINNATI
OHIO
KENTUCKY
OHIO RIVER
-N-
SOUTHWEST OHIO MAP
Revised 12/1/86
SCALE OF MILES
0
5
10
20

FIGURE 7

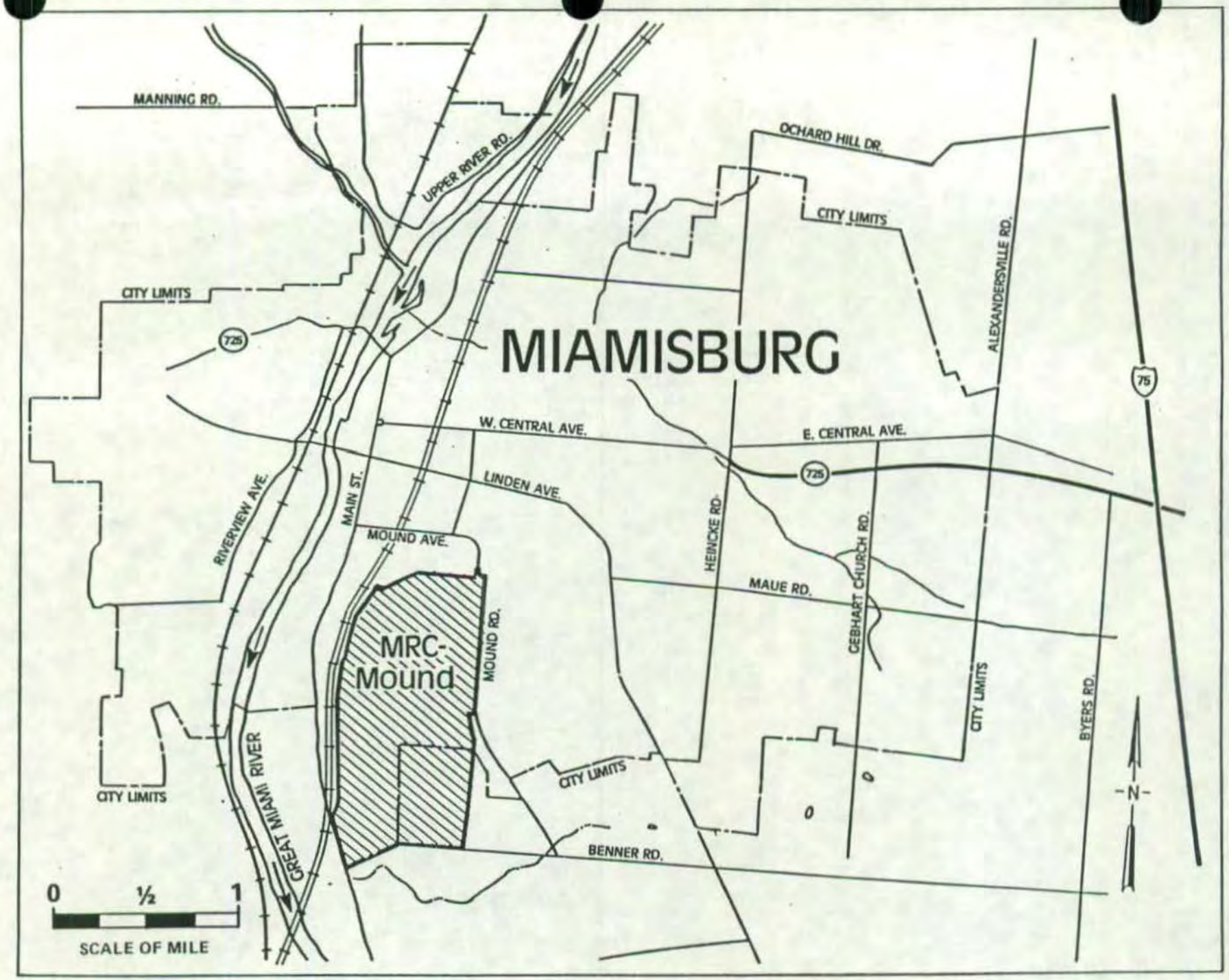
MIAMISBURG
MANNING RD.
UPPER RIVER RD.
OCHARD HILL DR.
CITY LIMITS
CITY LIMITS
ALEXANDERSVILLE RD.
725
75
W. CENTRAL AVE.
E. CENTRAL AVE.
725
LINDEN AVE.
RIVERVIEW AVE.
MAIN ST.
MOUND AVE.
HEINCKE RD.
CEBHART CHURCH RD.
MAUE RD.
MRC-
Mound
MOUND RD.
CITY LIMITS
BYERS RD.
CITY LIMITS
CITY LIMITS
GREAT MIAMI RIVER
BENNER RD.
N
0
½
1
SCALE OF MILE

FIGURE 8

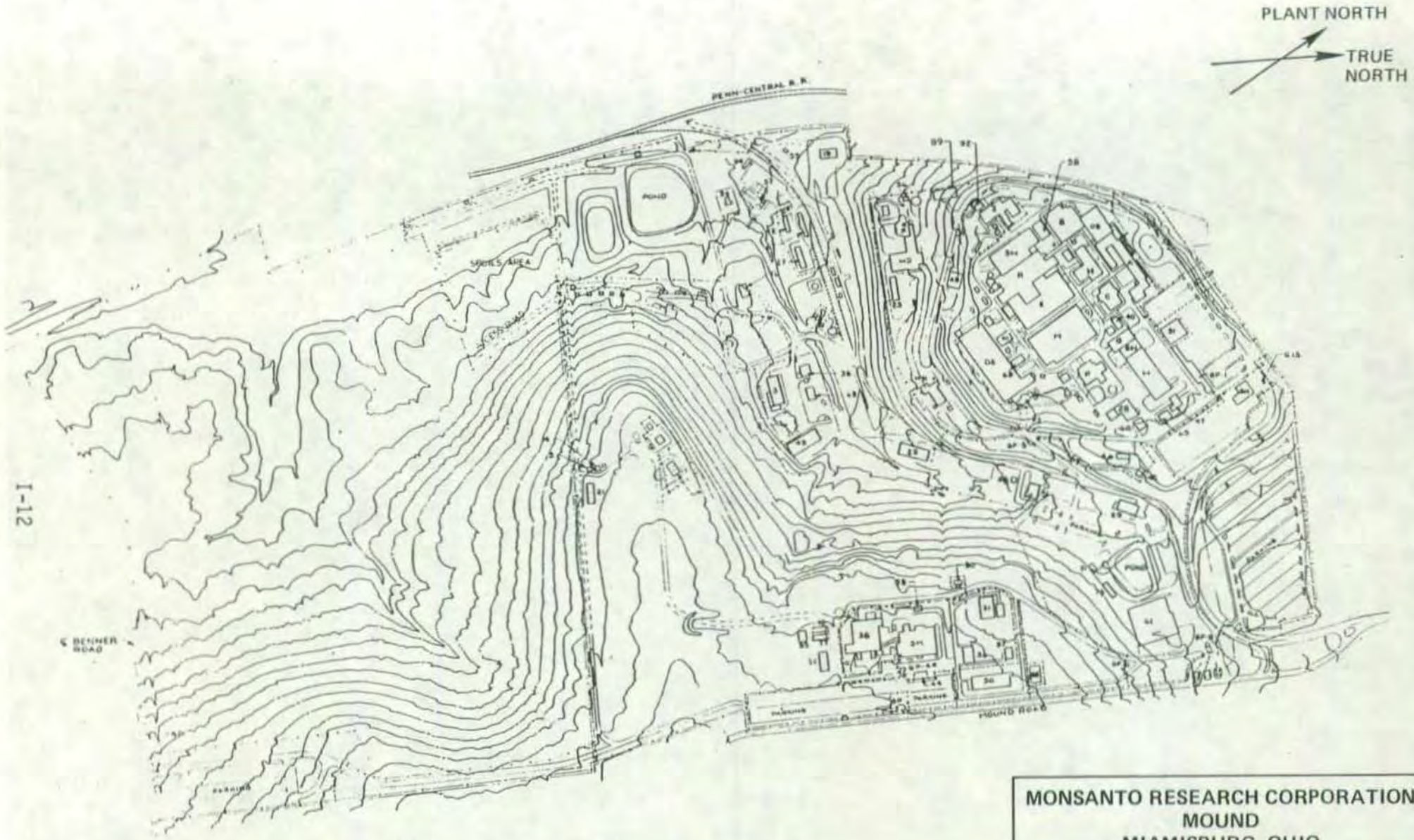

FIGURE 9

MONSANTO RESEARCH CORPORATION
MOUND
MIAMISBURG, OHIO

TOTAL SITE PLAN

B. Disposition Modes Considered

Beginning in FY 1975, an ongoing evaluation of various disposition (D&D) modes was made. The primary modes were:

- Readiness
- Partial Decontamination (standby)
- Extensive Decontamination
- Complete Decontamination

These modes were defined as:

1. Readiness: A condition that will permit full operation of a laboratory within a short period of time (one calendar quarter or less) after notification and with a minimum expenditure of funds. All operating equipment will remain in place and routine maintenance will be performed. No wipable contamination would exist in the laboratory areas. However, the average wipe level in the high risk areas, such as access corridors and building system equipment areas, would be reduced to 2200 dis/min per 100 cm^2 (dpm/100 cm^2).

This readiness condition applies to the physical plant only. Unless a commitment is also made to hold trained personnel, the staff will be reduced by layoff and transfer. A return of full operation presupposes the immediate availability of a nucleus of trained personnel. Loss of staff nucleus would lengthen operational readiness requirement from one quarter to one full year.

Operations to achieve this state are:

a. General cleaning of readily accessible areas and surfaces with gloveboxes, access corridors, and laboratory areas.

b. Flushing of process lines and vessels.

c. Changing of all glovebox gloves and filters.

d. Disposing of scrap and waste materials resulting from cleanup activities.

e. Servicing of operating equipment. This will include frequent operation of inline processing equipment to ensure its operability at all times.

f. All major building support equipment will be kept operating. The major building support equipment includes the house vacuum, corrosive vapor, process chill water, and building ventilation systems. The emergency power system will be maintained and checked to ensure operability at all times.

g. Changing of all inert atmosphere boxes to an air supply to minimize procurement costs of inert gases.

h. Changing of appropriate building exhaust filters for areas to be placed in state-of-readiness.

This condition may be maintained for a period of time not to exceed three years. By the end of this three-year period, this readiness condition will be reevaluated for one of the following options:

1) Areas to be put back into operation.

2) Areas to be partially decontaminated (standby).

3) Areas to be extensively decontaminated.

4) Areas to be decommissioned.

2. Partial Decontamination (standby): A condition that will permit full operation of a laboratory within a moderate period of time (within one year or less) after notification and with a reasonable expenditure of funds. The average wipe levels in the high risk areas would be reduced to 220 dis/min per 100 cm^2. Again, laboratory areas still exist because gloveboxes would be

in place. Therefore, the laboratory areas would be left with no wipable contamination.

Operations required to achieve this standby condition include those operations stated in the above readiness state, plus the following:

a. More thorough cleaning of the gloveboxes, including all glovebox wells.

b. Removal of all degradable materials and equipment from gloveboxes and support equipment. This includes materials and equipment that would not normally be expected to remain operational for the duration of the standby condition. This degradable equipment would include, for instance, electric motors, valves, and glass components.

c. Changing of all glovebox gaskets, both front and rear. The required building ventilation system and Health Physics monitoring equipment will be maintained and serviced, in order to maintain radiological control of the facility. In addition, the emergency power systems will be maintained and checked to ensure operability at all times.

The state of partial decontamination (standby) may be maintained as long as the radiological safety of the environment is ensured.

3. Extensive Decontamination: Extensive decontamination includes the removal of internal glovebox piping and services, the gloveboxes themselves, and associated external equipment and services, and an intensive structural decontamination of the facility to "as low as reasonably achievable" levels. Since complete decontamination for unrestricted use would require removal of the entire structure, the facility will be left "tainted", i.e., small amounts

of sealed (fixed) residual contamination would remain. The building would remain under minimal radiological control and negative air pressure to protect personnel and the environment from any migration of contamination.

The final exposed average contamination levels in the facilities after this decontamination and sealing will be:

Wipe - ≤ 20 dis/min/100 cm^2

Direct - ≤ 1500 dis/min/100 cm^2

External Radiation - ≤ 1 mr/hr at surface

Since there is no identifiable need for the ANSPD(NE) or OMA "Inactive Areas", there was not any need to place these areas in a "readiness" or "partial decontamination" condition. Therefore, the purpose of the planning and D&D was to place these areas in an "extensive decontamination" condition.

4. Complete Decontamination and Decommissioning: Complete decontamination and decommissioning (uncontaminated or unrestricted condition) was not considered since this would require demolition[1] of the PP and R Buildings which are used for other ongoing programs and could be used for future programs. However, complete D&D was considered the only feasible approach for the Waste Transfer System which is unusable.

In summary, planning for D&D and evaluating various disposition conditions of "Inactive Areas" at Mound was formally started as early as 1975. This planning and evaluation continues today and will continue as the DOE D&D "state of the art" technology improves.

[1]Because of known and potential contamination (in structural members, underneath the facilities, and in cracks and crevices) and the inability to detect and remove this contamination.

Ultimate disposition of these areas depend on:

- Environmental, Safety, and Health Considerations
- Risks
- Benefits
- Costs
- Programmatic Needs
- Technical Feasibility

C. Description of Projects

The extensive decontamination and decommissioning of the inactive ANSPD(NE)/OMA areas at Mound involves three separate facilities. These facilities are: 1) portions of the Plutonium Processing (PP) Building (38); 2) portions of the Research (R) Building; and 3) the Waste Transfer System (WTS), including Building 41. The locations of these facilities are shown in Figure 10.

1. Site Description

Mound (formerly known as Mound Facility/Laboratory) was established in 1946 on a 728,000-m^2 (180-acre)[1] untillable portion of a farm which was adjacent to the City of Miamisburg, Ohio. Mound is operated for the Department of Energy (DOE) with the principal purposes being the manufacture of chemical explosive detonators, explosive timers, explosive-actuated transducers, explosive switches, and heat sources fueled with plutonium-238; surveillance of detonators and cables and of components containing radioactive materials; separation, purification, and sale of stable (nonradioactive) isotopes of noble gases, carbon, and several other elements of interest to the scientific

[1]An additional 123 acres of land adjacent to the southern site boundary was purchased by DOE in 1982.

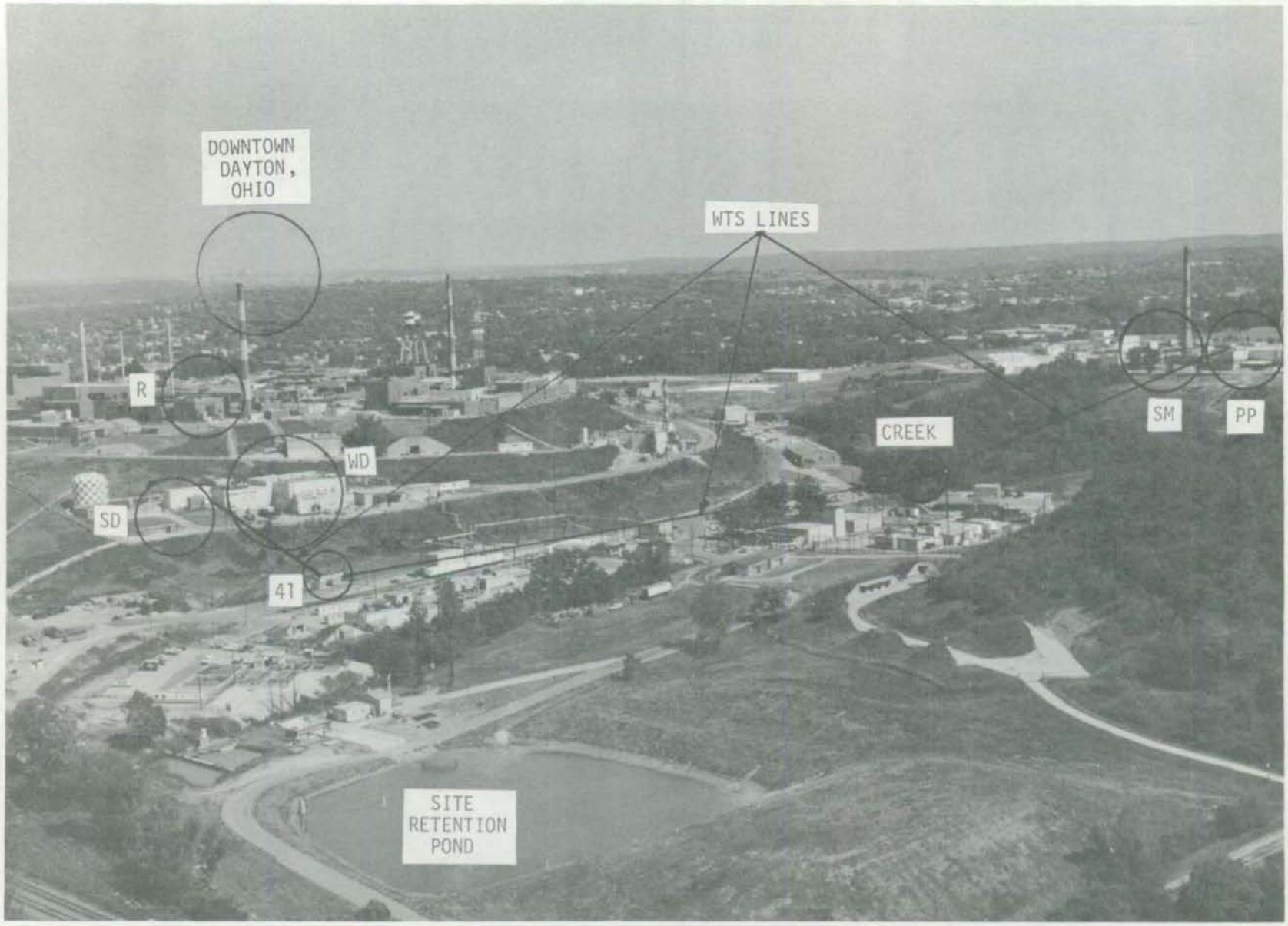

FIGURE 10 LOOKING NORTHEAST

community; recovery of tritium from wastes generated, and the peaceful applications of atomic energy.

Most of the buildings house the administrative, manufacturing, development, surveillance, and support activities. An area for the burning of small amounts of high explosives is on the sourthern edge of the plant site. The sewage treatment plant is located in the west central part of the site. As a result of operations at Mound, some of the buildings have been contaminated with radioactive materials to an extent that they require decontamination before they would be suitable for other types of operations.

Mound is located in the suburban Dayton area of Montgomery County, Ohio. The plant is bordered by agricultural lands on the south. Land to the north, east, and west of the plant site is residential housing.

2. Building Description

a. Plutonium Processing (PP) Building

The PP Building (#38) is a two-floor (38,000 ft^2) reinforced concrete block building built in 1967. Radiochemical (primarily plutonium-238) processing operations began in 1968. These operations included process development, process engineering, production operations, encapsulation, scrap recycling, material transfer, waste handling, measurement, and analytical activities primarily for the production of ANSPD heat sources (SNAP, RITE, PACEMAKER, PIONEER, TRANSIT, VIKING, MULTIHUNDRED WATT). Similar operations were later performed for the production of OMA heat sources (MILLIWATT GENERATOR) beginning in the mid seventies.

Most of the building became inactive when unencapsulated plutonium-238 operations were relocated to other sites leaving two laboratories (PP-113 North Analytical Laboratory and PP-F1 Encapsulation Laboratory) in operation. These two remaining primary laboratories have only encapsulated plutonium-238 or small quantities of other isotopes. The other 27 out of 29 laboratories and support areas are in various stages of D&D and encompass 37,000 ft^2 out of the 42,000 ft^2 building area.

The processing operations were performed in gloveboxes on the second floor of the building with associated support equipment and services on the first floor. Appendix A-1, 2, and 3 show three typical gloveboxes that were used for processing operations (unshielded fiberglass gloveboxes, 4-in. shielded stainless steel gloveboxes, and 12- to 16 in. shielded stainless steel manipulator gloveboxes). These gloveboxes were connected by a continuous overhead conveyor. Primary services on the first floor were waste processing and packaging, ventilation, material (liquid) transfer, electrical distribution, and process services such as chilled and tempered water, acid/caustic supply, corrosive vapor, house vacuum, breathing air, and gas supply.

b. Research (R) Building

The R Building is a one-floor (54,000 ft^2) concrete block and brick building built in 1948. Radiochemical processing and research and development operations began in 1949. The current inactive laboratory areas were last used to support ANSPD/OMA operations in PP Building. The seven laboratories became inactive when unencapsulated plutonium-238 operations were relocated to other sites and the 6,000 ft^2 inactive area is in various stages

of D&D. The remaining portion of the building is still active for both radioactive and non-radioactive operations. The processing and research and development functions were performed in gloveboxes in the laboratories with associated support equipment and services in the laboratory or the overhead crawlspace. Appendix A-4 shows a typical R-Building glovebox.

c. Waste Transfer System (WTS)

The Waste Transfer System is an inactive underground liquid waste transfer system built in 1967 consisting of two underground lines (2,565 ft each) buried from 6 to 23 ft below ground and a one-level concrete block lift station (Building 41) with two underground tanks. Appendix A-5 shows where the underground lines cross a creek.

The system transferred liquid wastes generated in PP Building by gravity to Building 41 where the liquid waste was then pumped to the Waste Disposal (WD) Building for further processing. The system was abandoned (high risk in 1974, low risk in 1976) after several leaks developed in the underground lines and caused the surrounding soil to become contaminated; this contamination was subsequently released offsite via natural rain runoff. From that time, liquid waste from PP Building was then either absorbed in the PP Building or sent to the WD Building via a tanker truck.

3. Project Description

The decontamination and decommissioning (D&D) of the inactive ANSPD(NE)/OMA areas at Mound involves three separate facilities:

- Extensive D&D of most of the PP Building
- Extensive D&D of isolated laboratory rooms in the R Building
- Complete D&D of the Waste Transfer System

The D&D of a typical glovebox facility (PP or R Building) is accomplished in two phases — Glovebox Removal (GBR) and Structural Decontamination (SD).

a. Glovebox Removal (GBR) Phase

1) Cleaning and Preparation: The gloveboxes and their process equipment and piping are thoroughly cleaned to remove as much plutonium-238 as economically feasible and to minimize the spread of contamination during later decommissioning steps. Then all superfluous materials (desks, cabinets, shielding, uncontaminated equipment) are removed from the laboratory.

2) Glovebox Stripping: After the gloveboxes are cleaned, all external services (except for ventilation) are disconnected and blanked off. These include house vacuum, corrosive vapor exhaust, compressed gases, acids, product and liquid waste transfer lines, distilled water, and chilled water. At this time, these services are cut back only to the extent necessary to facilitate removal of the gloveboxes or equipment. Because some of these service lines are radioactively contaminated internally, a contamination control technique such as fixation, bagging or use of a temporary enclosure is required at each severance point to maintain radiological control.

Next the inner floor of the two-level gloveboxes in PP Building are plasma cut to gain access to the lower glovebox well for cleaning. All internal glovebox equipment (such as evaporators, dissolvers, tanks, furnaces, and piping) is removed via special ventilated temporary enclosures (plastic tents - see Appendix A) to control contamination spread. After removal, the equipment is packaged for disposal.

3) Glovebox Removal: The stripped glovebox is cleaned again, and the internal area of the glovebox is coated with a thin layer of foam which sets up rigidly to secure any residual contamination within the glovebox. The ventilation supply and exhaust lines are disconnected and blanked off. Each glovebox is separated from the adjoining glovebox, sectioned if larger than the waste package, and packaged according to Mound, DOE, and DOT regulations for subsequent shipment.

b. Structural Decontamination (SD) Phase

1) Structural Decontamination - Services: After the gloveboxes have been removed, the remaining services and support equipment are removed back to their point of origin (including penetrations through walls, ceilings, and floors).

2) Structural Decontamination - Room: The vacated area is now decontaminated to "as low as reasonably achievable" by removing a layer of material from walls, ceilings, and floors, and removing doors and windows in potentially contaminated areas.

3) Structural Decontamination - Isolation: After the area has been decontaminated as much as practicable and radiologically monitored, a "permanent" isolation barrier is installed on all surfaces to seal any remaining contamination and prevent future migration. Surveillance services (air sampling, fire detection and protection, lighting, electrical, negative pressure filtered ventilation, and drains) are then installed. The final radiological release survey is then taken and the certification report is issued.

This procedure is referred to as "extensive decontamination and decommissioning." The final average contamination levels in the PP and R Building, after sealing, will be:

Wipe - ≤20 dis/min/100 cm^2

Direct - ≤1500 dis/min/100 cm^2

External Radiation - ≤1 mr/hr at surface

The filtered ventilation for the decommissioned areas will continue to provide a negative pressure to protect personnel and the environment from any migration of residual contamination. These actions will leave the decommissioned areas in a condition acceptable for either additional encapsulated plutonium-238 work, other radioactive work, or "cold" (non-radioactive) work performed with limited surveillance (monitoring) of the work area. Limited surveillance encompasses air sampling, periodic wipes and direct monitoring to verify that any residual contamination remains fixed.

The complete decontamination and decommissioning of the Waste Transfer System will follow the same general procedure, i.e., Equipment Removal Phase and Decontamination (Facility and Soil Removal) Phases. As complete decomissioning is planned, remaining contamination levels (in the soil) should approach unrestricted levels[1] (conditional release).

D. Schedule of Projects .

During the development of the D&D project schedule, several external factors were considered to minimize any impact that may be related to the D&D Project.

[1]A level of 100 pCi/g is the goal of remedial action of near surface soil (first 12 inches). A lower limit of 25 pCi/g is the goal for ALARA evaluations.

1. Funding Responsibilities

Funding responsibilities were determined based on the last user[1] concept of primary processing and common support areas:

a. Primary Processing Areas: Primary processing areas are laboratories that were dedicated to a particular DOE program agency.

ANSPD areas: PP-A1, A2, B1, C1, C1, C3, C4, E1A, F1 (part), F2, F3, F4, 15, 122, 177, and 178

R-120, 127, 130, 131, 143, and 147

WTS - all areas

OMA areas: PP-B2, B3, D1, D2, E1, E2, and 111

R-159

b. Common Support Areas: Common support areas in PP Building contain common support systems that have been used to support ANSPD and OMA processing programs and that continue to support the D&D of the dedicated inactive ANSPD(NE) and OMA gloveboxes and laboratories. These systems include:

- Glovebox Waste Processing
- Waste Packaging
- Material Transfer
- Ventilation Systems
- Process Systems

These systems include: 187 linear ft of gloveboxes in PP-A3, B4, D3, E3, 13, 14, 16, 52, and 130 laboratories; 930 linear ft of overhead conveyor; major pieces of equipment (fans, pumps, motors, tanks, evaporators,

[1]Original user of most of the PP and R Building laboratories was ANSPD

scrubbers, etc.); miles of piping; and the entire first floor of PP Building along with the major laboratory areas on the second floor. A more detailed description of these common support areas is given in Appendix B.

Responsibility for the D&D of these common support areas rested primarily (70% of total cost) with OMA as last primary user of these systems. Note that the D&D of most of the dedicated ANSPD(NE) and OMA processing gloveboxes had to be accomplished prior to D&D of the common support systems.

2. Coordinated NE/OMA Funding

The D&D schedule is based on coordinated NE/OMA funding to provide the most efficient effort by following a logical sequence of D&D steps in areas of joint ownership rather than performing each program's D&D steps separately and in different time frames. The advantages of this coordinated plan are:

- Lower radiological risk to personnel by reducing the number of high potential D&D jobs or duplication of jobs
- Lower cost because of elimination of duplication of work effort and schedule extension
- Minimized recontamination of cleaned areas by completing an entire area rather than part of an area
- Balanced resources required by avoiding fluctuations
- Retention of experienced plutonium-238 decommissioning personnel

- strippable coatings to facilitate decontamination

- use of "Radiation Control Area Maintenance Permit" (see Appendix D for example)

- use of pneumatic tools to prevent electrical hazards

- burning permits

- fire watches

- special heavy duty transporters to minimize physical lifting and moving

- use of minimal polyurethane foam in equipment and piping to immobilize contamination and shore equipment

- use of "Three-Zone" (high-medium-low potential risk areas) concept to minimize potential spread of contamination

- pre-job conferences of all involved personnel on high potential risk jobs

- various radiological control points (airborne, wipe, gamma, neutron) where operations are stopped and reassessed, if exceeded

- various radiological data exception and trend analysis reports to management

- construction of semi-permanent airlocks for waste container loading and removal

- construction of semi-permanent barriers, walls, and airlocks for contamination control

- use of a portable changeroom and enclosure for outside work

- use of specialized cutting techniques such as plasma torching

- use of low and high pressure cleaning units to facilitate decontamination

- foam permit requiring inspector and monitor

- specially designed platforms for loading contaminated waste safely into waste containers.

- Time required to complete D&D minimized by following a logical D&D sequence.
- Shifts of funding responsibilities prevented.

3. Other Schedule Considerations

The D&D Plan is coordinated with the current DOE programmatic requirements in PP and R Buildings to provide minimum conflict with these ongoing programs. Changes in these other programmatic schedules and requirements may result in corresponding changes in the D&D project schedule and requirements.

The operations required in the D&D activities were weighted according to the potential radiological risk involved in the operation. To minimize the potential for a release of radioactive contamination, the D&D Project Schedule limits the number of higher potential risk operations being performed simultaneously in different areas of the PP Building to no more than two. Because of the type of construction of the R Building, only one higher potential risk operation will be performed at any given time.

The removal of the underground waste transfer system requires proper weather conditions. Although this activity is normally scheduled for May through October of each year, work will be performed during any favorable weather. Also, since these are outside activities, very stringent radiological controls are established to protect the environment and personnel.

The work force in a given area is sized to provide optimum efficiency and safety for the operation being performed. The work force size will be limited by type of operation and physical limitations with the area.

Traffic control and material movements required by this D&D effort are coordinated with, and meet the requirements of, the Nuclear Materials Safeguards Program.

The timing of certain intermediate activities in the current D&D Project Schedule may change as the SM Building Decommissioning (DP) Project continues. These changes may be required to properly coordinate higher potential contamination release activities between the two projects to mimize the overall site potential release risk. However, this should not affect the final completion date of either project.

This D&D Project Schedule is developed with an objective to maintain an even or descending level funding requirement for the project duration; however, the effects of rising costs could impact this objective in future years. The schedule also provides for the effect of reduced ANSPD(NE) funding in FY1980, FY1981, and FY1982 and for OMA's supplemental funding in FY1981.

E. Cost of Projects

Resource requirements for the decontamination and decommissioning of the inactive ANSPD(NE) and OMA areas at Mound are given in Table 1 (on next page) by fiscal year and by individual project in their respective sections. A comparison is made below to previous estimates with an explanation of variances:

	FY88 Budget Submission Costs ($ in millions)	Proposed FY89 Budget Submission Costs ($ in millions)	Total Change ($ in millions)
ANSPD(NE)	36.5	44.3	7.8
OMA	32.7	37.9	5.2
TOTAL	69.2	82.2	13.0

TABLE I

DECONTAMINATION AND DECOMMISSIONING ANSPD (NE) & OMA INACTIVE AREAS

MOUND

BUDGET OBLIGATIONS (BO)

PROGRAM PLAN RESOURCE REQUIREMENTS* BY FISCAL YEAR

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTALS
PP,R WTS														
NE(ANSPD)														
Dollars (x1000)	3000	3000	1500[2]	1700[3]	3000[4]	3820	4240	4190	4350	4360	3387	3529	4177	44,253
Direct Personnel[1]	33	44	18	18	37	40	38	38	38	33	25	25	25	412
PP & R (OMA)														
Dollars (x1000)	--	170	2170	3985[3]	3000	3327	3967[5]	3904[6]	3930	4222	4555	4646	0	37,876
Direct Personnel[1]	--	2	34	57	38	39	39	38	35	33	33	33	0	381
TOTALS														
Dollars (x1000)	3000	3170	3670	5685	6000	7147	8207	8094	8280	8582	7942	8175	4177	82,129
Direct Personnel[1]	33	46	52	75	75	79	77	76	73	66	58	58	25	793

*FY1989 and beyond in FY1989 dollars

[1]Direct Personnel includes Nuclear Operations, Engineering, and Health Physics Personnel.

[2]Most NE areas in standby during reduced FY1980 funding year.

[3]OMA supplemented NE standby funding level ($1,700K) by $1,000K (and 19MY) of the $3,985K to maintain the intent of the "Coordinated NE/OMA D&D Plan" in PP Building for FY1981.

[4]Funding reduced ($300K) from $3,300K.

[5]Includes removal of thorium contaminated soil on SM/PP Building hillside at $101K.

[6]Includes maintenance and surveillance of SW Cave areas at $130K.

The $7.8M increase in the ANSPD(NE) costs is because of increased scope on the PP Building project at $1.8M (increased contamination and difficulty of structural decontamination of support areas on the first floor) and for increased scope on the WTS project at $6.0M (increased contamination soil volumes and burial costs). These increases are compared to the previously approved baseline that was set in FY 1980. Details of the increase are:

	FY 1980 Cost Estimate	Current Cost Estimate	Increase
PP Building Project	$17,243	$19,000	$1,757
R Building Project	$ 9,230	$ 9,205	$ (25)
WTS Project	$ 9,992	$16,048	$6,056
Total	$36,465	$44,253	$7,788

The $5.2M increase in the OMA costs is also because of increased scope on the PP Building project (increased contamination and difficulty of structural decontamination of support areas on the first floor). This increase is compared to the previously approved baseline that was set in FY 1980. Detail of the increase is:

	FY 1980 Cost Estimate	Current Cost Estimate	Increase
PP Building Project[1]	$32,689	$37,876	$5,187

NOTE: See Appendix G for additional details on cost increases for NE and OMA compared to the FY 1980 baseline.

[1]Includes one laboratory in R Building (R-159B)

F. Other Mound Projects

Several other D&D projects have been identified for Mound that are or will be funded in current and future years and are summarized in Table II (page I-32). These projects are:

SM Building Decommissioning - Complete demolition of the Special Metallurgical Building (23,000 ft^2). The radiochemical processing building has been partially D&D'd (FY1968-1972) and requires complete demolition including an auxiliary building, stack, underground tanks, and removal of contaminated soil and leach field.

R 149 - D&D of surplus laboratory within the Research Building.

HECPAF Construction - Radiological survey (core sampling) and removal of contaminated soil during construction of the High Explosives Component Production and Assembly Facility (HECPAF) - capital project.

SW Building D&D (Partial) - D&D of several surplus gloveboxes and equipment within the Semi-Works (SW) Building (SW-8, 12, 13, 150, 152, 219, 240).

WD Building D&D (Partial) - D&D of surplus contaminated equipment within the Waste Disposal Building (WD-5, 9, 10, 13, 14, 15, 110) and contaminated soil.

TABLE II

OTHER DECONTAMINATION AND DECOMMISSIONING PROJECTS AT MOUND

BUDGET OBLIGATIONS (BO)

Areas	Funding Agency	Estimated* Cost ($)	Duration
SM Building Decommissioning	DP	46.4M	FY1983-1996
R 149 D&D	DP	1.6M	FY1985-1988
SW Building (Partial) D&D	OMA	3.9M	FY1988-1992
WD Building (Partial) D&D	OMA	3.9M	FY1988-1992
SD Building Decommissioning	DP	2.4M	FY1988-1990
HECPAF Construction	OMA	2.6M	FY1988-1993
SW Cave Area D&D	NE	2.1M	FY1989-1990
Building 21 Decommissioning	DP	13.5M	FY1991-1997
Other Underground Lines to WD	TBD**	Not available	Not Budgeted
Site Soil Areas	TBD**	Not available	Not Budgeted

* FY 1988 and beyond in FY 1988 dollars (to be updated to FY 1989 dollars in February, 1987)

** To be determined.

SD Building Decommissioning - Complete demolition of the old Sanitary Disposal Building and associated underground tanks and contaminated soil.

SW Cave Area - D&D of surplus gloveboxes, equipment and laboratories within the Semi-Works (SW) Building (Cave, 128-130, 132-138).

Building 21 Decommissioning - Complete demolition of the thorium storage building and removal of contaminated soil.

Other Underground Lines - D&D of future surplus underground low-level liquid waste transfer lines from R/SW/H Buildings to WD Buiilding

Site Soil Areas - Stabilization or removal of contaminated soil areas identified by the Site Survey Project.

PROJECT
STRUCTURE

II. PROJECT STRUCTURE

The project is divided into four major categories; the first being the conceptual design. Considerable thought was given to the physical configuration of the buildings and site and the problems of logistics, in situ decommissioning, obstructions, and other structural factors. These problems were also viewed from other perspectives, such as safety, need for size and volume reduction, handling of secondary wastes generated, packaging, transportation and burial requirements.

The second category dealt with the need for new construction, modifications to existing buildings, material handling equipment, special tools, instruments, and supplies as developed during the conceptual phase of the engineering design.

The third category was the development of detailed work flow diagrams showing every operation in proper sequence, including sampling and testing.

The fourth category was the quality control requirements and the establishment of written procedures from the work flow plan and the method for controlling and auditing changes to these procedures. In-line inspections are noted in the work flow plan and include a final inspection and approval of the packages prepared for shipment.

A. Engineering Design and Waste Management Consideration

1. Building and Site: An in-depth analysis of Buildings PP, R, and 41 and the site of the underground lines revealed a number of physical problems involving logistics, safety, and maintenance of continuity of operations. It was evident that numerous modifications and new construction would be required to solve these problems. For example, Corridor 5 in R-Building is the main

corridor through which waste packages and equipment are brought into and out of the laboratories to be decontaminated and decommissioned. This corridor was filled with equipment, much of it obsolete, which had to be removed or relocated. Air locks with larger doors were required for contamination control in the R Building. Also, the PP Building docks were too small to accommodate the transfer of large TRU boxes and required enlargement.

Contamination control presented other problems. The corridors required additional air locks to provide effective isolation from other areas. Temporary partitions were needed to maintain isolation from the rest of the building.

Control of contamination at the pumping station (Building 41) for the underground waste lines presents a serious problem during D&D operations. The most cost effective plan was to build a temporary superstructure to enclose the entire building.

In the logistics plan, provisions were made to provide storage areas for waste boxes, tools and other supplies. These facilities also serve as staging areas for waste packages since they require protection from the elements while awaiting transfer to the new fiberglass sealing and gamma scanning facility.

The decommissioning of the underground waste lines presented a number of difficult problems. First, there was a considerable amount of soil to be removed -- in some cases, as deep as 23 feet which required extensive shoring. There are also many elevation changes (up to 140 feet) which required temporary silt retention basins. The plan used mechanical and manual digging to minimize the potential for breaking the lines. Also, there were more than 400 flanged joints in the waste lines, each requiring special care in handling.

Special enclosures were required to protect the personnel and environment during this phase of work.

2. Safety and Health Physics: An overriding consideration of the decontamination and decommissioning plan is the prevention of undue risks in the areas of Environmental Protection, Personnel Safety and Health (ESH) and implementation of the "as low as reasonably achievable" (ALARA) philosophy in these areas.

The prevention of undue risks and the promulgation of the "ALARA" philosophy is being achieved by special emphasis in the areas of:

- Planning
- Managment Involvement and Commitment
- Organization (Responsibility and Authority)
- Communications
- Quality Program
- Training
- Procedures
- Controls/Audits
- Follow-up/Corrective Action
- Safety Analysis
- ALARA Program
- Experience
- Consultants
- Manpower Planning
- Special Protective Equipment and Techniques

a. Planning: Mound has effectively decontaminated and decommissioned four other major facilities since 1949. Many minor areas have also been decontaminated and decommissioned. See Appendix C for the reports "A Summary Review of Mound's Experience in D&D of Radioactive Facilities 1949-1973", "Mound's Decommissioning Experience, Tooling, and Techniques", "The Use of Urethane Foam in the Decontamination and Decommissioning of Nuclear Facilities" and "Tools for Decontamination and Decommissioning of Nuclear Facilities" for more details.

The previous and current experience with D&D projects provided valuable input into the planning of this project. Other valuable sources of input were:

- MRC D&D experienced personnel
- DOE and Contractor experienced D&D personnel
- Published D&D reports
- MRC's experience with plutonium-238 and other isotopes

Various D&D alternatives were formulated and evaluated on a basis of:

- Environmental, Safety, and Health Considerations
- Risks
- Benefits
- Costs
- Programmatic Needs
- Technical Feasibility

These alternatives were described in Section I.B. Plans are flexible and are modified as D&D parameters change. Some examples of the planning efforts being performed are:

- Coordinated D&D Program Plan
- Long Range and Short Range Engineering Plans
- Use of Computer Scheduling Programs such as "Qwik-Net" and "Project 2"
- Ten Year Plan for D&D for Mound
- Budget Plan
- Yearly Plan and Quarterly Update
- Quarterly DOE/DAO D&D Meeting
- Monthly Director D&D Meetings
- Weekly D&D Planning Meetings
- Weekly Coordination Meetings
- Daily Planning Documents (Radioactive Control Area Maintenance Permit)
- Pre-Job Conferences
- Special Planning Meetings

b. Management Involvement and Commitment: MRC management involvement and commitment started at the Mound Director level (see Section IV). Some examples of this management involvement and commitment are:

- D&D Project included in the MRC Mound Director's published Emphasis Areas
- D&D Project as one of the major emphasis areas of The Safety Department
- D&D area inspection quarterly by Directors
- Monthly Department Directors' meetings to review D&D status
- Weekly D&D Project Management meetings

- Daily contact with D&D activities by D&D Project Management

c. Organization: A special interdepartment D&D Management Team was formed to coordinate efforts of the three departments directly involved (Nuclear Operations, Engineering and Administrative Services). See Section IV for more details.

d. Communications: Efforts are made to ensure that communications on D&D are effective. Some examples of special communications techniques used are:

- Special bulletin boards in D&D areas
- D&D logo
- Special meetings for D&D personnel
- Periodic D&D bulletins to personnel
- Management Team approach to D&D
- Pre-Job Conferences
- Various special reports on D&D

e. Quality Program: In the areas of Environment, Safety and Health quality programs were formalized to ensure independent assessment of the quality of the plan of D&D activities and conformance to the plan. Significant aspects of this quality program include:

- Procedures
- Documentation
- Audits
- Controls
- Training
- Follow-up/Corrective Action

- Standards

See Section II.D. for more quality program details.

f. Training: As the D&D project involved obtaining additional manpower, an extensive training program was established for new and existing personnel to ensure that D&D personnel were qualified. Some examples of this program are:

- New employe Safety and Environmental Technology orientation
- Initial training of new D&D employes in other work areas
- Semi-annual refresher orientations
- Monthly group safety meetings
- ALARA refresher orientations
- Maintenance worker training program
- Area Health Physics and respirator protection orientations
- Special technique training sessions (foaming and welding, for example)
- Alpha Radiation Workers Certification Program

g. Procedures: Special procedures with management approval and worker involvement are developed for unusual jobs. Also existing procedures are applied toward D&D activities. See Section III.D for more details.

h. Controls/Audits: Special internal and external controls and audits of the effectiveness of these controls are developed and used with existing controls to ensure that radiation exposures are "as low as reasonably achievable". Critical radiological surveys are independently verified periodically by an outside organization. The radiological trend report on air levels, contamination, and exposures is one example of the type of controls used. Another example is the control of the number of activities at various risk levels that are permitted to be performed simultaneously in any one building. In addition, risk work is not performed outside of buildings during inclement weather.

i. Follow-up/Corrective Action: Deviations from the D&D Plan are closely monitored by the various levels of involved management through the required status reports and planning meetings, and by personal observations. Significant deviations are investigated, corrective action is taken and follow-up is made to ensure conformation.

j. Safety Analysis: Safety analyses are performed on unusual situations that could potentially cause an environmental, safety or health problem. Some examples of the safety analyses performed are:

- Pre-Job Conferences
- Loss Prevention and Environmental Control (LP&EC) Reviews (on concepts, designs, construction, modifications, and processes)
- Managerial Analytical Reviews
- Hazard Analysis Reviews
- MORT and Fault Tree Analyses
- Readiness Reviews

These reviews take into consideration such areas as:

- Safety
- Industrial Hygiene
- Radiation Protection
- Criticality
- Waste Management
- Environmental Protection
- Fire Protection
- Security

k. ALARA: Emphasis on maintaining radioactive and nonradioactive exposures and effluents "as low as reasonably achievable" (ALARA) started in the early 1970s. As a result of this emphasis, exposures and effluents have significantly been reduced since 1970.

Special emphasis has been placed on ALARA as it applies to the D&D Project through several approaches:

- A major emphasis area of Mound's Executive Safety Committee
- Special D&D logo
- Periodic Management ALARA Review
- Special ALARA Orientations for D&D Personnel

l. Experience: Mound personnel, in addition to handling radioactive material safely for more than 35 years, have been decontaminating and decommissioning facilities and laboratories since 1949. The organization of the D&D planning is utilizing these experienced personnel where possible. In addition, contact is being maintained with other DOE and contractor personnel experienced in D&D.

m. Consultants: Mound has sought and will continue to actively seek the advice of other non-Mound personnel on D&D and related efforts through publications, telephone conversations, Mound visits, and visits to other contractors and equipment manufacturers to help ensure that the D&D plan is as effective as possible and uses "state-of-the-art" techniques and equipment.

n. Manpower Planning: Because of the large manpower requirement of the D&D project, several considerations were evaluated in planning manpower disciplines, levels and timing. Some of these considerations are:

- Use of experienced personnel
- Qualification of new personnel
- Effective management and control of work group sizes
- Analysis of work schedule
- Advantages/disadvantages of shift work and overtime versus risk control.

o. Special Protective Equipment and Techniques: Some examples of special protective equipment and techniques used on the D&D project are:

- Respiratory Protection Fitting (Aersol Test Chamber) and Orientation
- Respiratory Protection:
  - field tested (smoke checked) full-face mask
  - self-contained supplied air full-face mask
  - supplied-air full-face mask
  - supplied-air plastic bubble suit
- Protective Clothing:
  - radiation area control clothing (smocks, two-piece uniforms, coveralls)
  - two-piece plastic or paper suits and bubble suits
  - shoecovers
  - various glove combinations
  - headcovers

- Safety Equipment
  - safety glasses and shoes
  - hard hats
  - bump hats
  - portable fire extinguishers
  - specialized gloves
  - hearing protection
  - face shields
  - ground fault interrupters
- Monitoring Equipment
  - industrial hygiene monitors
  - selective Pu-238 laboratory and stack monitors
  - alpha monitors (onsite and offsite) including portable Fidler detectors
  - gamma and neutron TLD dosimeters and monitors
- Monitoring Techniques
  - air, water, soil samples (building, onsite and offsite)
  - personnel and area dosimeters
  - personnel bioassay samples (nosewipes, urine, blood, sputum, fecal, and whole body counting)
  - alpha wipe, alpha direct, gamma and neutron measurements
- Protective Equipment
  - portable ventilated enclosures (tents, airlocks) with HEPA filtered exhaust for additional containment
  - portable HEPA filtered exhausters with variable air flow rates
- Special Techniques
  - use of contamination control techniques when separating service lines and gloveboxes (enclosures, fixtures, special tools)

- strippable coatings to facilitate decontamination

- use of "Radiation Control Area Maintenance Permit" (see Appendix D for example)

- use of pneumatic tools to prevent electrical hazards

- burning permits

- fire watches

- special heavy duty transporters to minimize physical lifting and moving

- use of minimal polyurethane foam in equipment and piping to immobilize contamination and shore equipment

- use of "Three-Zone" (high-medium-low potential risk areas) concept to minimize potential spread of contamination

- pre-job conferences of all involved personnel on high potential risk jobs

- various radiological control points (airborne, wipe, gamma, neutron) where operations are stopped and reassessed, if exceeded

- various radiological data exception and trend analysis reports to management

- construction of semi-permanent airlocks for waste container loading and removal

- construction of semi-permanent barriers, walls, and airlocks for contamination control

- use of a portable changeroom and enclosure for outside work

- use of specialized cutting techniques such as plasma torching

- use of low and high pressure cleaning units to facilitate decontamination

- foam permit requiring inspector and monitor

- specially designed platforms for loading contaminated waste safely into waste containers.

C. Waste Management

Mound incorporates sound waste management practices in the Decontamination and Decommissioning effort. A number of cost effective steps are taken to reduce 1) the amount of radioactive waste to be shipped for burial as non-TRU waste to the Nevada Test Site; and, 2) the TRU waste to be placed into retrievable storage at Idaho National Engineering Laboratory. A brief description of some of these practices and procedures follows:

a. Materials Introduction: A formal program was implemented in July of 1974 to reduce the quantity of support materials introduced into areas where TRU contamination is possible. Specific actions taken under this program include a) unpacking of supplies and equipment in nonradiation areas; b) timely radiation surveys of such materials introduced into controlled areas to permit discarding as non-TRU; c) storage of required supplies in controlled areas having very low potential for contamination; d) thorough cleaning of gloveboxes prior to performing maintenance or D&D work; and e) minimizing materials introduced into the gloveboxes. These practices are applied in day-to-day operations and will certainly have direct application during the D&D operations. Efficient control of this program has demonstrated that significant reduction in the volumes of TRU waste generated can be achieved.

b. Compaction: Mound uses a compactor for volume reduction of alpha-contaminated-compactible LSA waste. The compaction operation yields an average volume reduction ratio of 4:1.

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[1] non-burnable

c. Incineration: Combustible waste was incinerated in the glovebox line in the PP Building D3 Laboratory (for internal glovebox TRU waste) or at the Waste Disposal (WD) Building (for non-TRU waste).

4. Waste Volumes: Wastes are generated in most of the activities in the D&D Program. These wastes are varied in composition and consist of cleaning solutions, rags, tools, piping, tanks, gloveboxes, concrete, soil, etc. Table III (next page) summarizes the estimated total waste volumes involved in this Program. The current status of D&D waste and scrap residues measured to date versus the target is given below in grams:

	PP Building	R Building	Total
FY77	15	56	71
FY78	167	0	167
FY79	335	66	401
FY80	198	54	252
FY81	635	4	639
FY82	201	9	210
FY83	27	1	28
FY84	5	1	6
FY85	7	1	8
FY86	0	1	1
Total	1590	193	1783
Target	2870	420	3290
Percent of Target	55%	46%	54%

5. Packaging: All radioactive wastes are packed in accordance with either current DOT and DOE criteria for burial of low level waste at the Nevada Test Site (NVO-185), or Idaho storage criteria (IDO-10074), and WIPP-WAC criteria for final disposal of TRU waste. There are basically two types of packages utilized for waste materials, a 55-gallon steel drum and plywood or metal boxes. The specifications for these containers vary dependent upon the level of activity to be confined within the two broad categories of TRU and non-TRU (LSA)waste.

TABLE III

ESTIMATED WASTE VOLUMES
(Thousands of cubic feet)

Fiscal Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
ANSPD(NE) LSA	8	8	3	11	11	13	44	55	72	49	26	39	77	416
OMA LSA	-	-	8	10	10	7	11	17	18	12	23	12	0	128
TOTAL LSA	8	8	11	21	21	20	55	72	90	61	49	51	77	544
ANSPD(NE) TRU	2	4	1	9	9	5	5	2	1	6	1	0	0	45
OMA TRU	-	-	6	9	9	4	4	1	1	1	1	0	0	36
Total TRU	2	4	7	18	18	9	9	3	2	7	2	0	0	81

LSA = Low Specific Activity or Non-TRU

a. TRU Waste Packaging: All transuranic waste generated at Mound must be packaged in a 20-year retrievable container in accordance with DOE Order 5820.2 "Radioactive Waste management", and WIPP criteria documents (DOE-WIPP-069 and DOE-WIPP-114). A number of TRU packages are in use throughout the DOE complex. Mound has adopted the containers originally developed by Rocky Flats. The drum set consists of a 55-gallon Spec. 17C steel drum with a 90 mil high density polyethylene liner inside. The liner has a snap-in lid. An outstanding Quality Control Program administered by Mound personnel provides high quality drums and liners for packaging the wastes. Operations involving the loading of wastes into these drums in preparation for shipment and storage are rigorously documented by operation sheets and these operations are subject to periodic internal and DOE audits.

A comprehensive compilation of all operations with regard to packaging and TRU waste handling is presented in MD-70205 "TRU Waste Management" (see Appendix E for Table of Contents). A sophisticated materials accountability system identifies specific items within a drum or box and provides documented traceability on all materials packaged for shipment.

Examples of the types of waste which are packaged in these drum sets from D&D operations include:

1) in-line equipment, metal, tools (non-combustible).

2) in-line waste, paper, gloves, plastic bags (combustible).

The second TRU container which had been used was a fiberglass reinforced plywood (FRP) box. This is a nominally 4 x 4 x 7 ft. in size and is certified as a DOT Spec 7A container. As with the drum, a QC Program ensures quality boxes for use in the program.

The boxes were fabricated by a qualified offsite vendor. After the box was loaded, the final seal and coating of the lid area was applied at a fiberglassing facility at Mound. In addition to the standard 4 x 4 x 7 ft FRP box, Mound personnel designed oversized FRP boxes[1] to accommodate some of the larger equipment items and gloveboxes which had to be removed during the D&D operations. The oversized boxes were required because Mound did not have a size reduction facility for handling equipment of this type. These oversize boxes were fabricated by an outside vendor and were tested and certified at Mound for DOT Spec 7A compliance. These oversized FRP boxes were used prior to FY 1983, and are no longer used. They are currently in storage at INEL site. The use of the standard size FRP box was discontinued in 1985.

The third TRU container is a steel box which will replace the FRP box in 1985. The steel box satisfies the Waste Isolation Pilot Plant (WIPP) requirement for non-combustible Type A packages. The steel boxes are also fabricated by a qualified offsite vendor and are inspected to assure conformance to the specification of DOT Spec 7A.

An integral part of the TRU box for D&D operations is the use of a minimal amount of urethane foam. This foam, which is injected by gun and has a rigid set, is used 1) to seal any contamination in the glovebox, 2) to anchor the glovebox or other equipment within the box, and 3) to enhance structural integrity in the box for transportation and handling safety.

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[1]Mound was authorized prior to FY 1983) by Idaho to utilize five different sized fiberglass (FRP) coated boxes for TRU waste. These sizes are:

TYPE	SIZE (Width x Height x Length)
Std.	4 ft x 4 ft x 7 ft
I	5 ft-11½ in. x 8 ft-10-5/8 in. x 11 ft-4½ in.
III	5 ft-½ in. x 8 ft-8-1/8 in. x 9 ft-1½ in.
IV	4 ft x 5 ft-6 in. x 8 ft
V	5 ft-½ in. x 5 ft-2-1/8 in. x 8 ft-7½ in.

b. Non-TRU Waste: As with TRU waste, 55-gallon drums and boxes are the two general types of containers utilized. The drums are 55-gallon Spec 17H steel drums. The boxes are constructed of plywood. The DOT regulations call for a strong tight container for shipment of radioactive wastes of this level of activity, and the plywood box meets the requirements. The standard LSA box size is 4 x 4 x 7 ft; however, smaller boxes (2 x 4 x 7) are used for heavy items for ease of handling. The loading of the non-TRU waste material is also subject to audit.

6. Transportation and Burial/Storage: After loading, the waste packages are staged for shipment. During the staging period, a thorough package inspection is made to ensure that the waste is properly packaged and the waste container is acceptable for shipment. The inspection checklist includes items such as touch-up painting of drums, checking drum gaskets, checking bolt rings for specified torque, applying permanent seals, gamma scanning, direct and wipeable radiation surveys, and application of appropriate shipping labels. As in other phases of the Waste Management Program, this check-off list is carefully audited. Noncomplying waste packages are reprocessed to meet shipping criteria. Each package must be certified by a designated certifying officer before it can be offered for shipment.

a. TRU Waste: The TRU waste from Mound is shipped by rail to Idaho National Engineering Laboratory which is operated for DOE by EG&G. The waste is placed into retrievable storage (above ground) until the WIPP facility is operational. Mound has four ATMX railcars available, two 500 series (ATMX 501 and 504) and two 600 series (ATMX 610 and 613).

These railcars have been specially modified for transporting waste shipments and have been granted DOT special permits for handling Type B and greater quantities of TRU materials. The two 500 series railcars have three bays, each of which will accommodate 64 55-gallon drums or four standard TRU boxes. One 600 series railcar has two large bays with each bay accepting a standard ICS container in which approximately 60 55-gallon drums can be placed. A total of 120 drums can be shipped per this 600 series railcar. The other 600 series railcar has three bays and was utilized to ship the oversized FRP boxes.

b. Non TRU Waste: The low-level (non-TRU) waste from the D&D project is also subjected to a preshipment checklist. The packaged LSA waste is then loaded into a commercial closed van for shipment to the Nevada Test Site (NTS), where it is placed into shallow land burial. Mound has been shipping its low-level waste to NTS since March, 1980. Prior to this time, Mound shipped low-level waste to commercial burial sites utilizing Chem Nuclear's Barnwell, South Carolina, burial ground from 1976 to 1980 and other commercial and DOE sites prior to that time. Mound personnel maintain close contact with the burial ground operations to ensure compliance.

B. Construction and Procurement: As stated earlier, certain modifications and new construction are required to solve problems in logistics, safety and isolation of ongoing operations. Each area, PP, R, and the Waste Transfer System, must be considered separately as the problems are very specific. The modifications and new construction are described, by area, below:

1. PP Building: The transfer of TRU boxes from the interior of the PP Building must be made without disturbing ongoing programs. To accomplish this, the main Corridor 137 (see Figure 11) was isolated from the building by

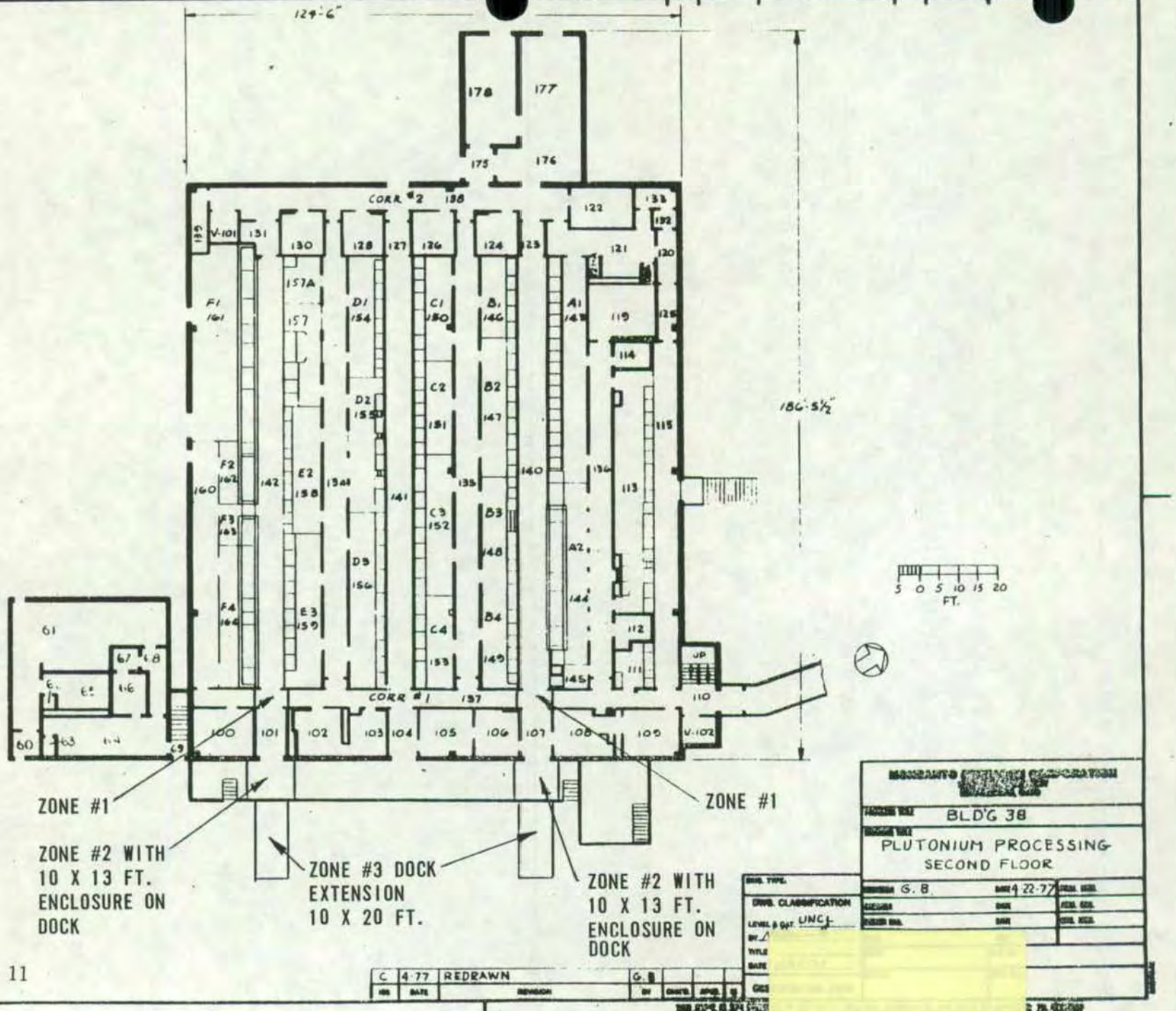

FIGURE 11

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

erecting airlocks at the A-B Corridor on the north end and E-F Corridor on the south end. The existing airlocks, PP-101 and PP-107, were also extended to the full depth of the dock and sealed. The existing doors were replaced with taller doors. Empty TRU boxes are loaded and foamed in these airlocks. The enclosed dock extensions, 10 x 20 x 24 ft high, were constructed in line with PP-101 and PP-107 to facilitate loading of trucks. Contamination control is provided by setting the pressure in the extended airlock to 0.10 in. WG.

The need for construction of the third airlock extension (PP-104) was eliminated by modifying internal building walls to gain access to PP-101 from PP-141.

The need for an expanded airlock replacing PP-11 to facilitate the packaging of large pieces of equipment to be removed from the first floor of the PP Building (see Figure 12) was evaluated. With the development of size reduction techniques, an extensive airlock expansion was not required.

Building 39 was modified to service three functions: a staging and intermediate storage area, final fiberglass sealing of the TRU fiberglass boxes, and gamma scanning of the final TRU package.

The modifications include the fabrication and installation of a 15 ft diameter turntable to serve both the fiberglass sealing operation and gamma scan facility and construction of an 18 x 15 x 11 ft paint drying booth. The gamma scan equipment is housed in a new 6 x 9 x 8 ft room.

Ventilation was provided for heating the building and controlling the temperature of the gamma scan instrument room.

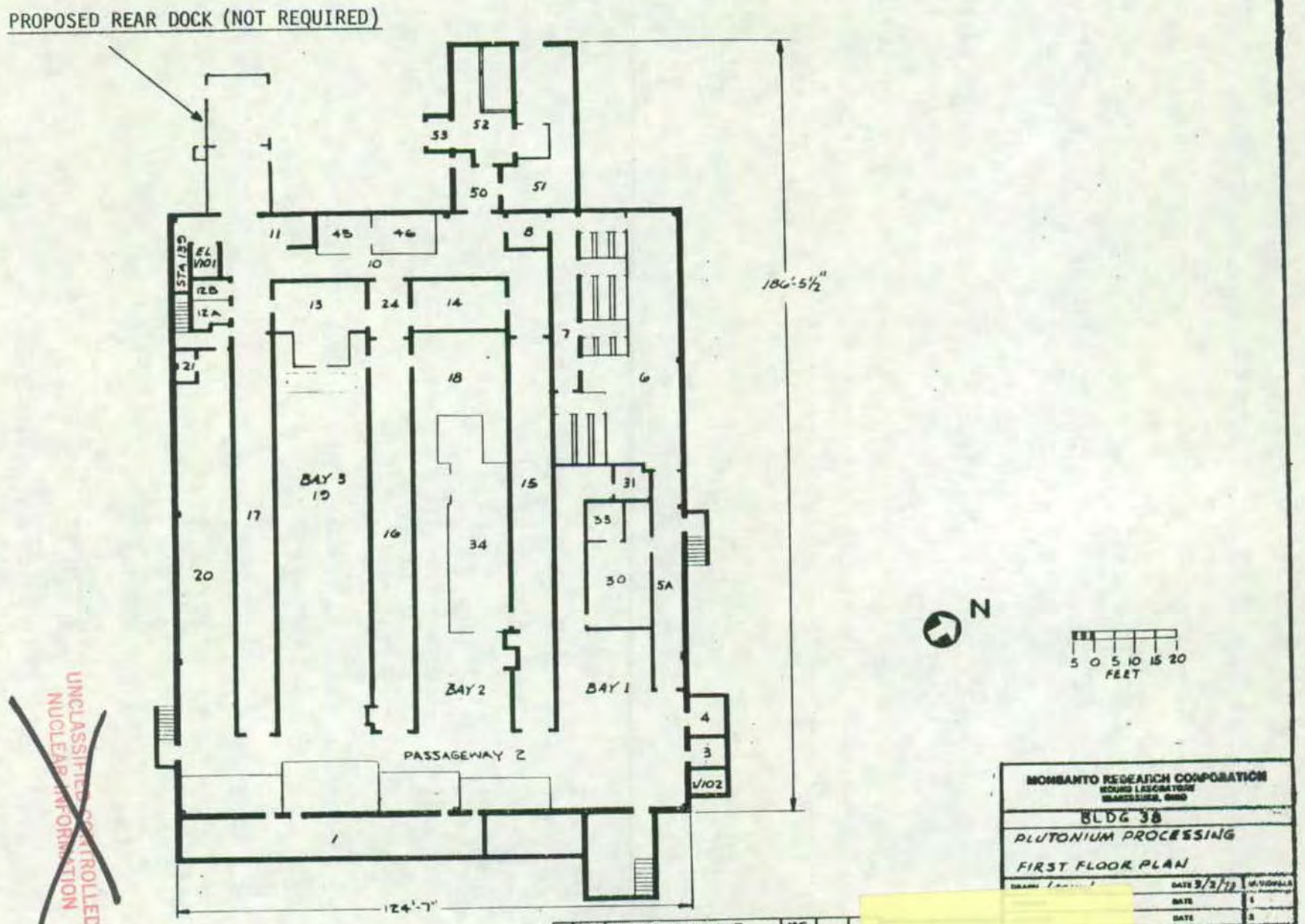

FIGURE 12

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

2. R. Building: The plan was designed to remove obsolete equipment in Corridor 5 to simplify movement of equipment and other trash to a staging area. The recirculting air system at the south end of Corridor 5 served gloveboxes for ongoing programs, so prior to its removal, accommodations were made to provide other means for servicing these laboratories.

This was accomplished by placing several gloveboxes on a nitrogen purge and exhausting them to the glovebox filter bank. Other gloveboxes needing a low oxygen atmosphere were provided with a deoxo unit. All other boxes on the recirculating system being decontaminated and decommissioned were provided with a single pass air exhausting to the glovebox filter bank.

The door at the south end of Corridor 5 was too small to permit passage of equipment to be moved out of the building and was replaced with a larger double door. For contamination control, it was necessary to add an airlock at the south end of Corridor 5 (see Figure 13).

Several other pieces of equipment located in Corridor 5 prevented free passage of materials from being removed from the D&D areas. It was therefore necessary to relocate this equipment.

The plan also required the construction of a facility to be used as a storage and staging area for waste packages and equipment. An unheated steel building, 63 x 34 x 13 ft high, was located at the south end of the R and E Building. This building (68) contains three bays, each approximately 20 x 34 ft, with individual roll-up doors on the south end. This arrangement permits the use of a forklift truck for material handling. The building was provided with a "dry" pressurized sprinkler system to prevent the freezing of the sprinkler water during periods of low temperature. In the event of fire, the system operates as a normal "wet" system.

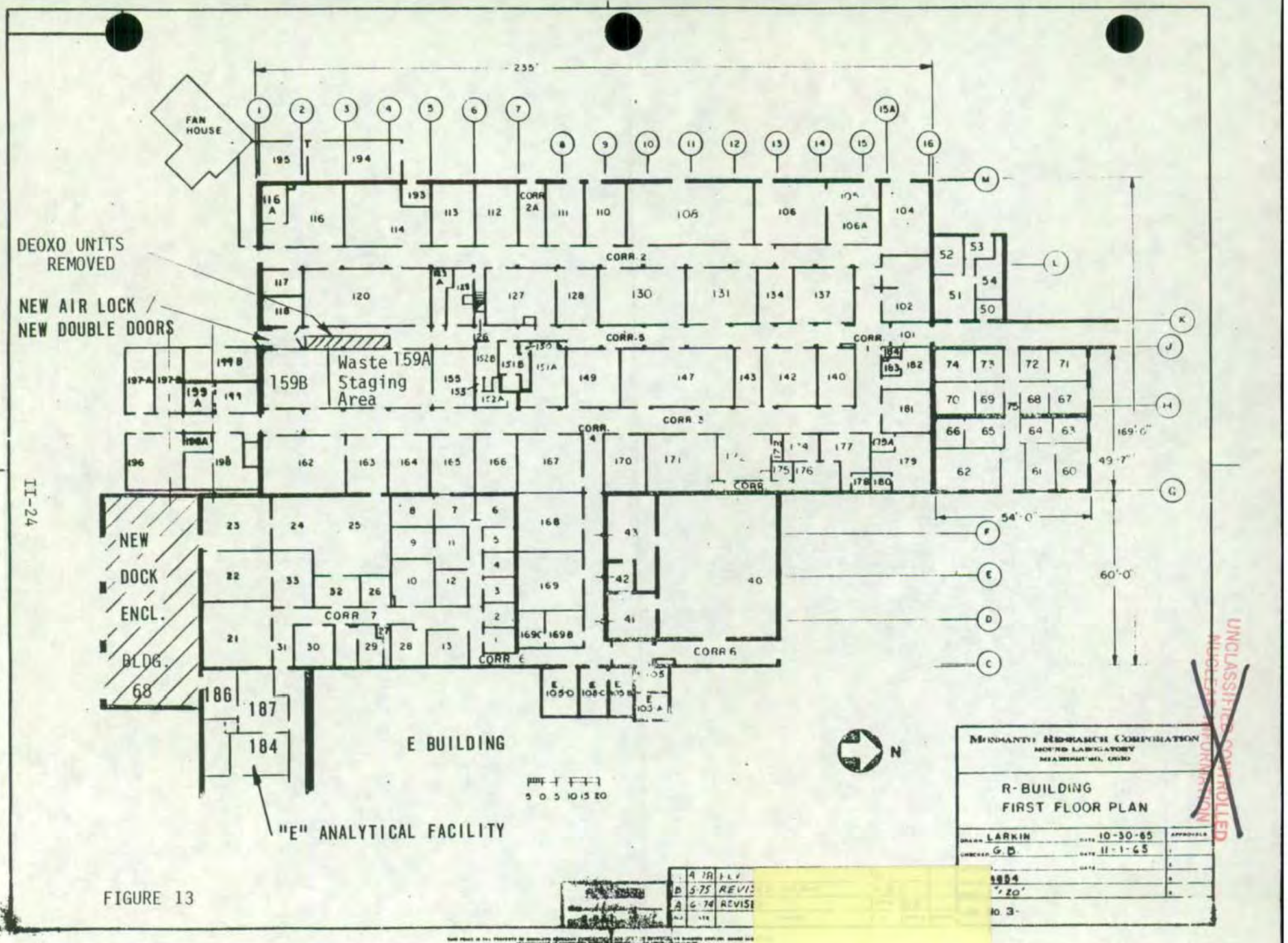

FIGURE 13

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

In order to facilitate the packaging of large pieces of equipment, R-159 was stripped of all equipment and gloveboxes in FY1981 and the north end (R159A) is now being used as a temporary waste staging area for D&D operations.

3. Waste Transfer System: A portable fumehood is used to enclose the work area during the dismantling and blanking of the underground waste lines. It is 8 ft long by 2 ft wide and 3 ft high to cover sections of the waste lines and provide a work space. The fumehood is provided with HEPA filtered exhaust.

Prior to the excavation of the waste lines, silt retention basins are constructed as needed to control and/or minimize erosion problems. Also, a personnel decontamination (safety shower trailer) facility and a portable changeroom (trailer) have been procured and are in place.

The D&D of Building 41 required the construction of a temporary structure around it to provide protection to the environment. A description of this structure is as follows: it is a 49 x 19 x 17 ft pole barn type structure above ground with reinforced plastic inner and outer walls. It includes lights, portable exhausts, controlled ventilation, HEPA filters, and alpha monitors.

4. Tools: The tools required for the project fall into four major categories: size reduction, such as nibblers and saws; material handling, such as hoists, cranes, dollies, tractors, and buggies; foam generators, and concrete and soil removal equipment. Some tools have a limited life and require frequent replacement of essential parts or in toto.

A partial list of the tools that have been purchased to date is shown as follows:

- Power Nibblers
- Manual Nibblers
- Replacement Cutters for Nibblers
- Punches and Dies for Nibblers
- Fixed Boom Floor Crane
- Hoists from One-Half Ton to Five Ton Capacity
- Cable-Mini-Mules
- Power Riveters
- Electric Drills
- Foamers
- Pneumatic Tools
- Gantries
- Pallet Trucks
- Electric Pavement Breakers
- Fork Lifts
- Concrete Scabblers
- Tow Tractor
- Come-Alongs
- Sawsalls
- Roto Hammer
- Straddle Stacker
- Rol-A-Lift
- Hi-Jacker
- Floor Tile Remover

- Sandblaster
- Air Compressor
- Foamers - "Froth-Pak"
- Vacuum Cleaner - Absolute Filtered
- Spray Paint Equipment - Airless
- Machinery Dollies
- Lever Dollies
- Scaffolding
- Cut-Off Saws
- Concrete Removal Tools

C. Decommissioning and Decontamination Operations: A description of the operations was prepared in the form of flow diagrams for all work to be performed. For simplicity, only the major operations are shown.

Since the D&D of gloveboxes (Glovebox Removal Phase) in both PP and R Buildings are similar, one typical flow sheet was prepared (Figure 14). However, separate PP and R Building (Figures 15, 16) flow sheets were prepared for the Structural Decontamination Phase since the building designs are different.

Since the Waste Transfer System (underground lines and Building 41) involves complete demolition, a separate flow sheet was prepared (Figure 17).

D. Quality Assurance Program: The Quality Control organization within Mound's Administrative Services Department is directly involved in the D&D Program. The role of the Quality Control function is that of independent assessment

1) to ensure the adequacy of D&D plans; 2) to ensure by audit that D&D activities as implemented are consistent with the activities as planned; 3) to ensure that necessary changes in D&D work in progress have been approved as

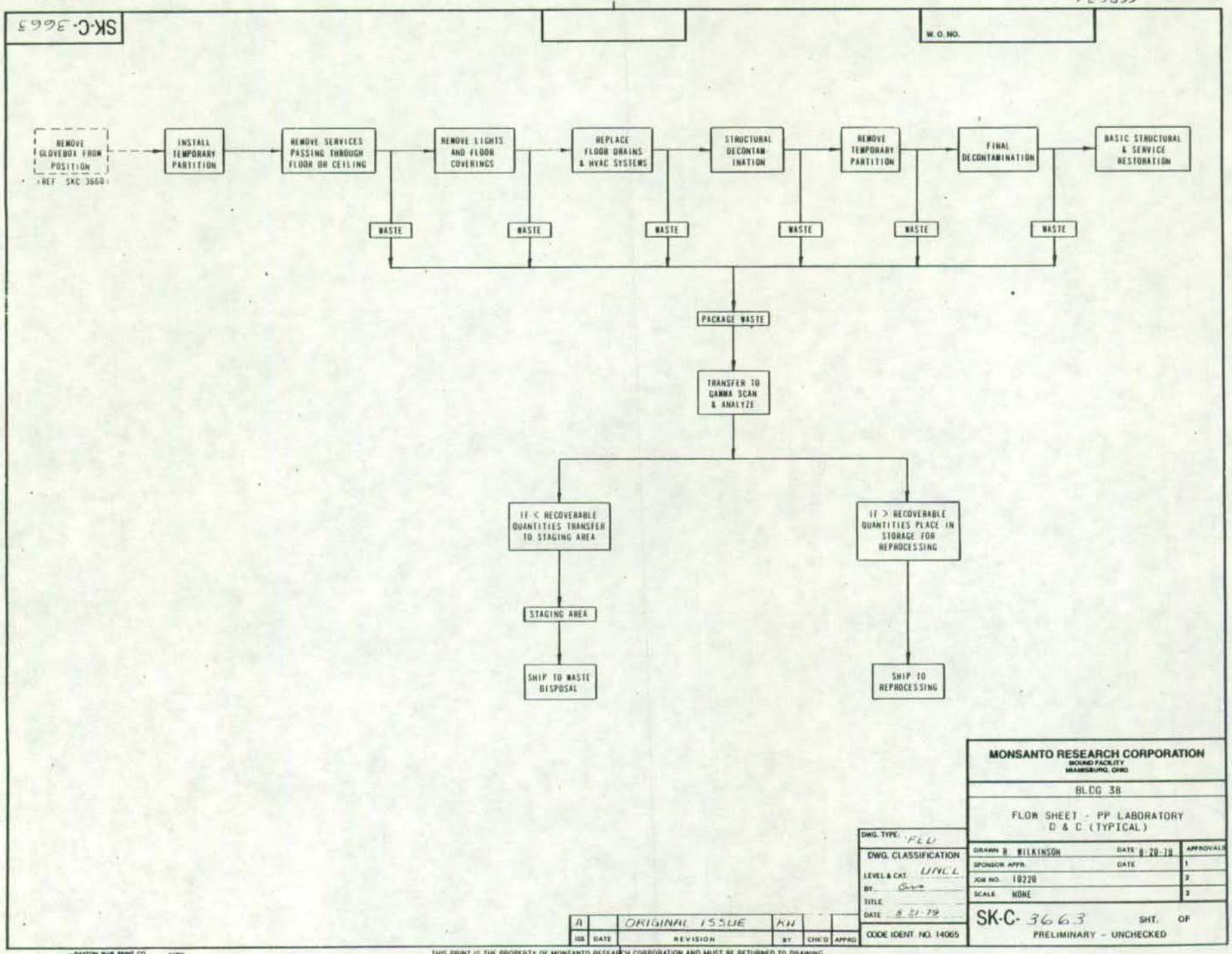
SK-C-3663
W. O. NO.
PE 5899
REMOVE GLOVEBOX FROM POSITION
(REF SKC 3660)
INSTALL TEMPORARY PARTITION
REMOVE SERVICES PASSING THROUGH FLOOR OR CEILING
REMOVE LIGHTS AND FLOOR COVERINGS
REPLACE FLOOR DRAINS & HVAC SYSTEMS
STRUCTURAL DECONTAMINATION
REMOVE TEMPORARY PARTITION
FINAL DECONTAMINATION
BASIC STRUCTURAL & SERVICE RESTORATION
WASTE
WASTE
WASTE
WASTE
WASTE
WASTE
PACKAGE WASTE
TRANSFER TO GAMMA SCAN & ANALYZE
IF < RECOVERABLE QUANTITIES TRANSFER TO STAGING AREA
IF > RECOVERABLE QUANTITIES PLACE IN STORAGE FOR REPROCESSING
STAGING AREA
SHIP TO WASTE DISPOSAL
SHIP TO REPROCESSING
MONSANTO RESEARCH CORPORATION
MOUND FACILITY
MIAMISBURG, OHIO
BLDG 38
FLOW SHEET - PP LABORATORY
D & C (TYPICAL)
DRAWN R. WILKINSON
DATE 8-20-79
SPONSOR APPR.
DATE
JOB NO. 10220
SCALE NONE
APPROVALS
1
2
3
DWG. TYPE: FLW
DWG. CLASSIFICATION
LEVEL & CAT. UNCL
BY
TITLE
DATE 8-21-79
CODE IDENT. NO. 14065
A ORIGINAL ISSUE KH
ISS DATE REVISION BY CHK'D APPRD
SK-C-3663 SHT. OF
PRELIMINARY - UNCHECKED
DAYTON BLUE PRINT CO.
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Figure 15

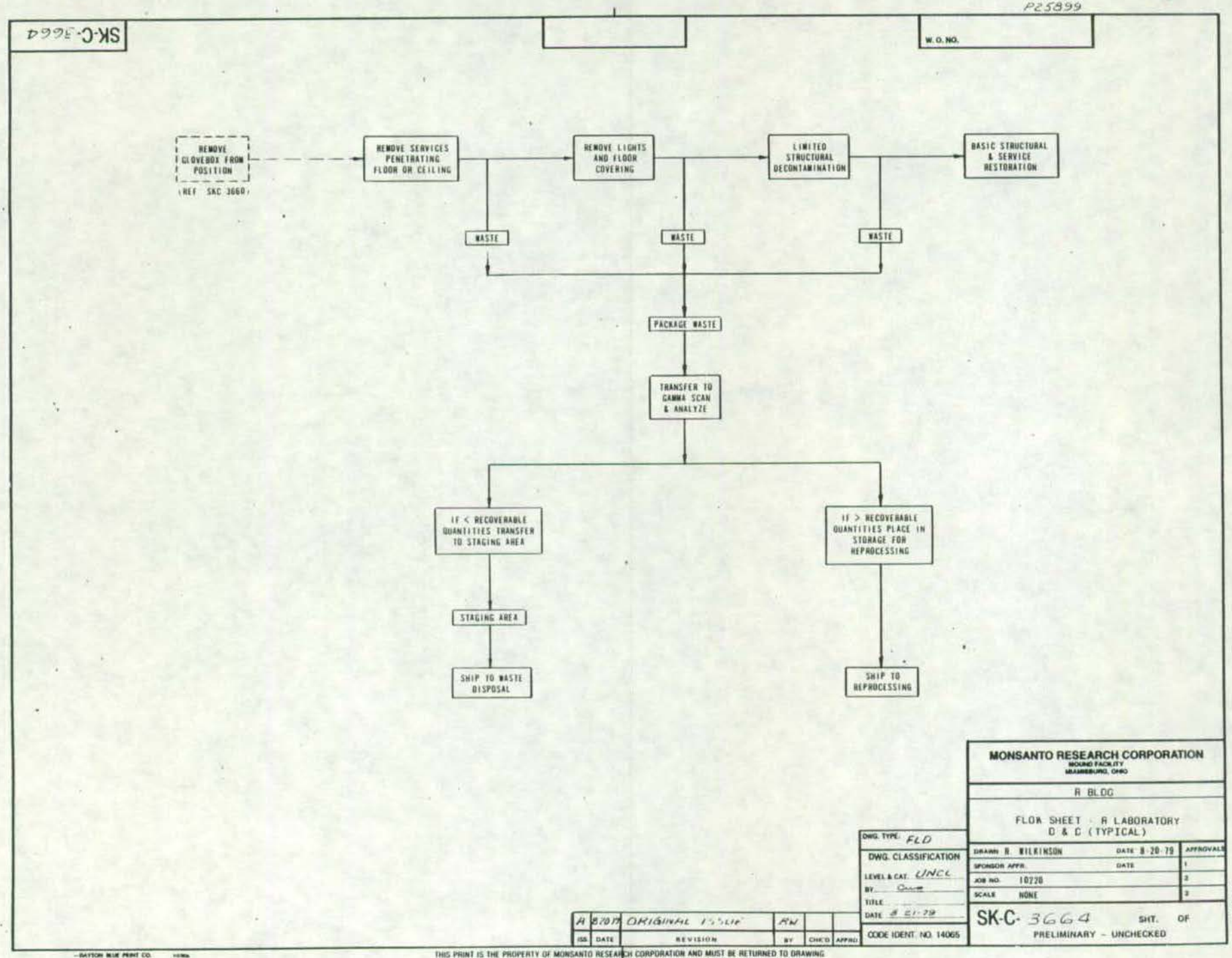
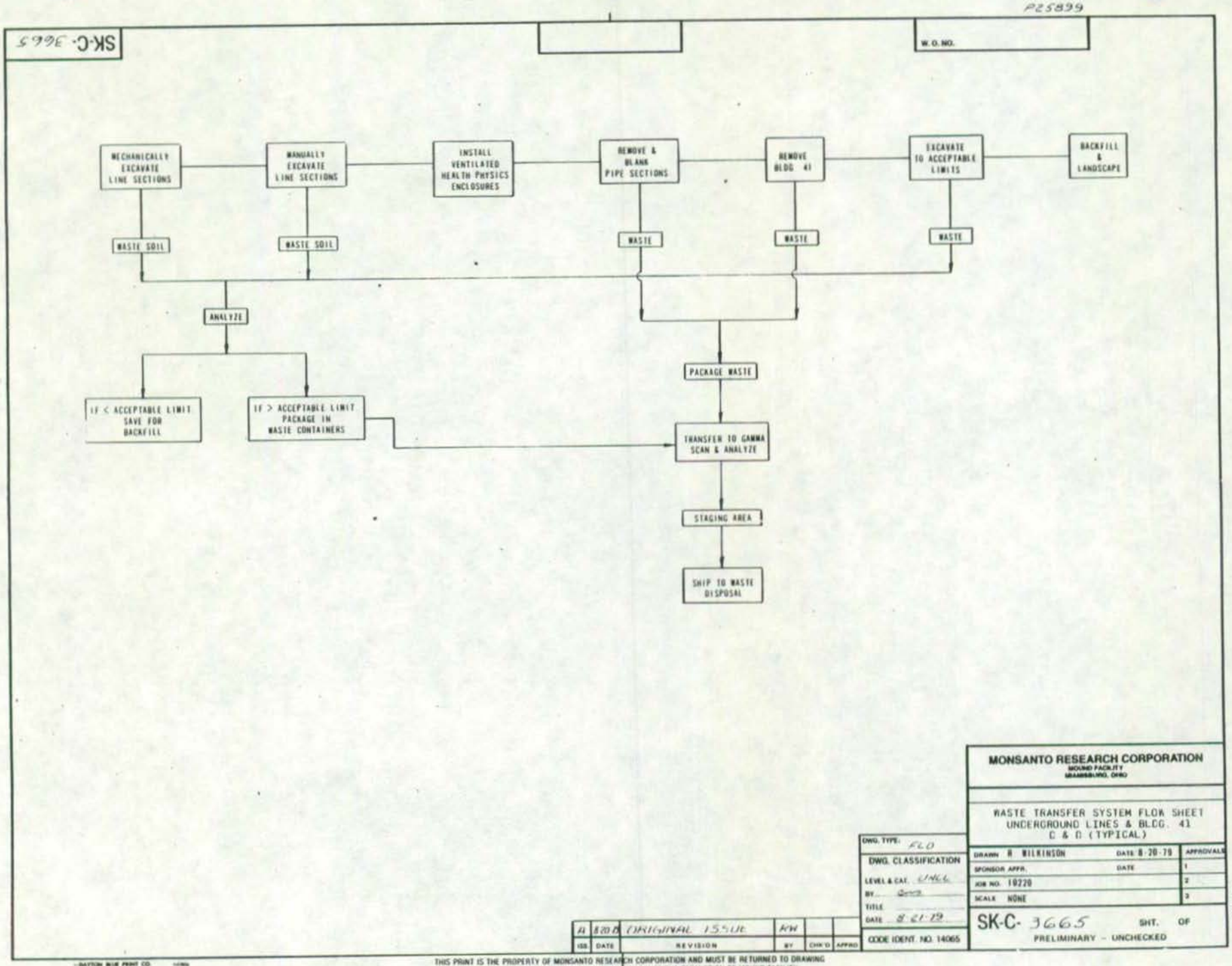


Figure 16
II-30


SK-C- 3665
W. O. NO.
P25899
MECHANICALLY EXCAVATE LINE SECTIONS
MANUALLY EXCAVATE LINE SECTIONS
INSTALL VENTILATED HEALTH PHYSICS ENCLOSURES
REMOVE & BLANK PIPE SECTIONS
REMOVE BLDG 41
EXCAVATE TO ACCEPTABLE LIMITS
BACKFILL & LANDSCAPE
WASTE SOIL
WASTE SOIL
WASTE
WASTE
WASTE
ANALYZE
PACKAGE WASTE
IF < ACCEPTABLE LIMIT SAVE FOR BACKFILL
IF > ACCEPTABLE LIMIT PACKAGE IN WASTE CONTAINERS
TRANSFER TO GAMMA SCAN & ANALYZE
STAGING AREA
SHIP TO WASTE DISPOSAL
MONSANTO RESEARCH CORPORATION
MOUND FACILITY
MIAMISBURG, OHIO
WASTE TRANSFER SYSTEM FLOW SHEET
UNDERGROUND LINES & BLDG. 41
C & D (TYPICAL)
DWG. TYPE: FLO
DWG. CLASSIFICATION
LEVEL & CAT. UNCL
BY
TITLE
DATE 8-21-79
CODE IDENT. NO. 14065
DRAWN R. WILKINSON
DATE 8-20-79
SPONSOR APPR.
DATE
JOB NO. 10220
SCALE NONE
APPROVALS
1
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SK-C- 3665
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PRELIMINARY - UNCHECKED
A 8-20-79 ORIGINAL ISSUE KW
ISS. DATE REVISION BY CHK'D APPRD
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Figure 17

required; and 4) to report to management in a timely manner. The objective of the QC effort is to preclude the occurrence of any uncontrolled change in D&D plans or activities that could have an impact on either safety or the environment.

There are a number of procedural checks indicated on the Work Flow Diagrams. These are designed to indicate when decontamination has reached the acceptable level, or provide information regarding the alternative to be followed.

These inspections and approvals are described as follows:

1. Samples of the acid rinse of process equipment were analyzed to determine whether the solutions were to be reprocessed or shipped out as waste.

2. In-line gamma scan provided accountability information.
3. Portable gamma scan of LSA material serves as a safeguards check.
4. Gamma scan of final TRU waste package provides accountability information and approval for shipment to Idaho. Any over limit package will be reprocessed.

In addition, radiological surveys of remaining contamination will be periodically verified by an outside organization using accepted methodology.

APPLICABLE STANDARDS

III. APPLICABLE STANDARDS AND CRITERIA

The planning and execution of the Decontamination and Decommisioning (D&D) of inactive areas at Mound is in accord with applicable sections of DOE Orders and Manual Chapters, Code of Federal Regulations, OSHA Regulations, ANSI Standards, NCRP & ICRP Reports and Recommendations and Mound Policy and Procedures.

Extensive decontamination of the areas in PP Building and R Building is defined as the removal of all contaminated equipment and systems, including gloveboxes and piping; decontamination of all remaining surfaces; and restoration of the areas to a reusable state. The final average anticipated contamination levels, after sealing, will be:

Wipe- $\leq$ 20 dis/min/100 cm^2

Direct- $\leq$ 1500 dis/min/100 cm^2

External Radiation- $\leq$ 1 mr/hr at surface

The sealed areas within buildings will remain under radiological control and negative air pressure to protect personnel and the environment.

Contaminated soil will be removed to an acceptable level. A level of 100 pCi/g is the goal of remedial action of near surface (first 12 inches) soil. A lower limit of 25 pCi/g is the goal for ALARA evaluations.

A. DOE Orders:[1] Applicable sections of the following primary DOE Orders were factored into the D&D Plan:

- DOE 3790.1, "Occupational Safety and Health Program for Federal Employees"
- DOE 5440.1B, "Implementation of the National Environmental Policy Act"
- DOE 5480.1A, "Environmental Protection, Safety, and Health Protection Program for DOE Operations"

[1]Partial Listing

- DOE 5480.4, "Environmental Safety, and Health Protection Standards"
- DOE 5480.1, Chapter III, "Safety Requirements for the Packaging of Fissile and Other Radioactive Materials"
- DOE 5480.1, Chapter IV, "Nuclear Criticality Safety"
- DOE 5480.1, Chapter V, "Safety of Nuclear Facilities"
- DOE 5480.1, Chapter VI, "Safety of Department of Energy Owned Reactors"
- DOE 5480.1, Chapter VII, "Fire Protection"
- DOE 5480.1, Chapter VIII, "Contractor Occupational Medical Program"
- DOE 5480.1, Chapter IX, "Construction Safety and Health Programs"
- DOE 5480.1, Chapter X, "Industrial Hygiene Program"
- DOE 5480.1, Chapter XI, "Requirements for Radiation Protection"
- DOE 5480.1, Chapter XII, "Prevention, Control and Abatement of Environmental Pollution"
- DOE 5480.2, "Hazardous, Toxic and Radioactive Mixed Waste Management"
- DOE 5481.1, "Safety Analysis and Review System"
- DOE 5482.1A, "Environmental Protection, Safety and Health Protection Appraisal Program"
- DOE 5483.1, "Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities"
- DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements"
- DOE 5484.2, "Unusual Occurrence Reporting System"
- DOE 5500.3, "Reactor and Nonreactor Nuclear Facility Emergency Planning, Preparedness and Response Program for Department of Energy Operations"
- DOE 5500.4, "Public Affairs Policy and Planning Requirements for Emergencies"

- DOE 5700.6B, "Quality Assurance"
- DOE 5820.2 "Radioactive Waste Management"
- DOE 6430, "General Design Criteria Manual"

B. Code of Federal Regulations: Applicable sections of the following primary Code of Federal Regulations were also factored into the D&D Plan:

- Title 10 - Energy (NRC)
- Title 29 - Labor (OSHA)
- Title 40 - Protection of Environment (EPA)
- Title 49 - Transportation (DOT)

C. Other Criteria: Applicable sections of other primary criteria were also factored into the D&D Plan:

- ANSI Standards
- ASTM Standards
- NCRP Reports and Recommendations
- ICRP Reports and Recommendations
- WIPP, Idaho and Nevada Test Site Disposal Criteria
- BNWL-2086 "A Guide to Good Practices at Plutonium Facilities"

D. Mound Policies and Procedures: Applicable sections of primary Mound policy and procedures were also factored into the D&D Plan:

- Policy-Procedure Manual
- MD-10019, "Nuclear Radiation Safety"
- MD-10038, "Nuclear Criticality Precautions"
- MD-10050, "R Building Health Physics Precautions"
- MD-10075, "PP Criticality Precautions"
- Mound Health and Safety Guide
- Mound Employee Guide to Respiratory Protection

- MD-10077, "Health Physics Precautions, PP Building"
- MD-10087, "Nuclear Operations Preparation of Material Prior to Shipment"
- MD-10113, "Nuclear Materials Management Procedures"
- MD-10114, "Nuclear Materials Safeguards and Accountability"
- MD-10134, "Custodians' Handbook, Nuclear Materials Safeguards and Accountability"
- MD-10161, "Mound Facility Respiratory Protection Manual"
- MD-10165, "Nonweapons Quality Policy and Program"
- MD-10173, "Users Handbook, Waste Accountability Shipping and Packaging"
- MD-10177, "Industrial and Environmental Protection Manual"
- MD-10181, "Mound Quality Audit Plan"
- MD-10193, "Loss Prevention and Environmental Control"
- MD-10197, "Guide to the Identification, Protection, and Handling of Sensitive Unclassified Data"
- MD-10198, "Computer Security Policy"
- MD-10203, "Mound WIPP Certification Program for Newly Generated Contact Handled (CH) Transuranic Waste"
- MD-10215, "General Procedure for the Calibration of Radiation Protection Instrumentation"
- MD-10240, "Quality Plans for Nuclear Operations"
- MD-10245, "Quality Plan for the Control of Radioactive Waste"
- MD-10246, "On Site Transportation of Hazardous Materials"
- MD-20209, "Operation Procedure for SW Health Physics Group"
- MD-20845, "Health Physics Procedures, Waste Disposal Area"
- MD-70205, "TRU Waste Management"
- MD-70204, "Non-TRU Waste Management"
- EOS 10000 "Master Plan: (Emergency Planning System)"

- EPS 10300 "Health Physics Nuclear Emergency Plan"
- Plus other operational procedures

In addition, specific operational procedures on D&D operations are prepared for unusual operations.

E. Specific Decontamination and Decommissioning Criteria: After several D&D alternatives were evaluated, the "Extensive Decontamination" mode was chosen as the best D&D approach (see Section I.B. on "Disposition" for more details).

Extensive decontamination includes the removal of gloveboxes and contaminated services and an intensive decontamination of the facility. Since complete decontamination would require removal of the entire structure, the facility will be left "tainted"; i.e., small amounts of residual contamination would remain. This residual contamination will be sealed, and the facility would remain under control and negative pressure to protect personnel and environment.

The final exposed average contamination levels in the facility after this decontamination and sealing will be:

Wipe- $\leq$ 20 dis/min/100 cm^2

Direct- $\leq$ 1500 dis/min/100 cm^2

External Radiation- $\leq$ 1 mr/hr at surface.

Contaminated soil will be removed to an acceptable level. A level of 100 pCi/g is the goal of remedial action of near surface (first 12 inches) soil. A lower limit of 25 pCi/g is the goal for ALARA evaluations.

PLUTONIUM 238/239 CONTAMINATED SOIL CLEANUP OPERATIONAL GUIDELINES FOR CONDITIONAL RELEASE

MOUND'S DECONTAMINATION AND DECOMMISSIONING (D&D) PROGRAM

Below are the operational guidelines to be used in evaluating whether plutonium-238/239 contaminated soil whithin the Mound restricted fence line requires additional remedial action. The objective of remedial action on soil is to primarily eliminate potential exposure health hazards from highly contaminated soil (TRU or 100nCi/g).

A secondary goal is to reduce contamination levels to "as low as reasonably achievable" (ALARA) levels based on a cost versus benefit analysis.

Based on an evaluation of regulatory guidance, work done at other DOE sites, field measurements and analysis capabilities, and a site specific pathways analysis a level of 100 pCi/g has been chosen as a goal of D&D remedial action of near surface (first 12 inches) soil.

However, this goal (and action levels for soil deeper than 12 inches) is dependent on several factors and exemptions will be granted by the D&D Management Team and Environmental section based on an evaluation of several parameters:

- Availability for migration, resuspension, or disturbance
- Cost versus benefit of additional remedial action
- Risk to personnel and the environment for further remedial action
- Potential for recontamination by other operations
- Physical location, level, extent and depth of contamination

PLUTONIUM 238/239 CONTAMINATED SOIL CLEANUP OPERATIONAL GUIDELINES
FOR CONDITIONAL RELEASE
BASIS OF 100 PCI/G GOAL

In May, 1981 W. P. Davis, Mound's D&D Project Leader for the WTS project recommended to MRC's Environmental and Waste Management supervision a goal of 100 pCi/g be used for D&D soil remedial action projects for conditional release of soil. This recommendation was accepted.

This goal of 100 pCi/g was chosen based on both the Project Leader's previous 11 years and the Project Health Physicist's (J. M. Garner) 33 years experience with remedial action of contaminated soil on site and with contact with other DOE sites.

The level of 100 pCi/g was chosen as the most optimum (cost/benefit) level for remedial action of the restricted (from public access) Mound site contaminated soil areas for conditional release.

A level an order of magnitude higher (1000 pCi/g) was considered to be unacceptable because it would unnecessarily leave high levels of surface soil contamination and restrict many Mound areas from potential conditional reuse.

A level an order of magnitude lower (10 pCi/g) was considered unnecessarily restrictive and costly. Although this level could be considered unrestricted*, the Mound site is still a restricted site with continuing radioactive operations.

The level of 100 pCi/g was chosen as the most optimum level for remedial action for several reasons:

- Approaches unrestricted release levels*
- Minimizes potential future remedial action
- Minimizes impact to Mound site operations
- Field detection capabilities at this level existed within DOE
- Consistent with DOE's ALARA philosophy

In 1982 Mound developed a soil screening facility to measure plutonium 238/239 levels down to 25 pCi/g with reasonable accuracy with an approximately 30 minutes turn around on samples from the field. This level of 25 pCi/g was then chosen as the lower limit for ALARA evaluations.

In 1984 Mound performed a very conservative pathways analysis (see attached memo) based on NUREG 0707 "A Methodology for Calculating Residual Radiation Levels Following Decommissioning", October, 1980, program which was modified to correct errors in the original program (see attached modified NUREG 0707 program). The very conservative dose estimate at 100 pCi/g yielded approximately 1250 mrem/year if the employee was involved in digging, construction, and moving uniformly contaminated soil 2000 hours per year without any respiratory protection.

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*In 1981 DOE had no one definite unrestricted release level for plutonium. A range of 1 pCi/g (State of Colorado) to 100 pCi/g (Healy, J. W., "An Examination of the Pathways from Soil to Man for Plutonium", LA-6741-MS, 1977, Los Alamos Scientific Laboratory, Los Alamos, NM) was being considered as unrestricted at that time.

PLUTONIUM 238/239 CONTAMINATED SOIL CLEANUP OPERATIONAL GUIDELINES FOR ALARA EVALUATIONS

MOUND'S DECONTAMINATION AND DECOMMISSIONING (D&D) PROGRAM

Below are the operational guidelines to be used in evaluating whether plutonium-238/239 contaminated soil within the Mound restricted fence line requires additional remedial action. The objective of ALARA (as low as reasonably achievable) remedial action is to reduce soil contamination levels to as low as reasonably achievable based on a cost versus benefit analysis.

A level of 100 pCi/g is the goal of remedial action of near surface (first 12 inches) soil. A lower limit of 25 pCi/g is the goal of ALARA evaluations.

The following are the cost versus benefit parameters to be evaluated:

- Availability for migration, resuspension, or disturbance
- Cost versus benefit of additional remedial action
- Risk to personnel and the environment for further remedial action
- Potential for recontamination by other operations
- Physical location, level, extent and depth of contamination

AVAILABILITY FOR MIGRATION, RESUSPENSION, OR DISTURBANCE:

Consider the availability for migration (rain, ground water, aquifer), resuspension (wind), or disturbance (future excavation, construction).

COST VERSUS BENEFIT OF ADDITIONAL REMEDIAL ACTION:

Consider if prior removal efforts have been successful (reasonable decontamination factor), accessibility for additional excavation (depth location), shoring requirements, feasibility (undermining permanent structures and utilities), and impact on plant operations.

RISK TO PERSONNEL AND THE ENVIRONMENT FOR FURTHER REMEDIAL ACTION:

Consider if the risk to personnel (deep excavations) and the environment (length of exposure) is being minimized.

POTENTIAL FOR RECONTAMINATION BY OTHER OPERATIONS:

Consider the risk and level of recontamination by ongoing radioactive operations.

PHYSICAL LOCATION, LEVEL, EXTENT AND DEPTH OF CONTAMIANTION:

Consider the location (near structures/areas that require D&D in the future, in bedrock), level (25-100, 100-1000, 1000-10,000, 10,000-100,000 pCi/g), extent (spot versus area, potential for greater contamination deeper), and depth (near surface vs. deep).

All exceptions must be approved by the D&D Program Management Team (Program Manager - Nuclear Operations; Supervisor - Engineering; Supervisor (second level) - Health Physics).

WTS D&D SOIL EXEMPTION (>100 pCi/g)
OPERATIONAL GUIDELINES

Below are the operational guidelines to be used in evaluating whether plutonium-238/239 contaminated soil within the Mound restricted fence line can be left if greater than 100 pCi/g.

- When the project engineer and project health physics supervisor determine it is not cost beneficial to continue soil removal to reduce remaining soil contamination lower than 100 pCi/g he requests an exemption review by the D&D Program Management Team.

- The D&D Program Management Team (Program Manager - Nuclear Operations; Supervisor - Engineering; Supervisor (2nd Level) - Health Physics) reviews the recommendation and basis.

- The Environmental Supervisor then reviews the recommendation and grants a temporary field approval to exempt.

- The location of the contaminated area is measured and located on site drawing by the project engineer and final records are maintained by the Environmental Section.

- The contaminated area is then sealed with a minimum four-inch layer of Bentonite clay. A second layer of Bentonite clay may also be installed within two to three feet of the original surface.

- The exemption is communicated within 30 days to the following organizations:
  - o Directors of MRC Nuclear Operations, Engineering, and Administrative Services (Environmental and Health Physics)
  - o DOE/DAO D&D Program Engineer
  - o DOE/SFMP and AL (via monthly report)

- Before completion of the D&D project:
  - o Each exemption area will be independently radiologically verified by a non Mound contractor (currently Battelle Columbus Laboratories) and their report issued to DOE/DAO, AL, RL.

  - o Final radiological levels are noted on the Master Mound Site Contaminated Areas map which is included in "The Mound Site Development and Facilities Utilization Master Plan" MLM-ML-85-44-0002 and is updated at least annually and issued to DOE.

WTS D&D SOIL EXEMPTIONS (>100 pCi/g)

EXEMPTION 1 - October 30, 1985:

Area 1 (see attached map) was excavated (15 ft wide by 15 ft long) to a depth of approximately 7 feet to remove the two underground lines and their cleanouts. The cleanouts had previously leaked (being on the pressure side of the Building 41 pumps) and the soil was contaminated under the lines. Excavation continued in one foot increments and the soil was rechecked. Excavation was halted at the 11 feet depth level and an exemption to abandon further excavations was granted. The bottom of the excavation was sealed with a four inch layer of Bentonite clay and refilled/compacted with clean fill from offsite. A second layer of Bentonite was placed approximately three feet from the top of the excavation.

Discussion of Exemption:

Area 1 is located adjacent (see attached map) to the Waste Disposal (WD) Building. The WD Building receives and processes low level radioactive liquid contaminated waste from other radioactive buildings on site. There is a potential (although low) for Area 1 to become recontaminated (up to 10 nCi/g) from future operations. Also eventual removal of the WD Building when it becomes surplus would remove any remaining contamination. The current D&D excavation has removed soil contamination to less than 10 nCi/g. DOE/DAO, AL, RL representatives were notified of the decision.

The excavation beginnning at the 8 feet depth level was in bedrock and, because of the hillside on the north side and structures surrounding the Area 1, had vertical sides. It was felt that any remaining contamination was

primarily falling off the vertical sides (that couldn't be reasonably excavated because of surrounding structures and the hillside above the excavation). Any further excavation would have required extensive shoring and replacement and relocation of plant services.

Soil contamination was reduced from approximately 100 nCi/g to less than 5 nCi/g. Note that final contamination levels were on soil only after rocks (approximately 90% of sample) were removed.

Upper side walls	all samples < 0.1 nCi/g
Lower side walls	all samples < 1.0 nCi/g
Bottom	5 samples < 1.0 nCi/g
	1 sample 3.0 nCi/g

WTS D&D SOIL EXEMPTIONS (>100 pCi/g)

EXEMPTION 2 - November 27, 1985:

Area 2 was immediately adjacent to Area 1 (see attached map). Area 2 was excavated (15 ft wide by 30 ft long) to a depth of approximately 7 feet to remove the two underground lines and their cleanouts. The cleanouts had also previously leaked (being on the pressure side of the Building 41 pumps) and the soil was contamined under the lines. Excavation continued in one foot increments and the soil was rechecked. Excavation was halted at the 12 feet depth level and an exemption to abandon further excavations was granted. The bottom of the excavation was sealed with a four inch layer of Bentonite clay and refilled/compacted with clean fill from offsite. A second layer of Bentonite was placed approximately three feet from the top of the excavation.

Discussion of Exemption:

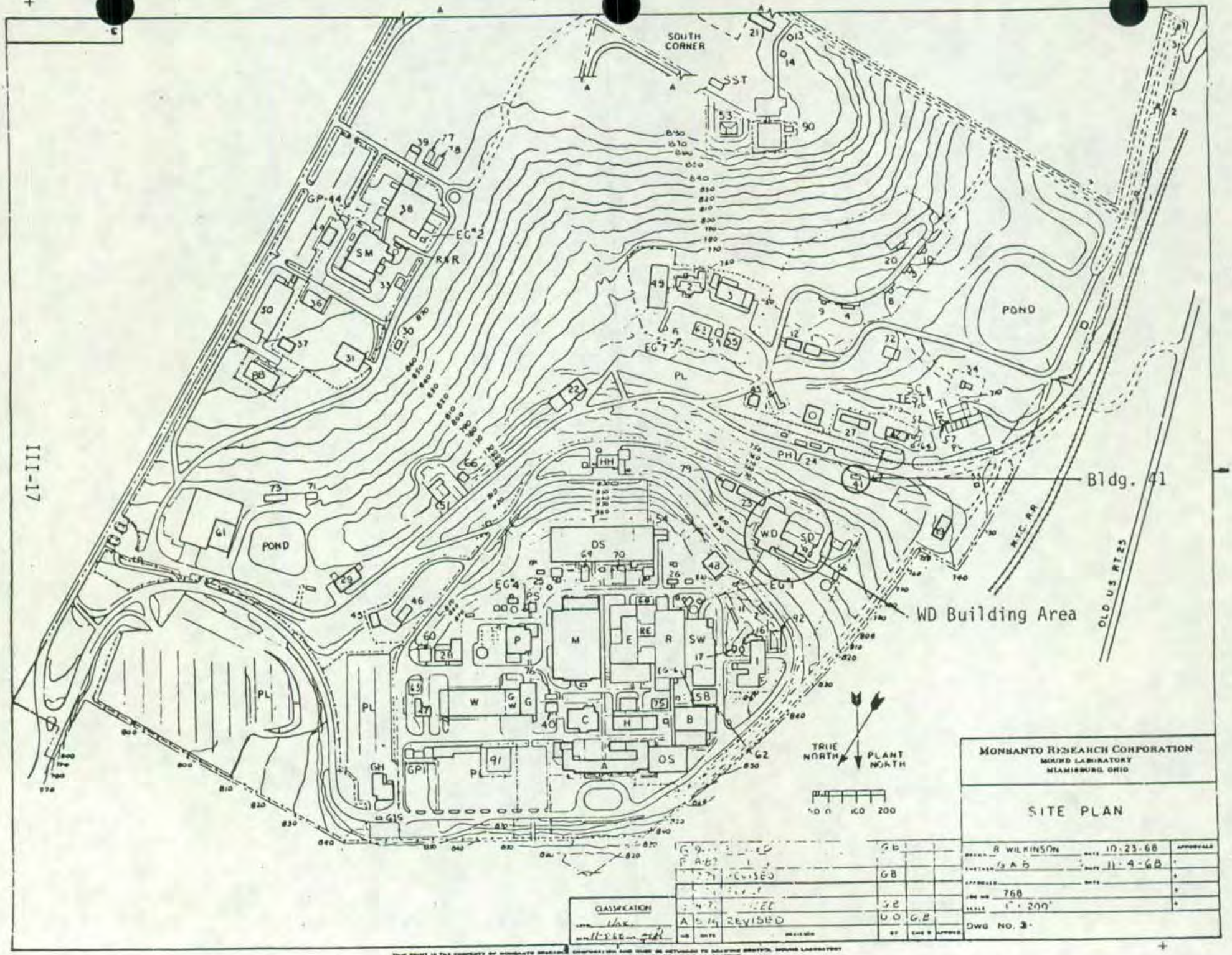
Area 2 is located adjacent (see attached map) to the Waste Disposal (WD) Building. The WD Building receives and processes low level radioactive liquid contaminated waste from other radioactive buildings on site. There is a potential (although low) for Area 2 to become recontaminated (up to 10 nCi/g) from future operations. Also eventual removal of the WD Building when it becomes surplus would remove any remaining contamination. The current D&D excavation has removed soil contamination to less than 10 nCi/g. DOE/DAO, AL, RL representatives were notified of the decision.

The excavation beginning at the 8 feet depth level was in bedrock and because of structures surrounding the Area 2, had vertical sides. It was felt that any remaining contamination was primarily falling off the vertical sides

(that couldn't be reasonably excavated because of surrounding structures and the hillside above the excavation). Any further excavation would have require extensive shoring and replacement and relocation of plant services.

Soil contamination was reduced from approximately 100 nCi/g to less than 1 nCi/g. Note that final contamination levels were on soil only after rocks (approximately 90% of sample) were removed.

Excavation	all samples < 0.6 nCi/g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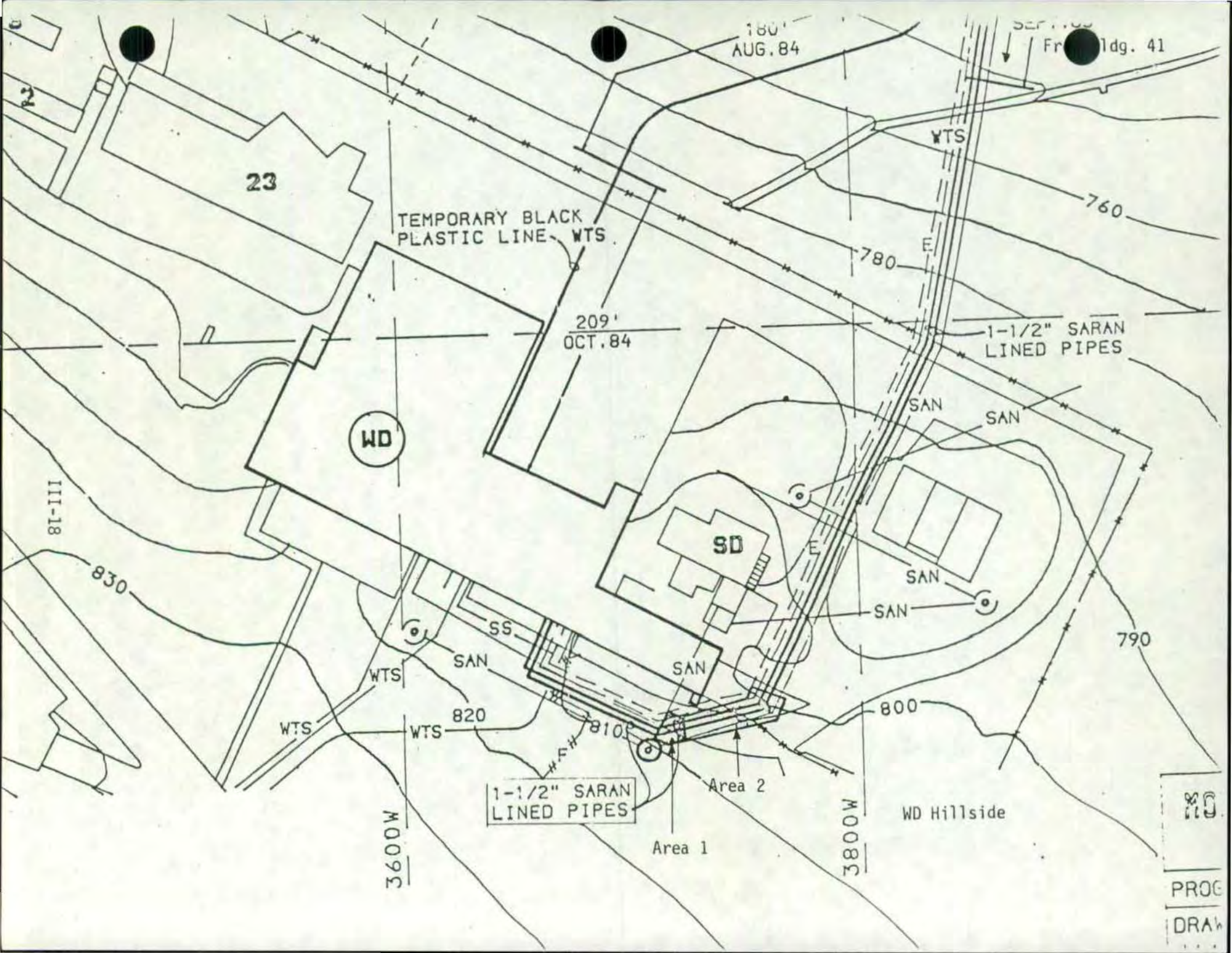
SST
GP-44
EG-2
R&R
SM
POND
EG-7
PL
TEST
PH
Bldg. 41
WD
SD
WD Building Area
N.Y.C. R.R.
OLD U.S. RT. 25
DS
HH
EG-4
PS
M
E
RE
R
SW
P
W
G
C
H
B
A
OS
GP
GH
EG-5
EG-6
TRUE NORTH
PLANT NORTH
50 0 100 200
MONSANTO RESEARCH CORPORATION
MOUND LABORATORY
MIAMISBURG OHIO
SITE PLAN
R WILKINSON
10-23-68
G A B
11-4-68
768
1" = 200'
DWG NO. 3
REVISED
CLASSIFICATION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AUG.84
Fr ldg. 41
23
TEMPORARY BLACK
PLASTIC LINE
WTS
209'
OCT.84
WD
SD
WTS
760
780
E
1-1/2" SARAN
LINED PIPES
SAN
SAN
SAN
SAN
SAN
E
790
800
830
SS
SAN
WTS
WTS
WTS
820
810
F
1-1/2" SARAN
LINED PIPES
Area 2
Area 1
3600W
3800W
WD Hillside
III-18
PROG
DRAW

ORGANIZATION

IV. ORGANIZATION AND RESPONSIBILITIES

A. Organization Chart of D&D Project Management Team - Although the responsibility for the D&D program lies with the Engineering Department, a project of this magnitude requires the coordinated efforts of two Mound Departments. A D&D Project Management Team consisting of representatives from the Engineering Department and the Administrative Services Department has been established to guide the efforts of all organizations involved. The administrative reporting organization is shown in Figure 18. The numbers on the organization charts are for references purposes only. The charts have been coded to identify a brief narrative description for the organizational units more involved in the D&D effort. This narrative has been incorporated in a later portion of this section.

The D&D Project Management Team is responsible for the overall D&D plan, resource requirement planning, development of budget requirements, schedule target dates, short and long range work plans, coordination of activities, control of schedules and costs, and reporting.

The matrix organizational concept is used in the management of the D&D project, i.e., the Decontamination and Decommissioning Project Management Team utilizes the resources of the functional organization at Mound. Figure 19 shows the functional relationships between the Project Management Team and

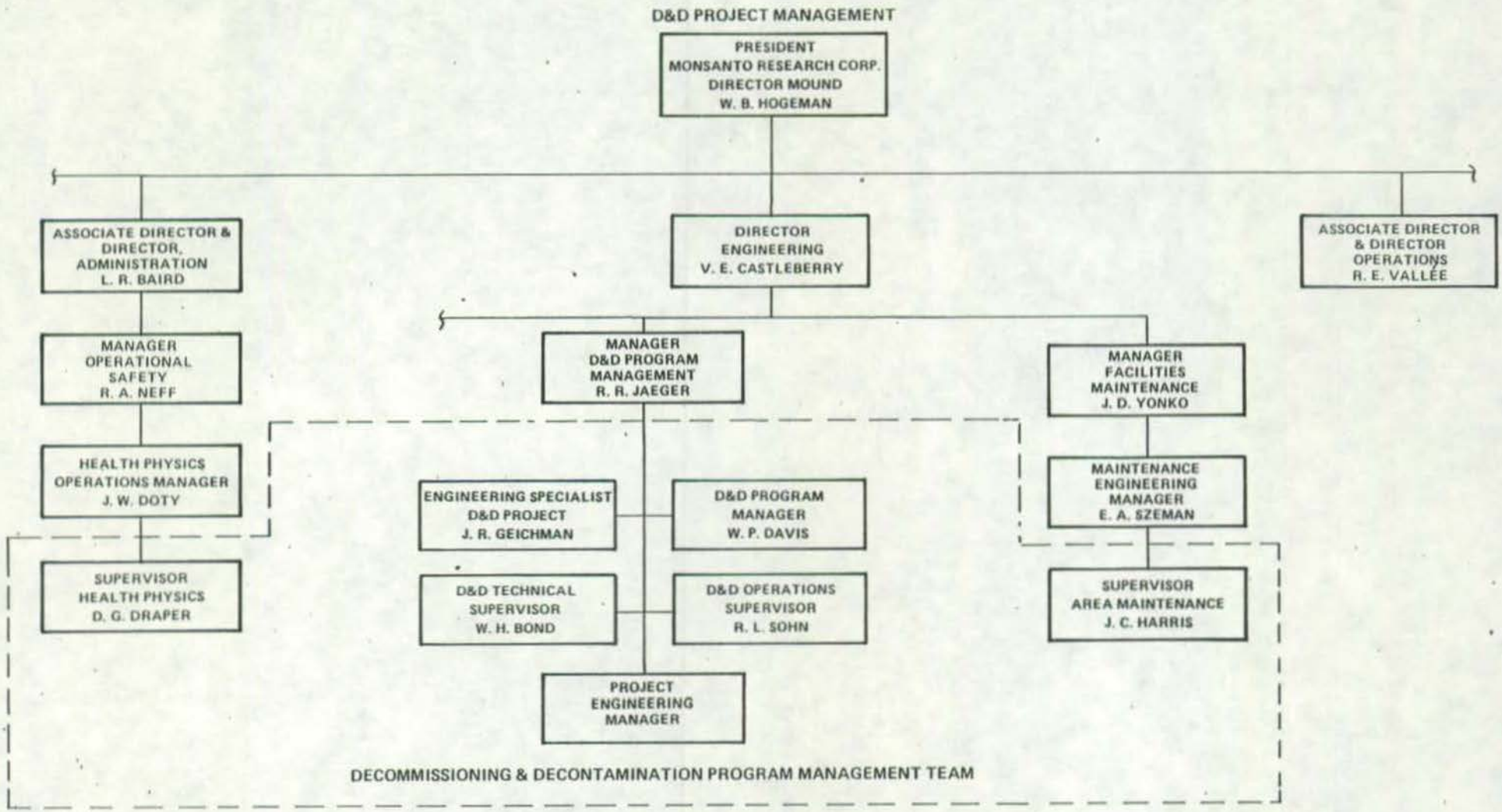

D&D PROJECT MANAGEMENT
PRESIDENT
MONSANTO RESEARCH CORP.
DIRECTOR MOUND
W. B. HOGEMAN
ASSOCIATE DIRECTOR & DIRECTOR, ADMINISTRATION
L. R. BAIRD
DIRECTOR ENGINEERING
V. E. CASTLEBERRY
ASSOCIATE DIRECTOR & DIRECTOR OPERATIONS
R. E. VALLÉE
MANAGER OPERATIONAL SAFETY
R. A. NEFF
MANAGER D&D PROGRAM MANAGEMENT
R. R. JAEGER
MANAGER FACILITIES MAINTENANCE
J. D. YONKO
HEALTH PHYSICS OPERATIONS MANAGER
J. W. DOTY
ENGINEERING SPECIALIST D&D PROJECT
J. R. GEICHMAN
D&D PROGRAM MANAGER
W. P. DAVIS
MAINTENANCE ENGINEERING MANAGER
E. A. SZEMAN
SUPERVISOR HEALTH PHYSICS
D. G. DRAPER
D&D TECHNICAL SUPERVISOR
W. H. BOND
D&D OPERATIONS SUPERVISOR
R. L. SOHN
SUPERVISOR AREA MAINTENANCE
J. C. HARRIS
PROJECT ENGINEERING MANAGER
DECOMMISSIONING & DECONTAMINATION PROGRAM MANAGEMENT TEAM

FIGURE 18

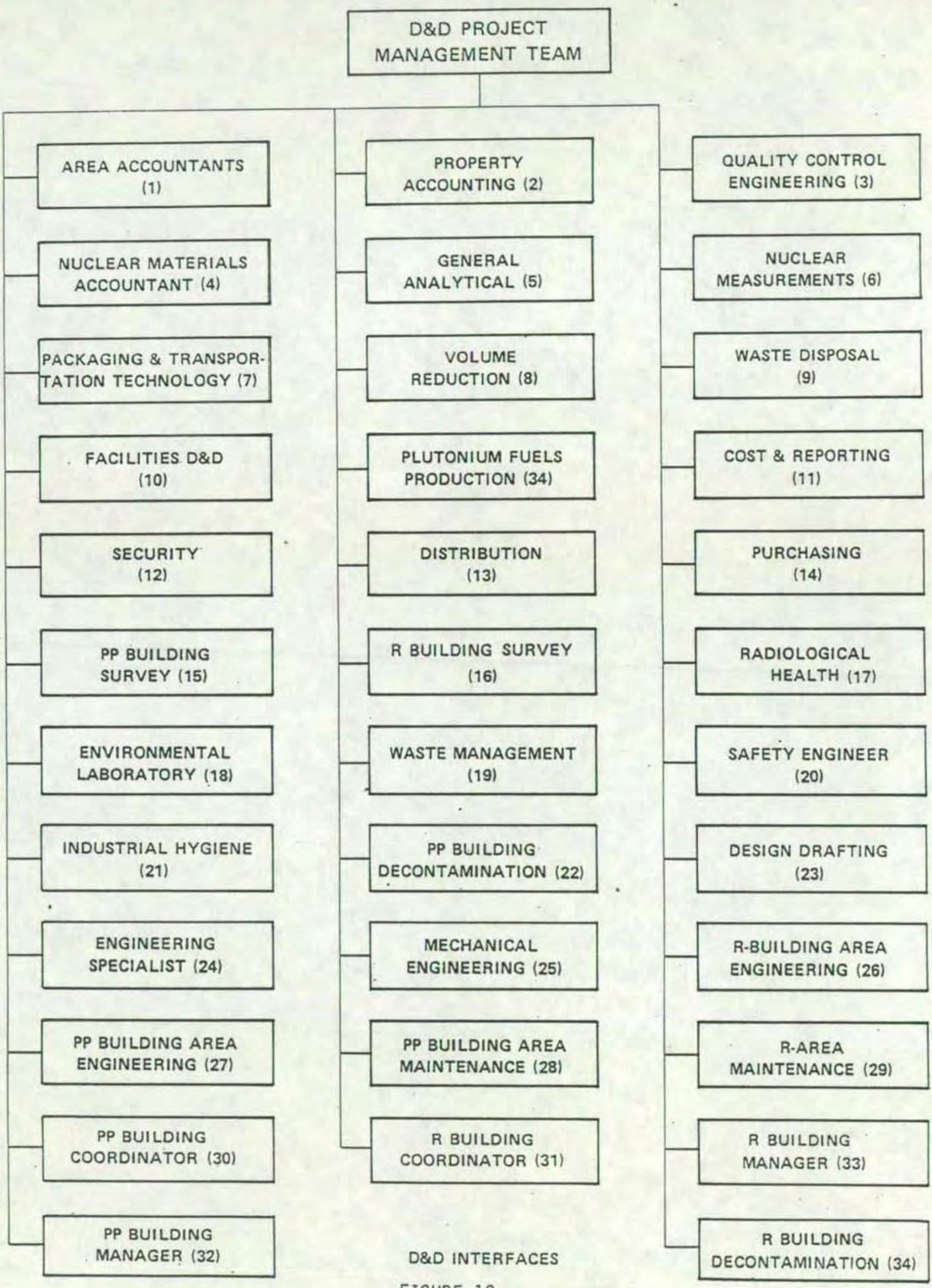

D&D PROJECT MANAGEMENT TEAM
AREA ACCOUNTANTS (1)
NUCLEAR MATERIALS ACCOUNTANT (4)
PACKAGING & TRANSPORTATION TECHNOLOGY (7)
FACILITIES D&D (10)
SECURITY (12)
PP BUILDING SURVEY (15)
ENVIRONMENTAL LABORATORY (18)
INDUSTRIAL HYGIENE (21)
ENGINEERING SPECIALIST (24)
PP BUILDING AREA ENGINEERING (27)
PP BUILDING COORDINATOR (30)
PP BUILDING MANAGER (32)
PROPERTY ACCOUNTING (2)
GENERAL ANALYTICAL (5)
VOLUME REDUCTION (8)
PLUTONIUM FUELS PRODUCTION (34)
DISTRIBUTION (13)
R BUILDING SURVEY (16)
WASTE MANAGEMENT (19)
PP BUILDING DECONTAMINATION (22)
MECHANICAL ENGINEERING (25)
PP BUILDING AREA MAINTENANCE (28)
R BUILDING COORDINATOR (31)
D&D INTERFACES
QUALITY CONTROL ENGINEERING (3)
NUCLEAR MEASUREMENTS (6)
WASTE DISPOSAL (9)
COST & REPORTING (11)
PURCHASING (14)
RADIOLOGICAL HEALTH (17)
SAFETY ENGINEER (20)
DESIGN DRAFTING (23)
R-BUILDING AREA ENGINEERING (26)
R-AREA MAINTENANCE (29)
R BUILDING MANAGER (33)
R BUILDING DECONTAMINATION (34)

FIGURE 19

other support groups. A brief description of the functions performed by each of the groups follows:

1. Area Accountants: Monitor the departmental expenses related to the D&D Program and coordinate the resultant data with AL Operations.

2. Property Accounting: Provides the accountability and audit function for all capital and sensitive equipment.

3. Quality Control Engineering: Performs the audit, review, and evaluation of the processes and procedures utilized by D&D personnel to ensure that MRC quality specifications and procedures are attained.

4. Nuclear Materials Accountant: Maintains the computer system and data for all D&D program transactions involving transuranic materials. Includes the creation of transuranic residue, accounting, and final disposition of the residue.

5. General Analytical: Provides general analytical chemistry support for the D&D program.

6. Nuclear Measurements: Performs the assay and evaluation of waste generated by the D&D program in order to assign the quantity of plutonium in the waste.

7. Packaging and Transportation Technology: Development of processes and packages for handling, shipping, and burial of transuranic waste. Includes package engineering for special case items as related to the D&D effort and evaluation of methods to immobilize D&D generated waste. Also procures and supplies qualified waste shipping containers for D&D wastes.

8. Volume Reduction: Provides the manpower and systems for the reduction of the total volume of D&D generated waste utilizing compaction. Low-level combustibles are compacted at a 4:1 ratio.

9. Waste Disposal: Chemical treatment of all waste water solutions to remove transuranic materials to comply with DOE, EPA, MRC, and ALARA philosophy and goals for waste water effluent.

10. Facilities D&D: Performs the Operations Department function of thoroughly cleaning gloveboxes, manipulator cells, equipment, and process piping prior to removal.

11. Cost and Reporting: Prepares the Project Cost and Schedule Summary Report and prepares the phasing data for estimated expenditures for the D&D Program.

12. Security: Provides consulting services and audit functions for compliance with all DOE security requirements.

13. Distribution: Provides for the audit of the movement of all incoming/outgoing materials, supplies, and equipment. Also provides storage facilities and onsite transport of incoming/outgoing materials, supplies, and equipment and furnishes special handling equipment as required to accomplish the onsite transport.

14. Purchasing: Provides for the procurement of all equipment (capital or expense), supplies, and material required to support the entire D&D Program.

15. PP Building Survey: Provides the required Health Physics support to monitor for external, airborne, and wipable radioactive contamination to maintain levels within ALARA guidelines. Provides special monitoring services in support of D&D generated work efforts and maintenance. Maintains advisory capacity for feasibility for proposed operations and work efforts. Also includes survey responsibility of the Waste Transfer System.

16. R-Building Survey: Same as #15, PP Building Survey, for R Building.

17. Radiological Health: Monitoring and evaluation of external exposure to whole body, body extremities, and skin from gamma and neutron radiation. Also, determination of internal exposure resulting from disposition of radioactive materials within the body.

18. Environmental Laboratory: Provides analysis and evaluation of environmental samples for trace quantities of radioactive materials. The samples include air, water, soil, vegetation, urine, tissue, blood, fecal material and food stuffs.

19. Waste Management: Oversees the handling of radioactive waste to ensure that MRC complies with all DOE and appropriate regulations and guidelines pertaining to the disposal of radioactive waste. Also acts as the prime contact for the various disposal sites.

20. Safety Engineering: Evaluates the various safety aspects of the D&D program, proposed new D&D work, or modifications to the existing program for hazards.

21. Industrial Hygiene: Provides support monitoring of nonradioactive chemicals and their uses. Manages the disposal of all nonradioactive chemical wastes.

22. PP Building Decontamination: Provides required support for Nuclear and Engineering work effort and constructs radiation control enclosures for D&D maintenance work. Provides support of TRU and LSA waste handling, packaging, and removal. Provides required decontamination of PP Building to meet ALARA requirements and general janitorial services in radiation support areas. Maintains advisory capacity for feasibility for proposed operations and work efforts. Includes decontamination responsibility for Waste Transfer System.

23. Design Drafting: Provides drafting services as required to support the D&D program, also assists in advisory capacity in design development and evaluation of proposed designs.

24. Engineering Specialist: Consultant to provide evaluation and guidance for design criteria for special problem areas of the D&D program.

25. Mechanical Engineering: Provides the design, purchase, fabrication and installation of mechanical equipment systems required for the D&D program.

26. R-Building Area Engineering: Assists in the design, procurement and installation of any new process equipment and performs advisory function in maintaining building support or process equipment or systems. Assist Nuclear Operations in the design, planning, procurement, budgeting and installation of proposed program systems.

27. PP Building Area Engineering: Same as 26 (R-Building Area Engineering) for PP Building.

28. PP Building Area Maintenance: Schedules and provides the required craft manpower and directs such manpower to accomplish the D&D work effort in PP Building.

29. R-Area Maintenance: Schedules and provides the required craft manpower and directs such manpower to accomplish the D&D work effort in the R-Area.

30. PP Building Coordinator: Provides planning of maintenance manpower in support of maintenance and engineering packages and secures the required materials to accomplish the D&D work effort in PP Building.

31. R-Area Coordinator: Provides planning of maintenance manpower in support of maintenance and engineering packages and secures the required materials to accomplish the D&D work effort in R Building.

32, 33. Building Managers (PP & R): Provide information on program schedules, building shutdowns, maintenance requirements, or any other building function that may impact the D&D schedule.

34. R Building Decontamination: Same as #22, PP Building Decontamination, for R Building.

B. MRC Organization - The Mound Management organization, as applicable to the Decontamination and Decommissioning Project, is shown in Figures 18-25.

This section relates to the Mound organizational structure the functions directly involved in or supportive of the D&D activities as described in Section IV A. This will permit a better understanding of the complex nature of the D&D Project and, at the same time, define the interrelationships among the various organizational units at Mound involved in the D&D functions.

C. MRC/DAO/AL/Headquarters - The interfaces between MRC, DOE/DAO and DOE/AL are shown in Figure 26.

MONSANTO RESEARCH CORPORATION
MRC-MOUND
ORGANIZATION CHART
DECOMMISSIONING & DECONTAMINATION PROJECT

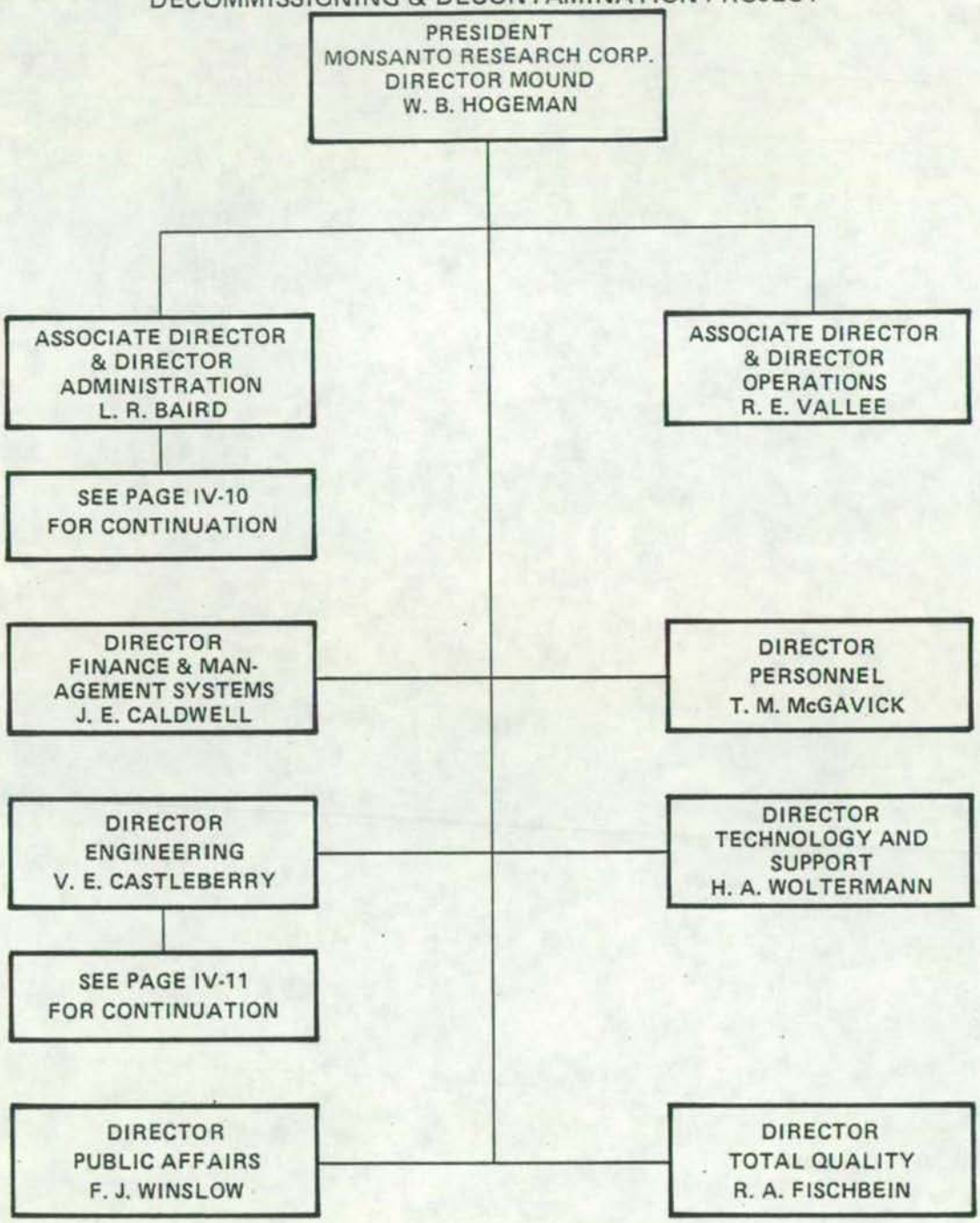


FIGURE 20

ADMINISTRATION DEPARTMENT
(Partial Organization)

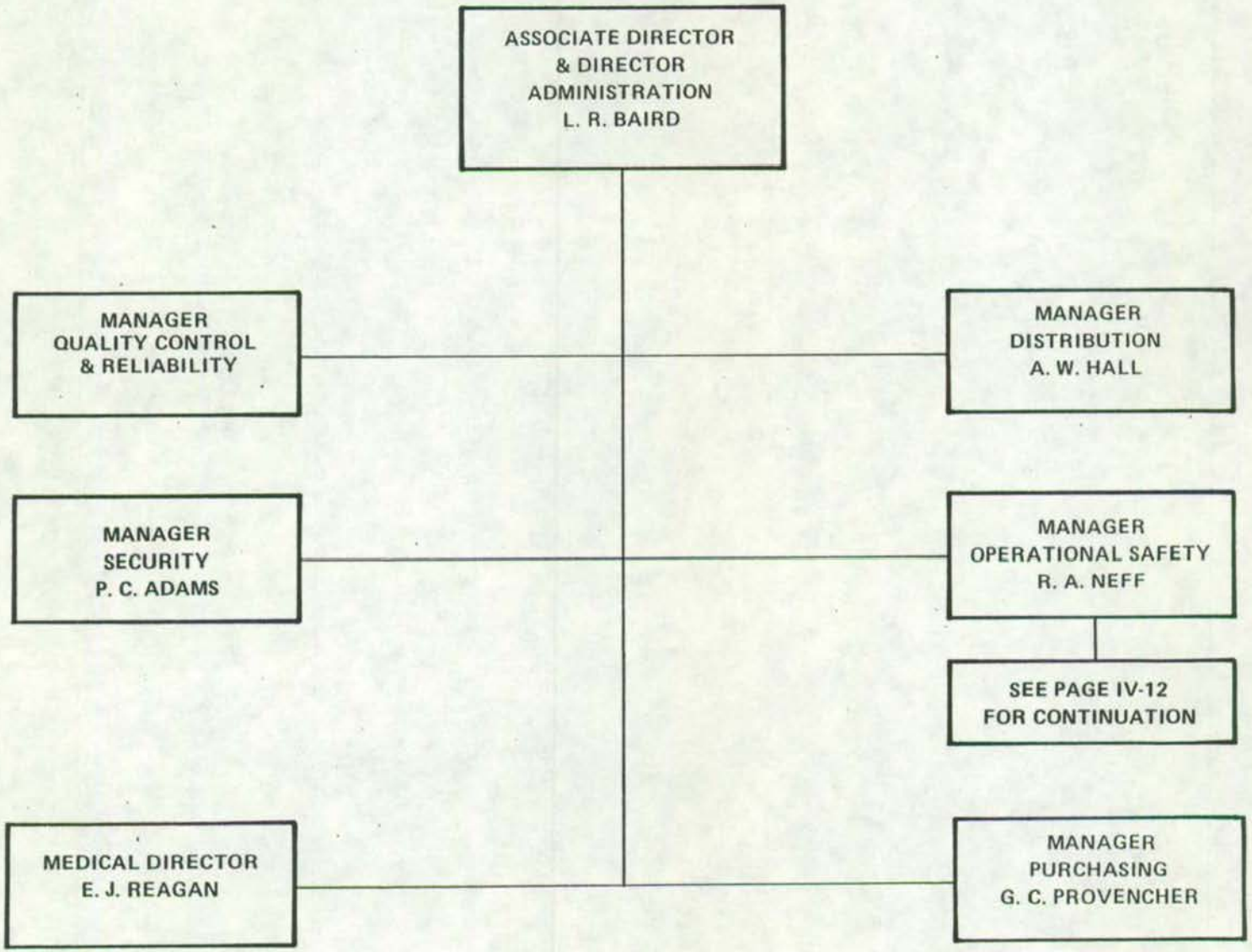


FIGURE 21

ENGINEERING DEPARTMENT
(Partial Organization)

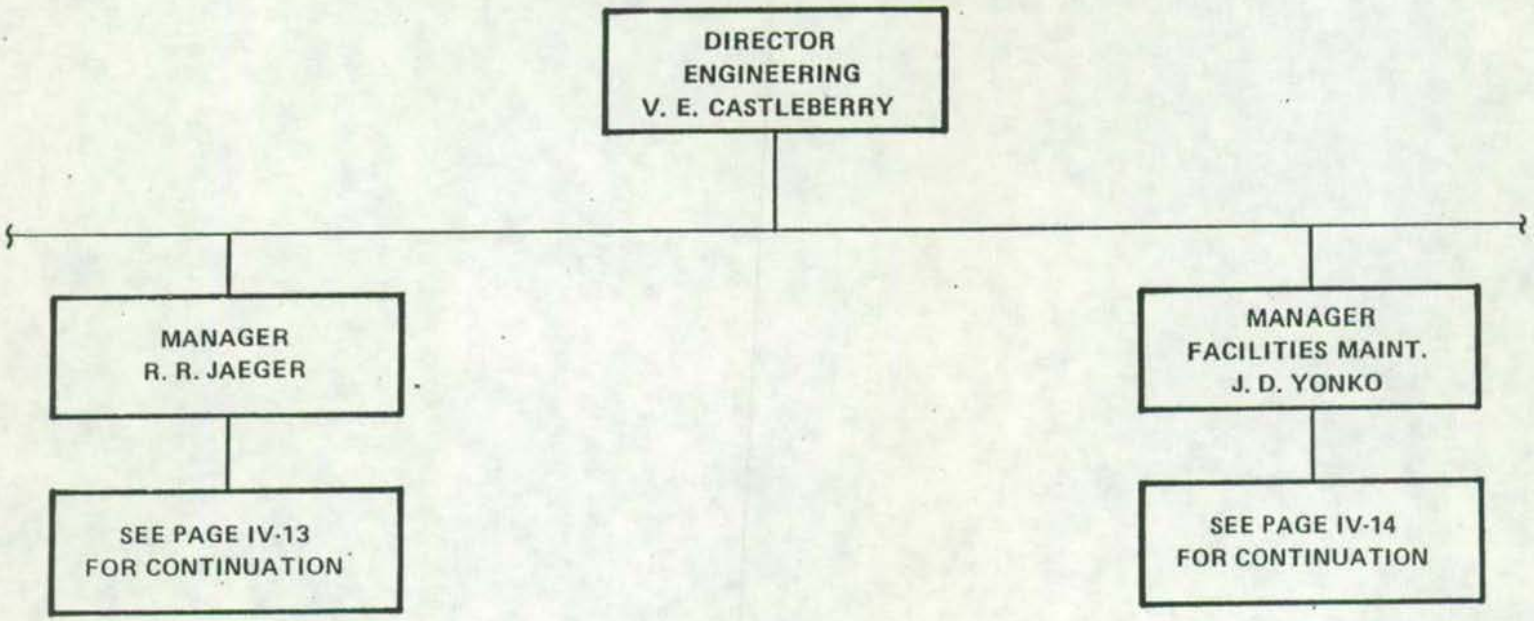


FIGURE 22

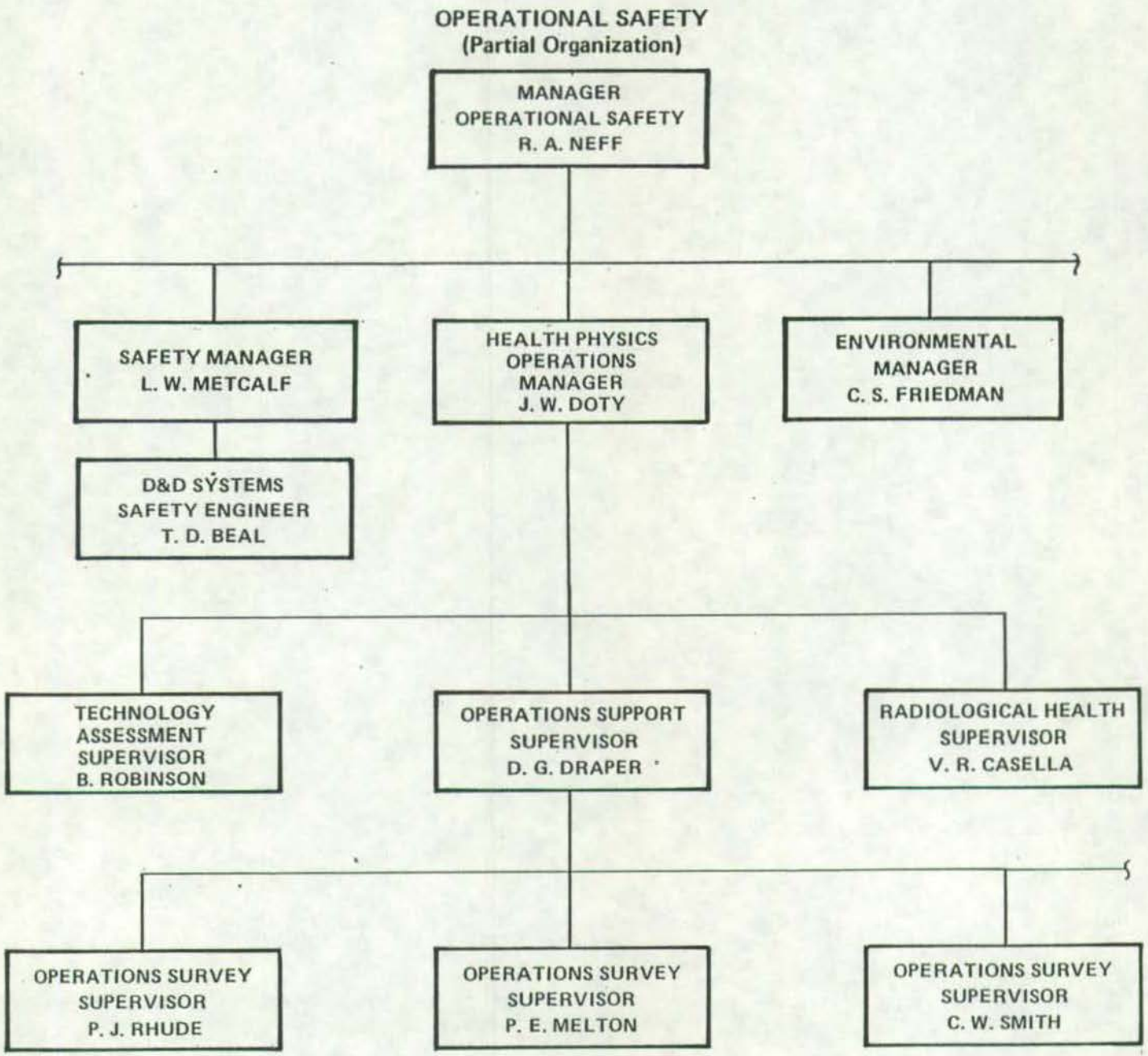

OPERATIONAL SAFETY
(Partial Organization)
MANAGER
OPERATIONAL SAFETY
R. A. NEFF
SAFETY MANAGER
L. W. METCALF
HEALTH PHYSICS
OPERATIONS
MANAGER
J. W. DOTY
ENVIRONMENTAL
MANAGER
C. S. FRIEDMAN
D&D SYSTEMS
SAFETY ENGINEER
T. D. BEAL
TECHNOLOGY
ASSESSMENT
SUPERVISOR
B. ROBINSON
OPERATIONS SUPPORT
SUPERVISOR
D. G. DRAPER
RADIOLOGICAL HEALTH
SUPERVISOR
V. R. CASELLA
OPERATIONS SURVEY
SUPERVISOR
P. J. RHUDE
OPERATIONS SURVEY
SUPERVISOR
P. E. MELTON
OPERATIONS SURVEY
SUPERVISOR
C. W. SMITH

FIGURE 23

D&D PROGRAM MANAGEMENT

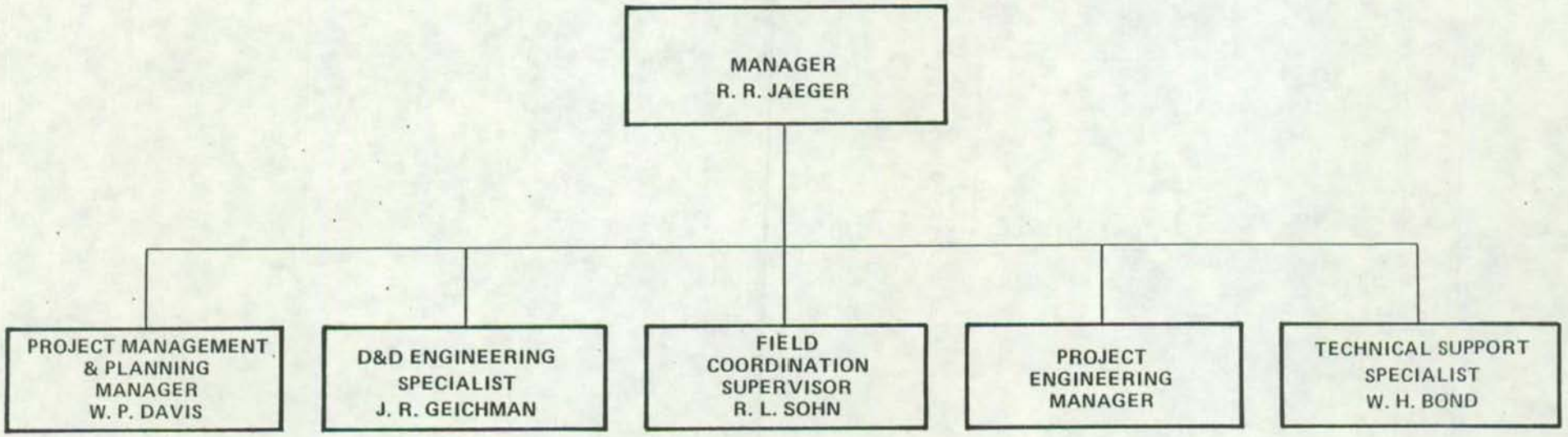


FIGURE 24

FACILITIES MAINTENANCE
(Partial Organization)

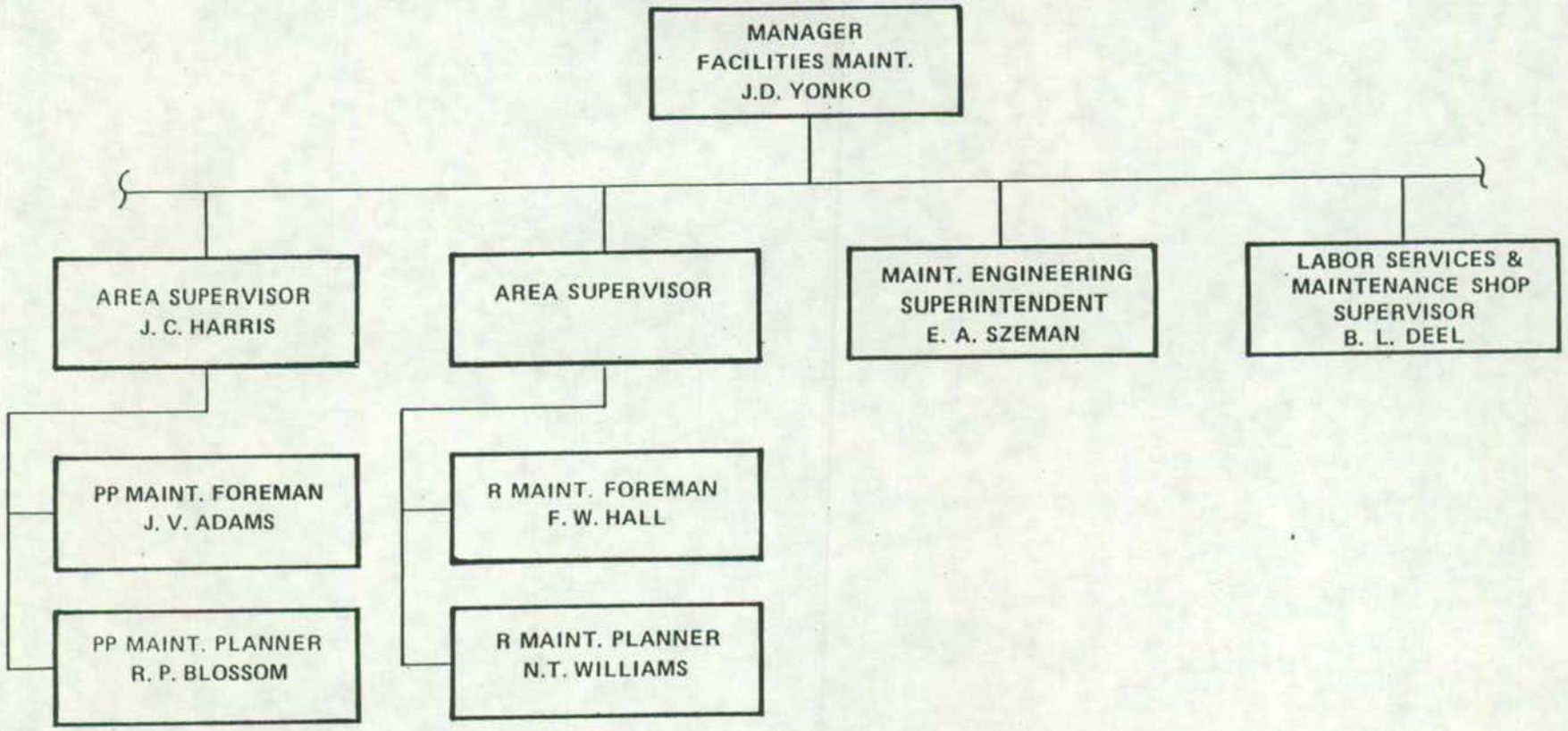


FIGURE 25

MRC-DOE INTERFACES

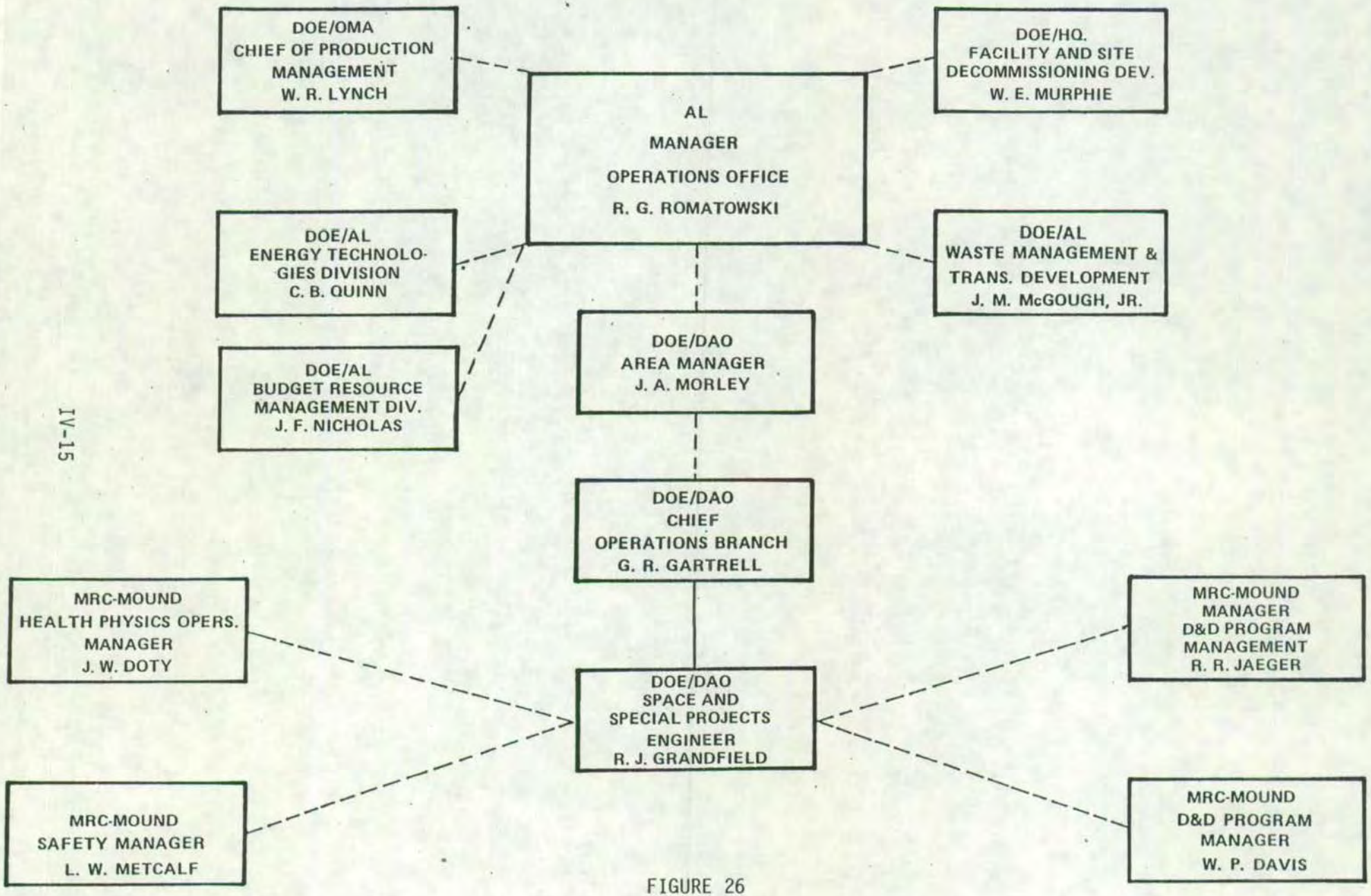


FIGURE 26

V. LOGIC DIAGRAMS

The following logic diagrams show the planned work breakdown structure of work to be performed by major categories.

The first diagram (Figure 27) shows the total ANSPD(NE) and OMA projects through completion (FY1990). The second and third diagrams (Figures 28, 29) give a more detailed breakdown of the work for ANSPD(NE), and the fourth diagram (Figure 30) shows a detailed breakdown of the OMA project.

The site plan and floor plans for PP and R Buildings and the Waste Transfer System (WTS) are included in Section I (pages 2-7) to assist in following the logic diagrams.

For simplicity, the activities and other items are indicated by abbreviations. These abbreviations are defined as follows:

A. Definitions and Floor Plans

GBR - Glovebox Removal Phase includes: a) cleaning of the glovebox, equipment, and lines; b) removal of laboratory and internal glovebox equipment, services, and piping; and c) minimal foaming, removal, and waste packaging of the gloveboxes themselves.

SD - Structural Decontamination Phase includes: a) the removal of piping and services penetrating the laboratory; b) decontamination of the walls, floor, and ceiling; and c) isolation of any remaining contamination and installation of minimal surveillance services for filtered ventilation and radiological monitoring.

RPR - Removal and Partial Replacement includes: removal of contaminated services and common support systems (see Appendix B for further details) and minimal replacement where required to support ongoing surveillance services and operations.

Building Preparations - Required to handle the waste generated by the projects. This includes modifications to PP and R Buildings' exit airlocks and docks, and new waste handling, sealing, measuring, and storage facilities.

Clean - Cleaning includes: cleaning and partial decontamination and decomissioning for reuse by ongoing operations.

COORDINATED O&O OF INACTIVE AN3PO (N.E.) /O.M.A. AREAS (FULL PLAN)

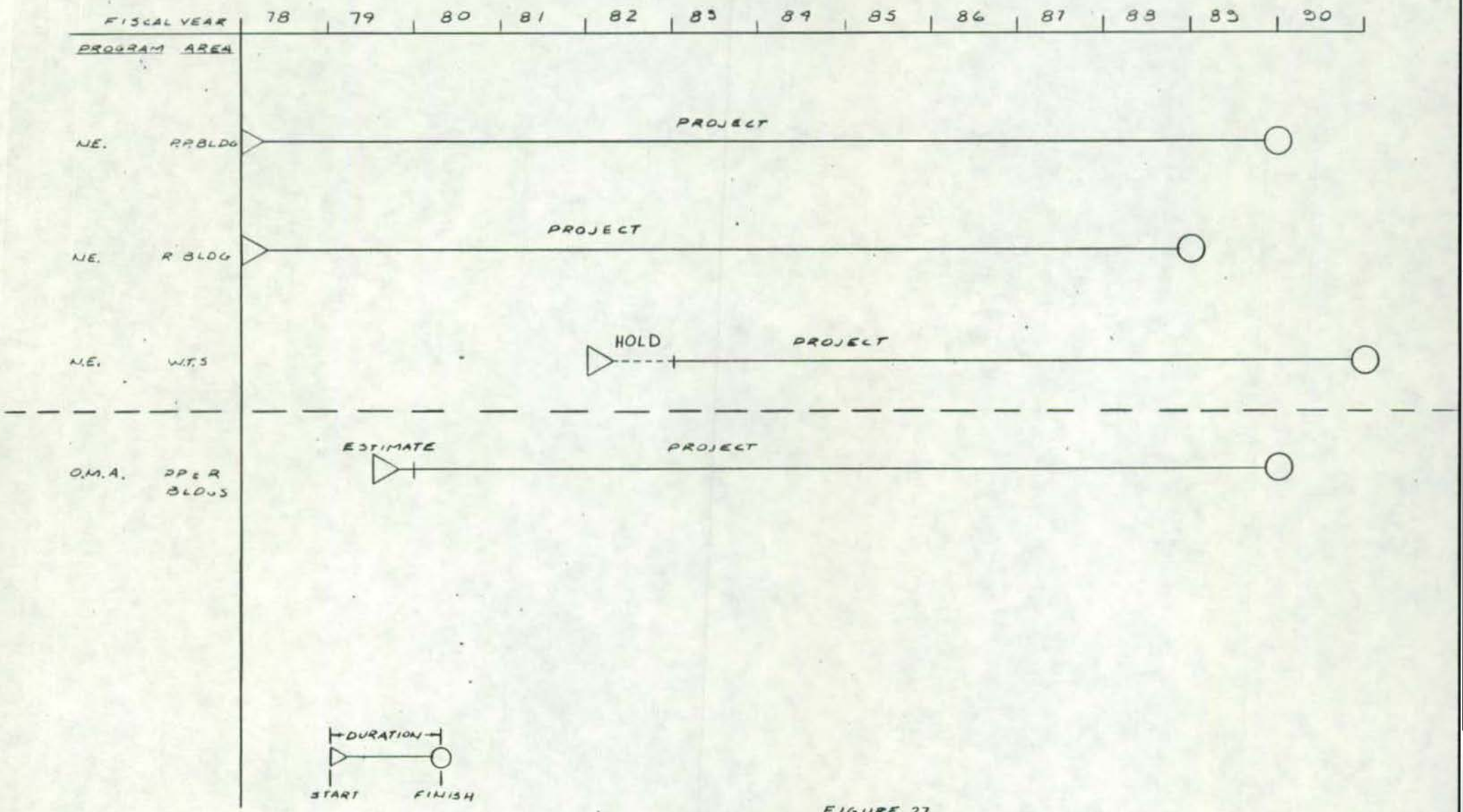
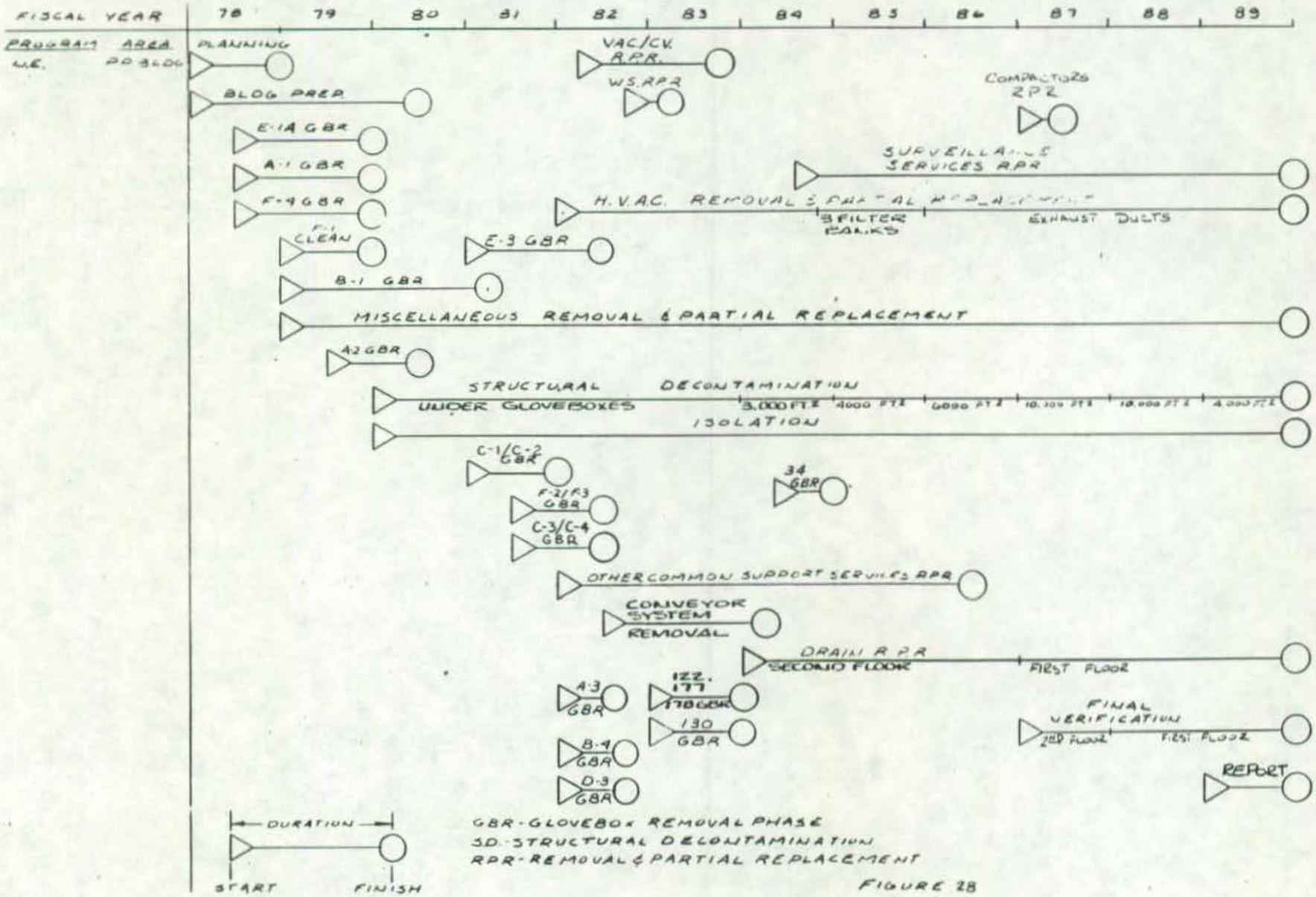


FIGURE 27

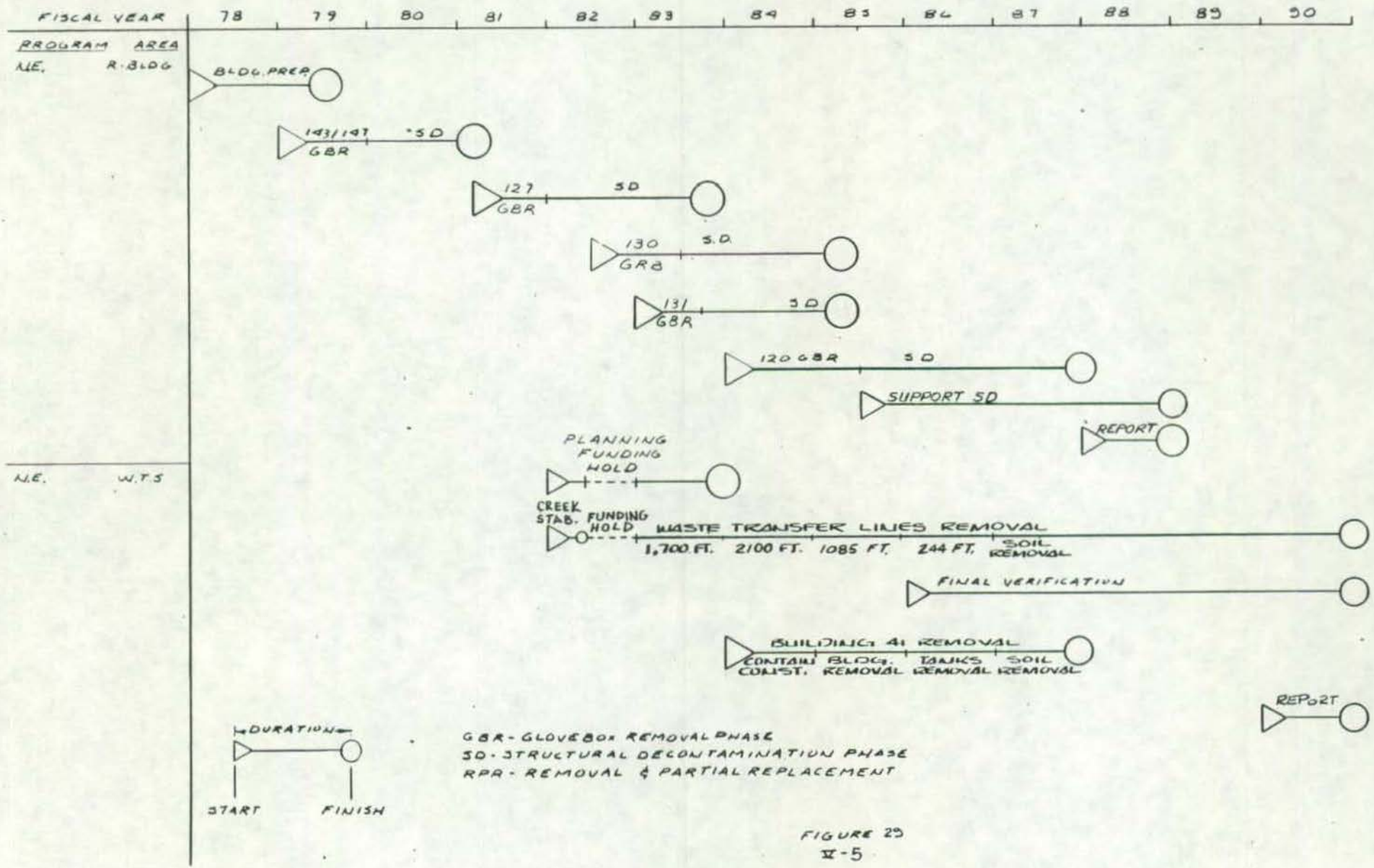
D&D OF INACTIVE ANSOP (N.E.) AREA
FULL PLAN



GBR - GLOVEBOX REMOVAL PHASE
SD - STRUCTURAL DECONTAMINATION
RPR - REMOVAL & PARTIAL REPLACEMENT

FIGURE 28

D&D OF INACTIVE ANSPD(N.E.) AREAS
(FULL PLAN)



GBR - GLOVEBOX REMOVAL PHASE
SD - STRUCTURAL DECONTAMINATION PHASE
RPR - REMOVAL & PARTIAL REPLACEMENT

FIGURE 25

Q&D OF INACTIVE OMA. AREAS
(FULL PLAN)

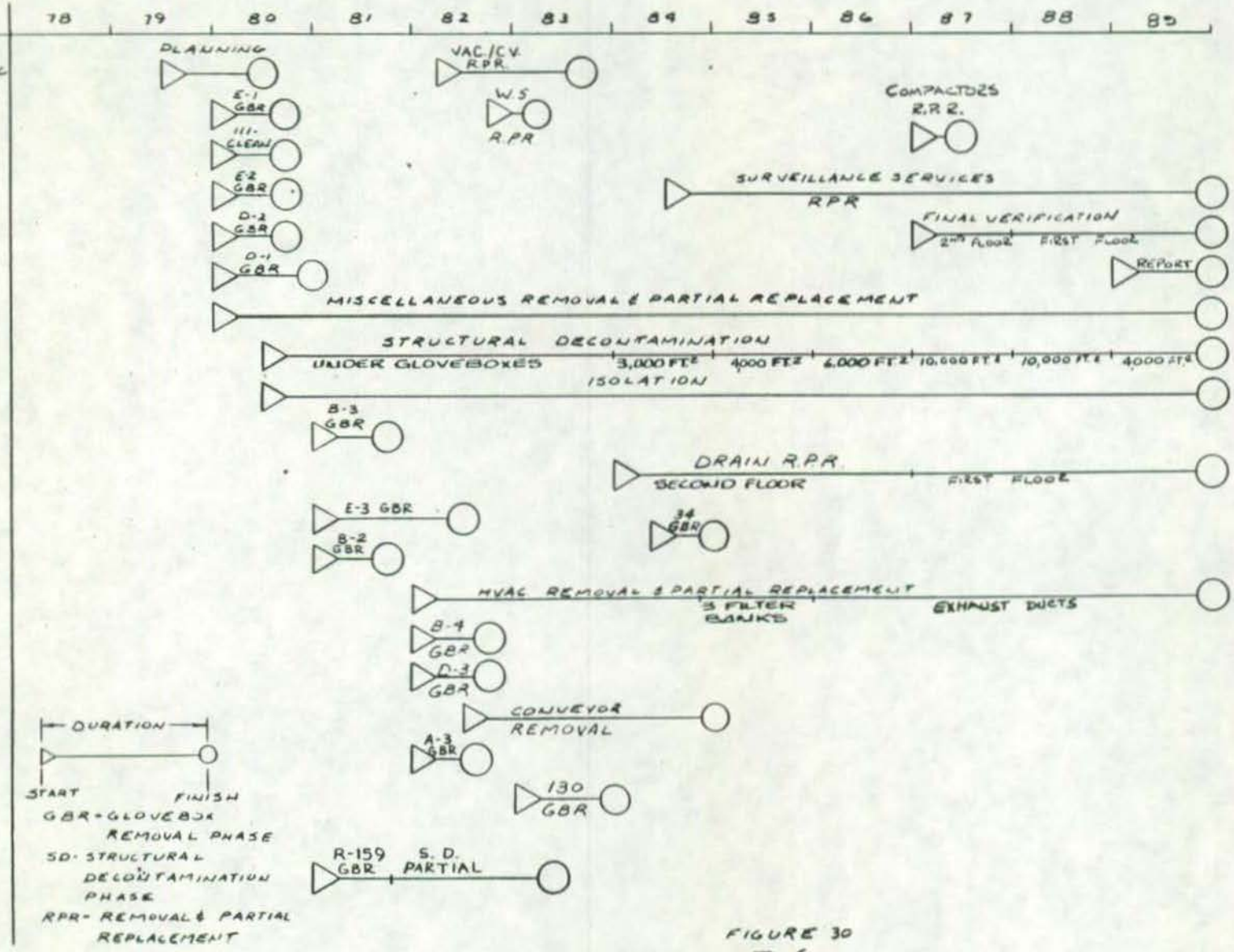
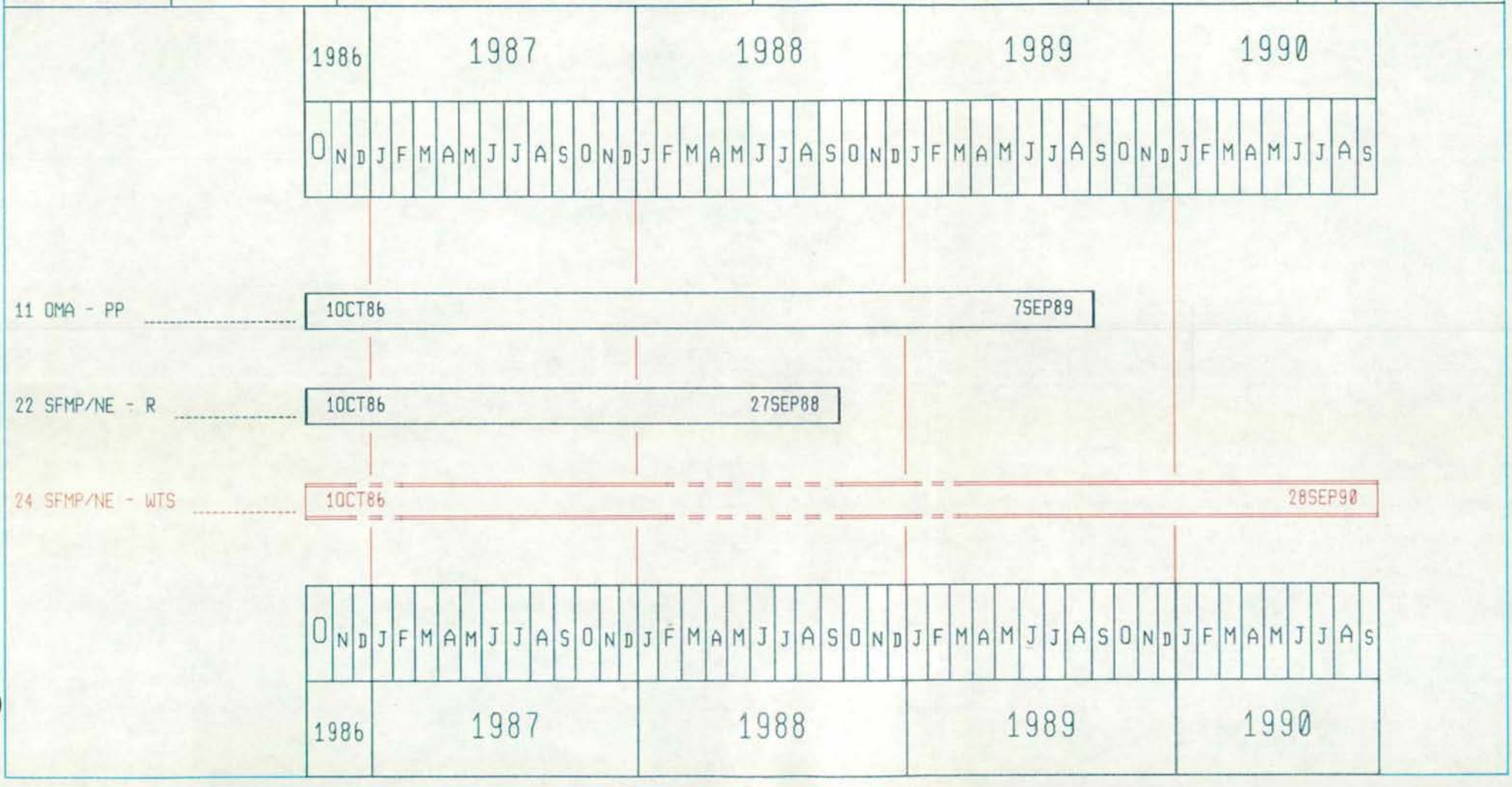


FIGURE 30

PROJECT DDORIG	START 10OCT86	D&D PROJECT FOR ALL AREAS	SUMMARY PLANNING SCHEDULE		RUN 27JAN87 08:35
PLOT DDALL	FINISH 28SEP90	DAVID A. ZORICH & PROJECT/2		MODE O/F	PROJECT/2 85A3
PAGE 1 SHEET 1		MONSANTO RESEARCH CORP	SUMMARY BREAK ON LEVEL 3	INTERVAL: 1 PERIOD(S)	SCHEDULE BAR CHART



UNCERTAINTIES

I. UNCERTAINTIES

This section has been included to define uncertainties that presently exist or may exist in the future with respect to the D&D function. These uncertainties may be in the form of unresolved issues, regulations, criteria or legal constraints, as well as yet-to-be-developed technologies and systems. In general, specific impact statements have not been made for these uncertainties because by their very nature they represent an area to be resolved. Additionally, this section has been added to alert DOE to these uncertainties which could have immediate or long-term impact on Mound's D&D Program.

A. Terminal Storage Criteria - An area of uncertainty exists with respect to changes in WIPP criteria and the impact that any terminal storage criteria might have on the interim storage waste acceptance criteria at Idaho National Engineering Laboratory. Two of these areas are:

1. Acceptability of waste packaging materials
2. Acceptability of waste form within containers

B. Transportation for Wastes - The D&D Plan assumes that existing transportation modes, such as the use of ATMX railcars, will continue at least until the WIPP site becomes operational. Any changes would impact costs and schedules. In addition, any state routing changes could also impact cost and schedules.

C. Availability and Costs of Burial Sites - Costs have already increased because o restrictions at burial locations. Any future restrictions would also impact cost and schedules.

E. More Restrictive Radiation Exposure and Emission Standards: An uncertainty that must be taken into consideration for the D&D Program is the impact

of lowering existing radiation exposure, emission standards, and soil contamination and the increasing emphasis on maintaining radiation exposures and emissions "as low as reasonably achievable" (ALARA).

Because the timing and exact standard levels that may be applied in the future to DOE (by NRC, EPA, State and Local Authorities - including DOE itself) are not known at this time, the total impact is difficult to ascertain. In addition, even more stringent controls and monitoring may have to be implemented in order to effectively meet any new lower criteria (including more specific emphasis on "ALARA"). These more stringent controls would most probably impact cost and schedule at some point in the future. However, because of the lack of specific information, the impact is difficult to quantify at this time.

E. Engineering Estimating Approaches - The engineering method utilized to estimate the resources required for this project was based on certain assumptions as to the techniques employed and the physical conditions of the buildings and laboratories housing the items to be decommissioned. In many instances one does not know if these assumptions provide the "best" route for decommissioning a particular area until after the actual effort has been initiated. This section has, therefore, been included to identify some of the uncertainties that exist with regard to the D&D engineering estimating activity in various ANSPD(NE) and OMA areas at Mound.

Contingency in construction is normally about 15% even after definitive design. The contingency is increased in proportion to the uncertainty of the information available. The estimate for this project initially employed a contingency of 25% (current contingency ranges from 15% to 20%) because of the lack of definitive information. The major areas of uncertainty are described below:

1. PP Building - The estimate assumed that contamination from liquid leaking out of the bottom of several gloveboxes would be limited to the grouting under the gloveboxes. If the contamination has spread significantly to the structural sections "or soil under the slab" it could result in an increase in cost.

2. R Building - The estimate includes removing a layer of the seven-inch concrete floor slab to remove most of the floor contamination and sealing any remaining low-level contamination. If significant contamination is found after removing this layer of concrete, additional excavation and its additional cost versus benefit would be evaluated. Core samples will be taken after a layer of concrete is removed to determine if any significant soil contamination exists under the slab from cracks in the slab or leaking drain lines.

3. Waste Transfer System - A degree of uncertainty exists as to the cost of the D&D of the contaminated soil from the underground lines and the extent of soil contamination under Building 41 is uncertain.

F. New Technologies and Methods - As experience is gained in the D&D areas at Mound and elsewhere, new or better methods and technology will continue to be evaluated and applied as appropriate to the project. Although these evaluations increase costs in the short term, the long term benefits should reduce overall costs.

G. Program Plan Funding - A degree of uncertainty exists as to the continuance of coordinated NE/OMA funding at the program plan levels. Any significant variance would impact the schedule, costs, funding responsibilities, effectiveness, and radiological risks associated with this project.

H. Resource Availability - A degree of uncertainty also exists on the timely availability of trained manpower and equipment. Any significant delay would impact the schedule and costs.

I. Hazardous Material - The estimate assumes that there are no significant quantities of hazardous material or contaminated soil.

J. Completion Date - The completion date of the projects assumes required resources for utilization of the projects' contingency would be available when required so as to not impact the completion date.

COST AND SCHEDULE

VII. COST AND SCHEDULE CONTROL

A. Cost Control - Mound utilizes a Responsibility Accounting System achieving cost control through sound cost-center management. Cost centers serve as a collection group for gathering related manpower, procurement, and miscellaneous costs. Monthly cost-center reports are used by management to analyze deviations of actual expenditure levels from budgeted levels for appropriate action.

Total D&D project costs are collected on a Program (P-Sheet) Report which accumulates costs from direct cost centers, direct support cost centers, and overhead cost centers. Overhead is collected in cost pools and distributed to benefiting programs by a step-down distribution method which allocates costs utilizing equitable collection bases. Monthly P-Sheet Reports are used by management to analyze monthly and year-to-date program expenditures against budgeted levels. All significant deviations from budget must be explained to MRC management and an action plan is developed to correct the deviation.

External reporting includes a monthly Management Information Systems-Financial Information Systems (MIS-FIS) transmission to Albuquerque on program costs and a variance analysis to explain deviations from budget. In addition, actual versus budget D&D Project costs are reported to DOE monthly using the Uniform Contractor Reporting System (UCRS) format.

B. Schedule Control - Applicability of the schedules shown in Section V are periodically reviewed and are updated at least annually. Detailed work schedules are also developed for the next year, the current year, and the following quarter, and are the tools used for detailed work planning. Planning meetings are conducted weekly to discuss current status, potential problem areas, and future work activities.

Progress and deviations from the scheduled activities are reviewed monthly with Mound Management and quarterly with DOE/DAO Management and included in the monthly reports to NE/OMA DOE Field Offices.

C. Change Control Board - A Change Control Board is utilized to control: the use of contingency, schedule changes, and minor scope changes. Any changes are reported in the monthly progress report to DOE. Significant impacts to cost, schedule, scope or contingency are immediately reported to DOE.

PROGRESS
REPORTS

VIII. PROGRESS REPORTS

The progress of the Decontamination and Decommissioning Project is reported to MRC-Mound Management and to DOE through formal written and verbal reports on a routine basis.

A weekly report, depicting the significant events and activities, is issued to MRC-Mound Management.

The D&D Project progress, costs and milestone status are reported monthly to Mound and DOE Management using the Uniform Contractor Reporting System (UCRS) format.

A D&D Project Status Review Meeting is held monthly with Mound Management and quarterly with DOE/DAO Management to discuss accomplishments, costs and problems.

Mound and DOE Management also tour the D&D Project areas on a periodic basis for visual check and personal knowledge of the project progress.

PP BLDG.

PLUTONIUM PROCESSING (PP) BUILDING

DECONTAMINATION AND DECOMISSIONING (D&D)

CURRENT STATUS

IX. PROJECT STATUS DETAILS

This project currently involves the coordinated funding and extensive decontamination and decommissioning (D&D) of inactive radioactively contaminated areas in the Plutonium Processing (PP) Building (Building 38) at Mound that were last operated by the Advanced Nuclear Systems and Projects Division (ANSPD) and the Office of Military Applications (OMA). The responsibility for the inactive ANSPD areas was assumed by the Office of Nuclear Energy - Waste Management (NE) in FY 1981. Since the decontamination and decommissioning of the individual NE or OMA areas had been completed in prior years, remaining funding responsibility for the D&D of the common NE/OMA support areas is 30 % NE and OMA is 70 % (as agreed to in the NE/OMA Memorandum of Understanding - see Appendix F for details).

Extensive decontamination and decommissioning involves:

Cleaning and removal of equipment and services from the inside of the surplus contaminated gloveboxes.

Removal of the gloveboxes and associated equipment.

Removal of surplus contaminated or highly contaminated (with minimal replacement) services and building equipment.

Decontamination or removal of contaminated surfaces (wall, ceiling, and floor) to "as low as reasonably achievable" (ALARA) levels with independent radiological verification of major surface areas.

Sealing of any residual contamination that might remain in cracks and crevices and isolation of the area to prevent recontamination from ongoing operations.

Installation of minimal building services (air sampling, fire protection, lighting, and ventilation) and final independent radiological verification of major surface areas.

Release of area for reuse and issue final report.

The goals of extensive decontamination to ALARA levels are:

Reduce wipable contamination levels to ≤ 20 dis/min/100 cm2 after sealing (normally achievable before sealing).

Reduce fixed contamination levels to ≤ 1500 dis/min/100 cm2 after sealing (normally achievable before sealing).

Reduce external radiation surface levels to ≤ 1 mr/hr (normally achievable before sealing).

A. SCHEDULE

The remaining activities as of the start of FY 1987 are primarily:

Finishing remaining structural decontamination activites on the second floor of the building during the fiscal year. This will permit release of the remaining open areas for potential reuse by other DOE programs.

Continuing contaminated building service removal and structural decontamination on the first floor of the building. These activities (and the project) will be completed and the final report issued by the end of FY 1989.

The following schedules show the remaining major activities of the project.

B. COSTS

The cost through FY 1986 and remaining estimated costs through FY 1989 are shown on the following table. An overall contingency of 17.5 % is used on remaining costs for unknown and unexpected costs. Potential specific project uncertainties (see Section VI. for general program uncertainties) that could be beyond the scope of contingency to cover and would then affect total schedule and cost are:

DECONTAMINATION AND DECOMMISSIONING BUDGET OBLIGATIONS (BO)

BY FISCAL YEARS (dollars in thousands*)

PLUTONIUM PROCESSING (PP) BUILDING PROJECT

FOR INACTIVE ANSPD/NE AND OMA AREAS

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
ANSPD/NE													
Cost	2200	2150	1100[1]	1200[2]	1800	1820	1790	1340	1137	1134	1287	1377	18335
Contingency Remaining	--	--	--	--	--	--	--	--	--	199	225	241	665
Total Cost	2200	2150	1100	1200	1800	1820	1790	1340	1137	1333	1512	1618	19000
OMA													
Cost	--	170	2170	3186[3]	2561	3242	3866	3774	3930	3436	3858	4131	34324
Contingency Remaining	--	--	--	--	--	--	--	--	--	786	697	515	1998
Total Cost	--	170	2170	3186	2561	3242	3866	3774	3930	4222	4555	4646	36322
NE/OMA													
Cost	2200	2320	3270	4386	4361	5062	5656	5114	5067	4570	5145	5508	52659
Contingency Remaining	--	--	--	--	--	--	--	--	--	985	922	756	2663
Total Cost	2200	2320	3270	4386	4361	5062	5656	5114	5067	5555	6067	6264	55322

* FY 1989 in FY 1989 dollars

1 Most NE areas in standby during reduced funding year in FY 1980.

2,3 OMA supplemented NE standby funding level ($1200K) by $670K of the $3186K to maintain the intent of the coordinated D&D plan in PP Building in FY 1981.

Future discovery of significant soil contamination (radioactive or hazardous) that requires removal from under or around the building from undetected or unknown underground drain line leakage or local spills. The potential of this is assumed to be low based on the surface sampling around PP and core samples taken in a much older facility (Research Building). Additional radiological characterization data will be taken in FY 1987 to better quantify this potential.

Future discovery of significant contamination of structural members that would require replacement rather than sealing. The known areas of significant structural contamination are scheduled to be decontaminated in FY 1987 and this potential will be known after this activity. The potential for major replacement is assumed to be low, but it may impact total schedule and cost if encountered.

The completion date of the project assumes that required resources and work areas are available as scheduled and also available for utilization of contingency (as needed) so as to not impact the completion date of the project and incur additional cost as a result. The potential for the required resources not to be available is considered to be moderate. The potential for the work areas not being available is considered low.

C. WASTE VOLUMES

The actual waste volumes (which are sent offsite for disposal - LSA to NTS and TRU to INEL) through FY 1986 and the estimated waste volumes through FY 1989 are shown on the following table.

ESTIMATED WASTE VOLUMES

(thousands of cubic feet)

FISCAL YEAR	78	79	80	81	82	83	84	85	86	87	88	89	Total
ANSPD/NE LSA	6	6	2[1]	8[2]	5	3	8	7	8	5	10	5	73
OMA LSA	-	-	8	7	7	7	11	17	18	12	23	12	122
TOTAL PP LSA	6	6	10	15	12	10	19	24	26	17	33	17	195
ANSPD/NE	1	3	1	7	8	2	2	1	-	-	-	-	25
OMA TRU	-	-	6	7	8	4	4	1	1	1	1	-	33
TOTAL PP TRU	1	3	7	14	16	6	6	2	1	1	1		58

[1]Funding reduced to near standby level.
[2]Funding reduction offset by supplemental OMA funding.

D. PERCENT COMPLETE

The estimated percent completion of the project is based on such factors as physical completion, manpower used, waste generated, degree of complexity, and professional evaluation. The estimated percent completion by fiscal year is:

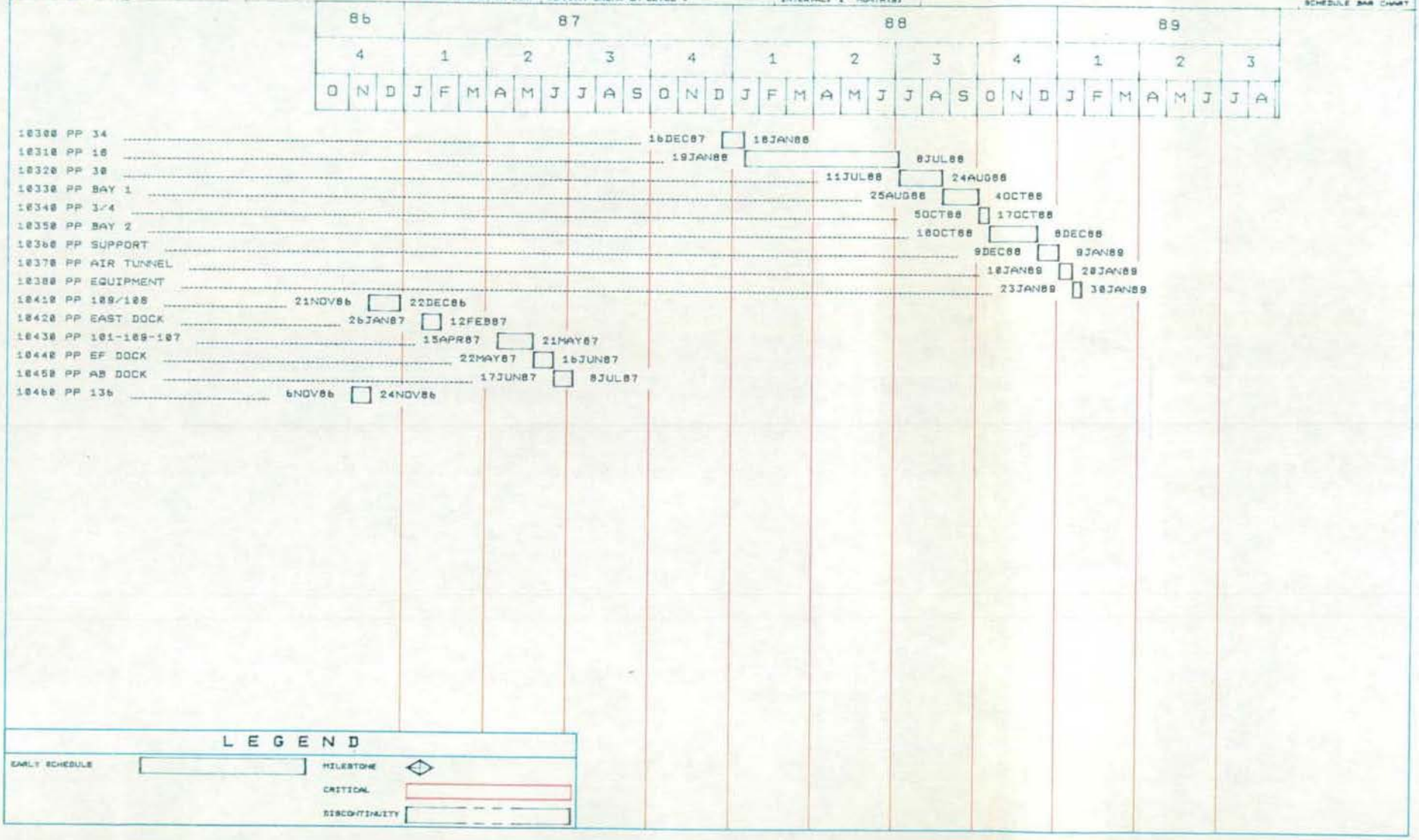
PERCENT COMPLETE

(%)

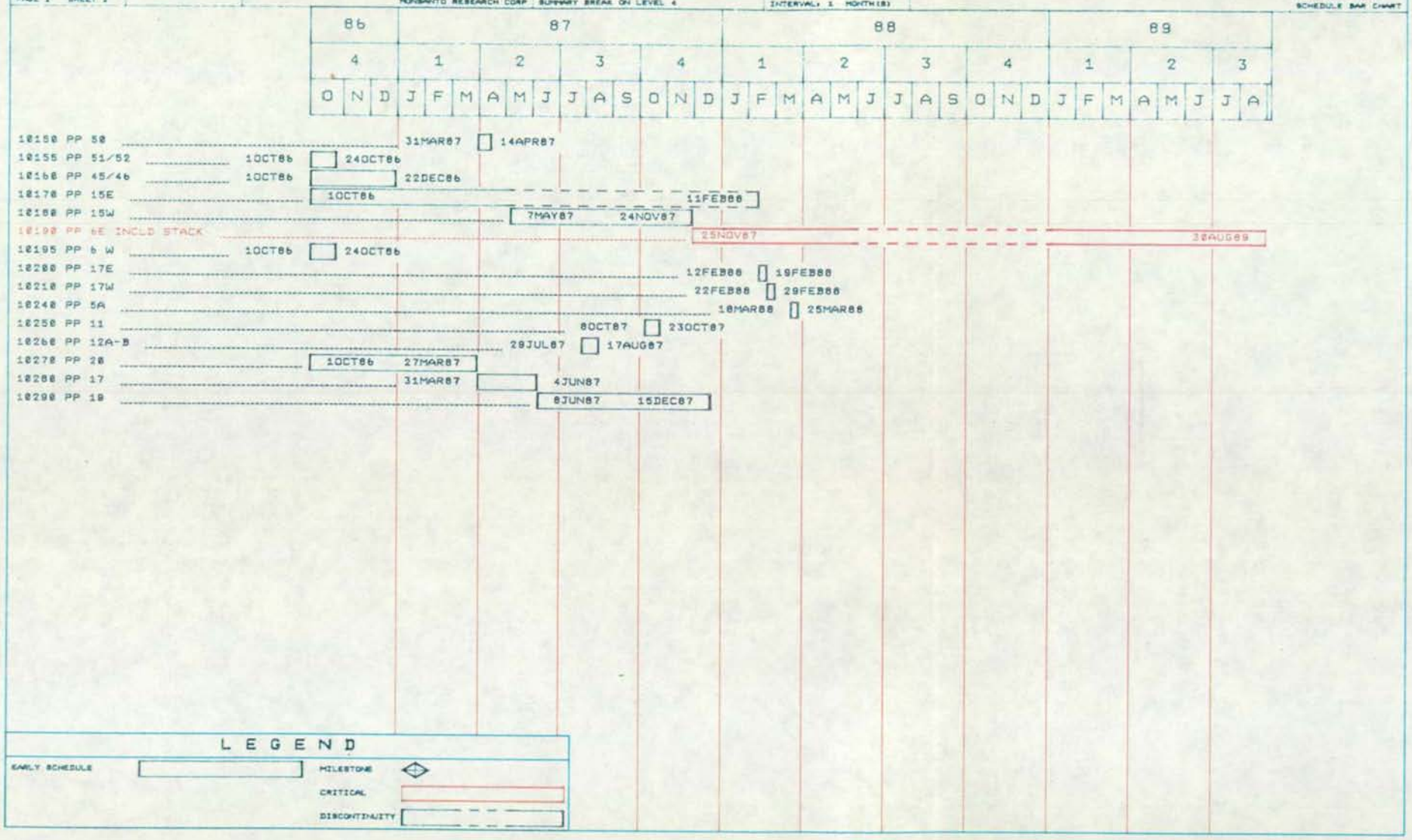
END OF FISCAL YEAR	78	79	80	81	82	83	84	85	86	87	88	89
ANSPD/NE	6	17	20[1]	29[2]	38	48	57	66	75	83	92	100
OMA	0	3	14	25	35	45	56	66	75	83	92	100

[1]Funding reduced to near standby level.
[2]Funding reduction offset by supplemental OMA funding.

PROJECT PPDAIG | START 10CT86 | D&D PROJECT FOR PP AREA ONLY ORIGINAL | SUMMARY P L A N N I N G SCHEDULE | RUN 18JAN87 08:32
PLOT TOTAL4 | FINISH 15EP88 | DAVID A. ZORICH & PROJECT/2 | MODE O/F | PROJECT/2 85A3
PAGE 1 SHEET 3 | MONSANTO RESEARCH CORP | SUMMARY BREAK ON LEVEL 4 | INTERVAL: 1 MONTH(S) | SCHEDULE BAR CHART



PROJECT PPDNIS | START 10CT86 | D&D PROJECT FOR PP AREA ONLY ORIGINAL | SUMMARY P L A N N I N G SCHEDULE | MODE O/F | RUN 28JAN87 88.33
PLOT TOTAL4 | FINISH 19EP88 | DAVID A. ZORICH & PROJECT/S | | INTERVAL: 1 MONTH(S) | PROJECT/S 85A3
PAGE 1 SHEET 1 | | MONSANTO RESEARCH CORP | SUMMARY BREAK ON LEVEL 4 | | SCHEDULE BAR CHART



L E G E N D

EARLY SCHEDULE

MILESTONE

CRITICAL

DISCONTINUITY

PROJECT PPDRIB
PLOT TOTAL4
PAGE 1 SHEET 1

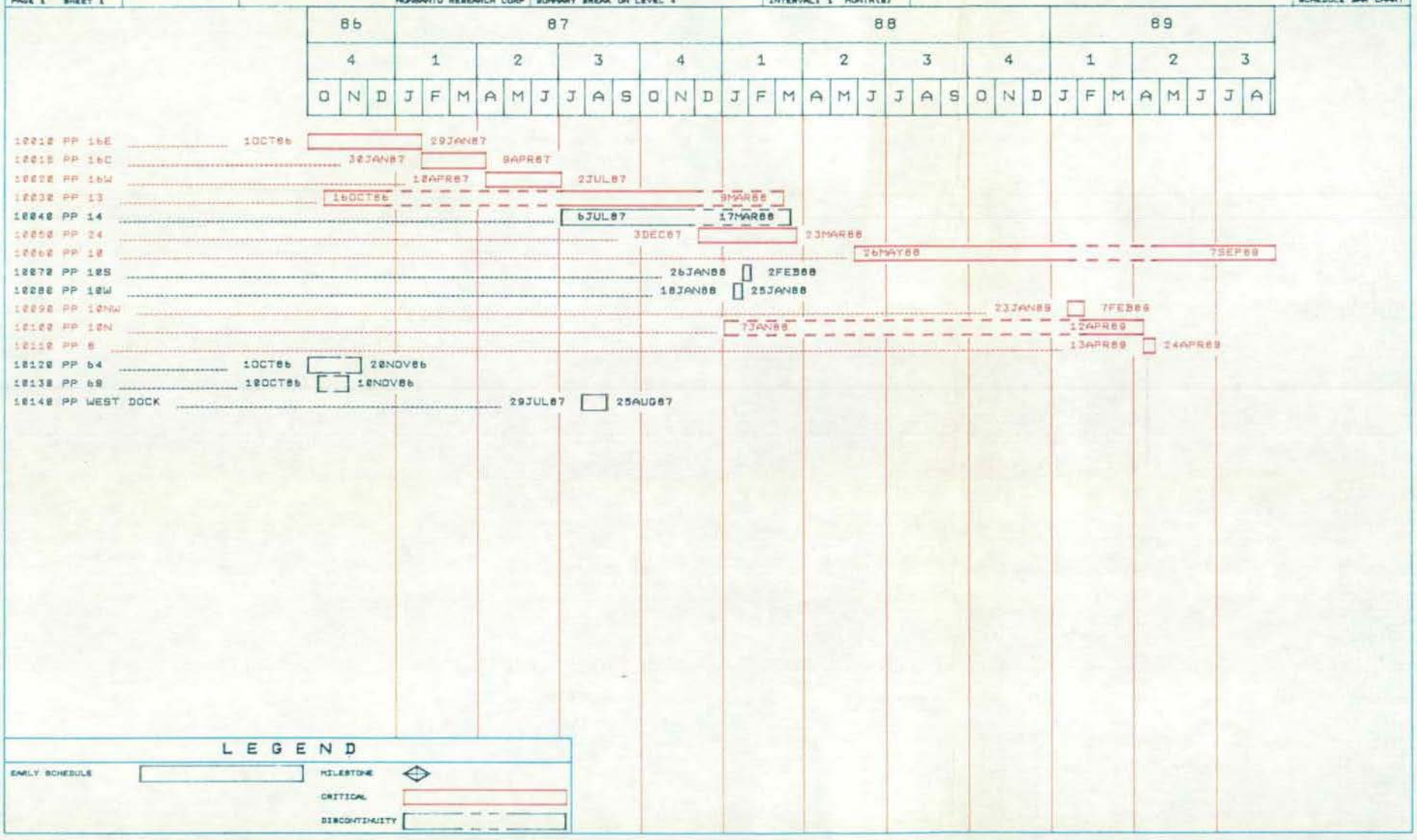
START 10OCT86
FINISH 7SEP88

D&D PROJECT FOR PP AREA ONLY ORIGINAL
DAVID A. ZORICH & PROJECT/2
MONSANTO RESEARCH CORP

SUMMARY P L A N N I N G SCHEDULE
SUMMARY BREAK ON LEVEL 4

MODE D/F
INTERVAL: 1 MONTH(S)

RUN 18JAN87 08:35
PROJECT/2 85A3
SCHEDULE BAR CHART



L E G E N D

EARLY SCHEDULE

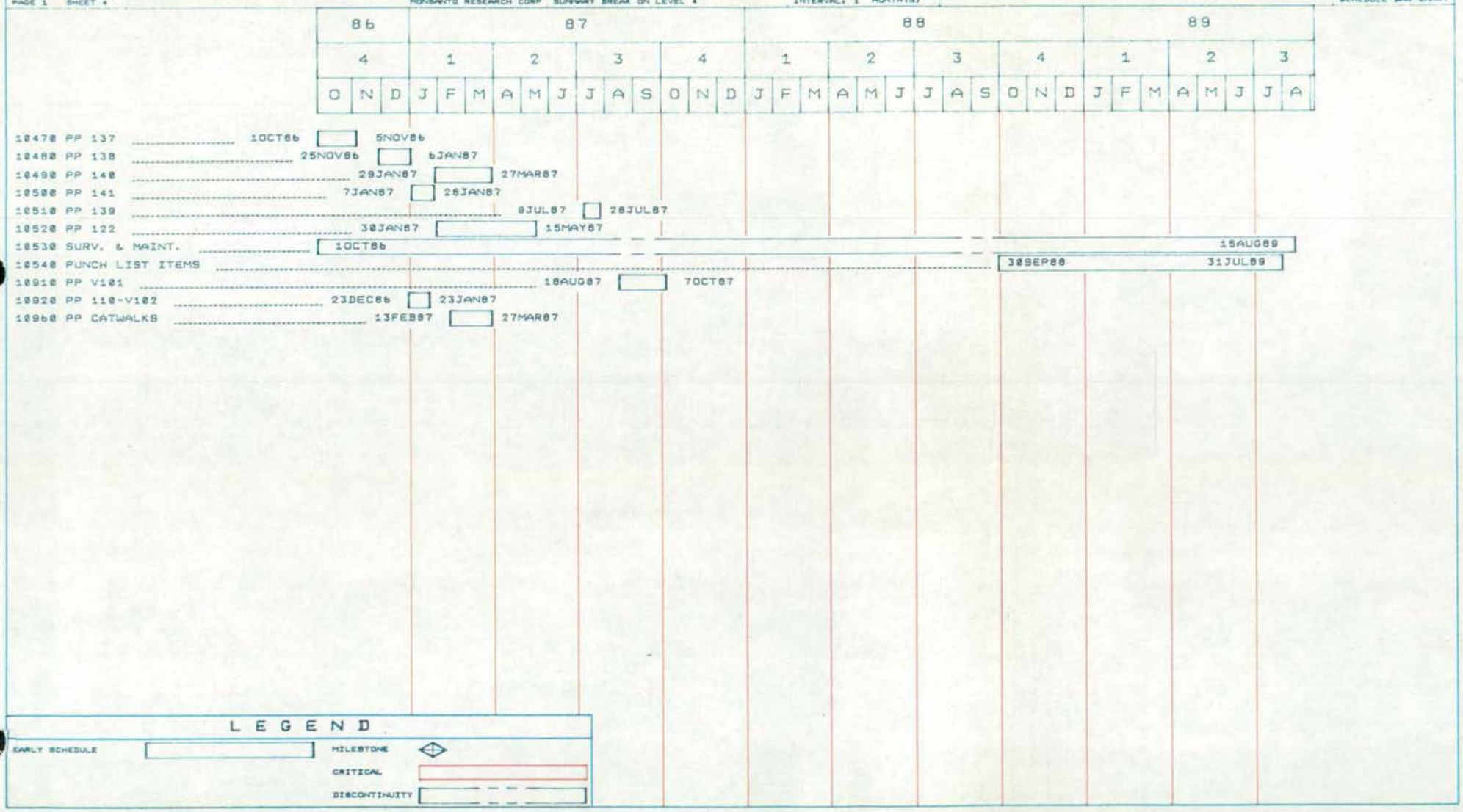
MILESTONE

CRITICAL

DISCONTINUITY

PROJECT PPORIG START 10CT86 D&S PROJECT FOR PP AREA ONLY ORIGINAL SUMMARY P L A N N I N G SCHEDULE
PLOT TOTAL4 FINISH 7SEP88 DAVID A. ZORICH & PROJECT/2 MODE O/F
PAGE 1 SHEET 4 MONSANTO RESEARCH CORP SUMMARY BREAK ON LEVEL 4 INTERVAL: 1 MONTH(S)

RUN 28JAN87 48:32
PROJECT/2 85A3
SCHEDULE BAR CHART



R BLDG.

RESEARCH (R) BUILDING

DECONTAMINATION AND DECOMISSIONING (D&D)

CURRENT STATUS

IX. PROJECT STATUS DETAILS

This project currently involves the extensive decontamination and decommissioning (D&D) of inactive radioactively contaminated areas in the Research (R) Building at Mound that were last operated by the Advanced Nuclear Systems and Projects Division (ANSPD) and the Office of Military Applications (OMA). The responsibility for the inactive ANSPD areas was assumed by the Office of Nuclear Energy - Waste Management (NE) in FY 1981. Since the decontamination and decommissioning of the single OMA area had been completed in prior years, remaining funding responsibility for the D&D of the R-120 laboratory is NE and responsibility of the common NE/DP (Defense Programs - Office of Defense Waste and Transportation Management) support areas (R-5, R-159A, and Building 68) is 85 % NE and DP is 15 % beginning in FY 1987.

Extensive decontamination and decommissioning involves:

Cleaning and removal of equipment and services from the inside of the surplus contaminated gloveboxes.

Removal of the gloveboxes and associated equipment.

Removal of surplus contaminated or highly contaminated (with minimal replacement) services and building equipment.

Decontamination or removal of contaminated surfaces (wall, ceiling, and floor) to "as low as reasonably achievable" (ALARA) levels with independent radiological verification of major surface areas.

Sealing of any residual contamination that might remain in cracks and crevices and isolation of the area to prevent recontamination from ongoing operations.

Installation of minimal building services (air sampling, fire protection, lighting, and ventilation) and final independent radiological verification of major surface areas.

Release of area for reusing and issue final report.

The goals of extensive decontamination to ALARA levels are:

Reduce wipable contamination levels to ≤ 20 dis/min/100 cm2 after sealing (normally achievable before sealing).

Reduce fixed contamination levels to ≤ 1500 dis/min/100 cm2 after sealing (normally achievable before sealing).

Reduce external radiation surface levels to ≤ 1 mr/hr (normally achievable before sealing).

A. SCHEDULE

The remaining activities as of the start of FY 1987 are primarily:

Finishing remaining structural decontamination activites on the second floor of the building during the fiscal year. This will permit release of the remaining open areas for potential reuse by other DOE programs.

Continuing structural decontamination activities in the remaining support areas. These activities (and the project) will be completed by the end of FY 1988 and the final report issued in FY 1989.

The following schedules show the remaining major activities of the project.

B. COSTS

The cost through FY 1986 and remaining estimated costs through FY 1988 are shown on the following table. An overall contingency of 15 % is used on remaining costs for unknown and unexpected costs. Potential specific project uncertainties (see Section VI. for general program uncertainties) that could be beyond the scope of contingency to cover and would then affect total schedule and cost are:

DECONTAMINATION AND DECOMMISSIONING BUDGET OBLIGATIONS (BO)

BY FISCAL YEARS (dollars in thousands)

RESEARCH (R) BUILDING PROJECT

FOR INACTIVE ANSPD/NE AND OMA AREAS

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	TOTAL
ANSPD/NE												
Cost	700	750	300[1]	350[2]	900	1000	1100	1100	972	874	894	8940
Contingency Remaining	--	--	--	--	--	--	--	--	--	131	134	265
Total Cost	700	750	300	350	900	1000	1100	1100	972	1005	1028	9205
OMA												
Cost	--	--	--	799[3]	439	85	--	--	--	--	--	1323
Contingency Remaining	--	--	--	--	--	--	--	--	--	--	--	--
Total Cost	--	--	--	799	439	85	--	--	--	--	--	1323
NE/OMA												
Cost	700	750	300	1149	1339	1085	1100	1100	972	874	894	10263
Contingency Remaining	--	--	--	--	--	--	--	--	--	131	134	265
Total Cost	700	750	300	1149	1339	1085	1100	1100	972	1005	1028	10528

1 Most NE areas in standby during reduced funding year in FY 1980.

2,3 OMA supplemented NE standby funding level ($350K) by $330K of the $799K to maintain the intent of the coordinated D&D plan in PP Building in FY 1981.

Future discovery of significant soil contamination (radioactive or hazardous) that requires removal from under or around the building from undetected or unknown underground drain line leakage or local spills. The potential of this is assumed to be low based on the core samples taken in other laboratories within the Research Building. Additional radiological characterization data will be taken in FY 1987 to better quantify this potential.

Future discovery of significant contamination of structural members that would require replacement rather than sealing. The potential for major replacement is assumed to be low, but it may impact total schedule and cost if encountered.

The completion date of the project assumes that required resources and work areas are available as scheduled and also available for utilization of contingency (as needed) so as to not impact the completion date of the project and incur additional cost as a result. The potential for the required resources not to be available is considered to be moderate. The potential for the work areas not being available is considered low.

C. WASTE VOLUMES

The actual waste volumes (which are sent offsite for disposal - LSA to NTS and TRU to INEL) through FY 1986 and the estimated waste volumes through FY 1988 are shown on the following table.

ESTIMATED WASTE VOLUMES

(thousands of cubic feet)

FISCAL YEAR	78	79	80	81	82	83	84	85	86	87	88	Total
ANSPD/NE LSA	2	2	1[1]	3[2]	4	5	8	10	9	4	1	49
OMA LSA	-	-	-	3	3	-	-	-	-	-	-	6
TOTAL PP LSA	2	2	1	6	7	5	8	10	9	4	1	55
ANSPD/NE	1	1	-	2	1	2	2	-	-	-	-	9
OMA TRU	-	-	-	2	1	-	-	-	-	-	-	3
TOTAL PP TRU	1	1	-	4	2	2	2	-	-	-	-	12

[1]Funding reduced to near standby level.
[2]Funding reduction offset by supplemental OMA funding.

D. PERCENT COMPLETE

The estimated percent completion of the project is based on such factors as physical completion, manpower used, waste generated, degree of complexity, and professional evaluation. The estimated percent completion by fiscal year is:

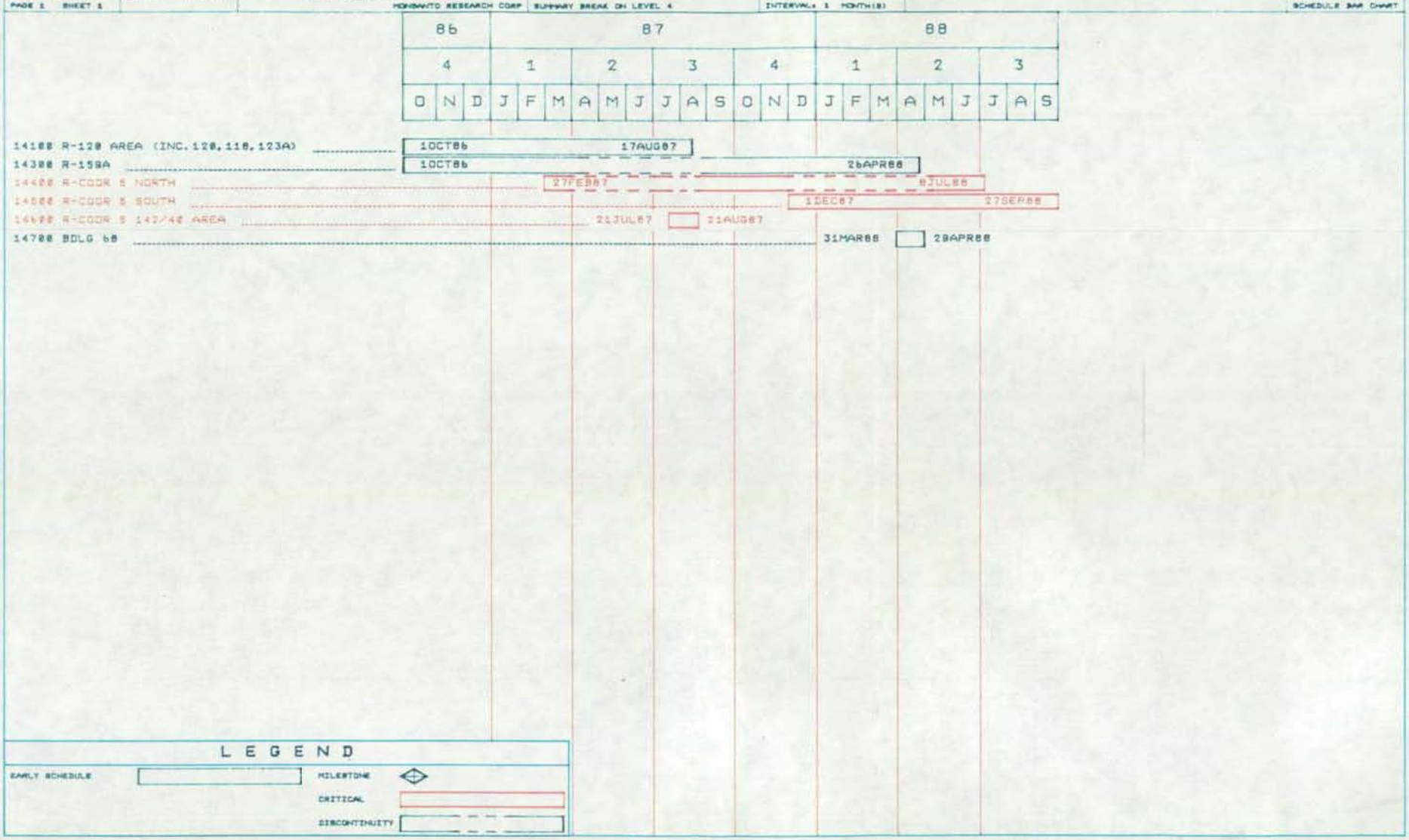
PERCENT COMPLETE

(%)

END OF FISCAL YEAR	78	79	80	81	82	83	84	85	86	87	88
ANSPD/NE	5	15	18[1]	28[2]	39	49	59	70	80	91	100
OMA	-	-	3	40	80	100	-	-	-	-	-

[1]Funding reduced to near standby level.
[2]Funding reduction offset by supplemental OMA funding.

PROJECT NO#10	START 1OCT86	D&D PROJECT FOR R AREA ONLY-ORIGINAL	SUMMARY P L A N N I N G SCHEDULE	RUN 18JAN87 08:32
PLOT TOTAL4	FINISH 17SEP88	DAVID A. ZORICH & PROJECT/E	MODE G/P	PROJECT/E BBA3
PAGE 1 SHEET 1		MONSANTO RESEARCH CORP	SUMMARY BREAK ON LEVEL 4 / INTERVAL: 1 MONTH(S)	SCHEDULE BAR CHART



WASTE TRANSFER
SYSTEM

WASTE TRANSFER SYSTEM (WTS)

DECONTAMINATION AND DECOMISSIONING (D&D)

CURRENT STATUS

XI. PROJECT STATUS DETAILS

This project involves the extensive decontamination of the inactive radioactively contaminated Waste Transfer System (WTS) piping including its pumping station (Building 41) and removal of associated contaminated soil at Mound that was last operated by the Advanced Nuclear systems and Projects Division (ANSPD). The responsibility for the inactive ANSPD areas was assumed by the Office of Nuclear Engery - Waste Management (NE) in FY 1981.

Extensive decommissioning and contaminated soil removal involves:

Cleaning and removal of equipment and services from the inside of the surplus contaminated pumping station (Building 41).

Removal of the underground piping and associated piping in the Plutonium Processing (PP) and Waste Disposal Buildings.

Removal of contaminated soil to "as low as reasonably achievable (ALARA)" levels.

Restoration of excavation areas and final independent radiological verification of major excavated soil areas.

Release of area for reuse and issue final report.

The goals of extensive decontamination to ALARA levels are:

Removal of highly contaminated TRU soil to <100nCi/g Pu-238).

Removal of contaminated soil to ≤ 100 pCi/g in near surface soil (the first 12 inches).

Removal of soil to ≤ 25 pCi/g is considered to be the lower limit of ALARA cost/benefit evaluations.

A. SCHEDULE

The remaining activities as of the start of FY 1987 are primarily:

Finishing remaining contaminated soil removal activities associated with Building 41 during the fiscal year.

Continuing contaminated soil removal associated with the major leak of the underground piping on the hillside below the Waste Disposal (WD) Building in 1969. This soil removal effort (and the project) will be completed and the final report issued by the end of FY 1990.

The following schedules show the remaining major activities of the project.

B. COSTS

The cost through FY 1986 and remaining estimated costs through FY 1990 are shown on the following table. An overall contingency of 20 % is used on remaining costs for unknown and unexpected costs. This is based on the soil contamination being nonhomogeneous. Current estimates of remaining soil contamination (166,000 ft^3) are based on radiological characterization data (128,000 ft^3) and a 30 % expansion factor (38,000 ft^3) based on historical decomissioning information. Potential specific project uncertainties (see Section VI. for general program uncertainties) that could be beyond the scope of contingency to cover and would then affect total schedule and cost are:

Future discovery of significant soil contamination (radioactive or hazardous) that requires removal from undetected or unknown underground piping leakage or local spills. The potential of this is assumed to be moderate based on the previous surface and core sampling around the underground piping and Building 41. Additional radiological characterization data will be taken in FY 1987 to better quantify this potential.

Future discovery of significant contamination in or along the bedrock. The potential of this is assumed to be low based on scientific evidence of Plutonium 238 migration.

DECONTAMINATION AND DECOMMISSIONING BUDGET OBLIGATIONS (BO)

BY FISCAL YEARS (dollars in thousands*)

WASTE TRANSFER SYSTEM (WTS) PROJECT

FOR INACTIVE NE AREAS

	1978	1979	1980	1981	1982	1983	1984
ANSPD/NE							
Cost	100	100	100	150	300	1000	1350
Contingency Remaining	--	--	--	--	--	--	--
Total Cost	100	100	100	150	300	1000	1350

	1985	1986	1987	1988	1989	1990	TOTAL
ANSPD/NE							
Cost	1750	2241	1685	706	1592	3481	14555
Contingency Remaining	--	--	337	141	319	696	1493
Total Cost	1750	2241	2022	847	1911	4177	16048

* FY 1989 and FY 1990 in FY 1989 dollars

1 In standby until FY 1982

Future changes of the project's existing boundaries: removal of soil in the near vicinity of the underground piping and Building 41 and the hillside between the Waste Disposal (WD) Building and Building 41. The potential of this is assumed to be moderate based on current acceptance of the project's boundaries.

Future changes in environmental or waste disposal criteria. The potential of this is assumed to be moderate based on recent changes in both criteria.

The completion date of the project assumes that required resources and work areas are available as scheduled and also available for utilization of contingency (as needed) so as to not impact the completion date of the project and incur additional cost as a result. The potential for the required resources not to be available is considered to be moderate. The potential for the work areas not being available is also considered moderate.

C. WASTE VOLUMES

The actual waste volumes (which are sent offsite for disposal - LSA to NTS and TRU to INEL) through FY 1986 and the estimated waste volumes through FY 1990 are shown on the following table.

ESTIMATED WASTE VOLUMES

(thousands of cubic feet)

FISCAL YEAR	78	79	80	81	82	83	84	85	86	87	88	89	90	Total
ANSPD/NE LSA	-	-	-	-	2	5	28	38	55	40	15	34	77	294
ANSPD/NE TRU	-	-	-	-	-	1	1	1	1	6	1	-	-	11

D. PERCENT COMPLETE

The estimated percent completion of the project is based on such factors as physical completion, manpower used, waste generated, degree of complexity, and professional evaluation. The estimated percent completion by fiscal year is:

PERCENT COMPLETE

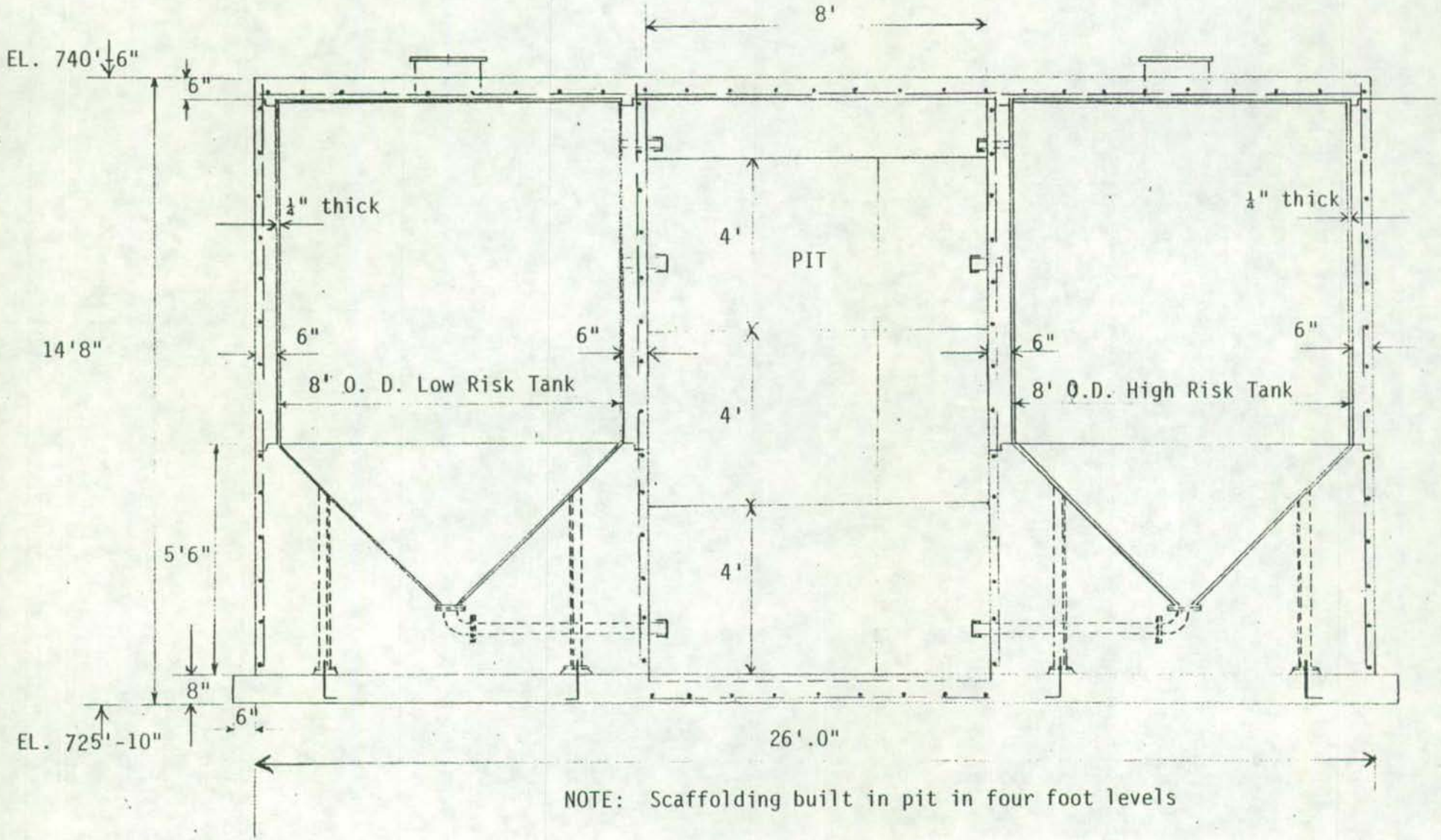
(%)

END OF FISCAL YEAR	82	83	84	85	86	87	88	89	90
ANSPD/NE	5	20	35	45	60	75	80	90	100

BUILDING 41 UNDERGROUND PORTION

SIDE VIEW

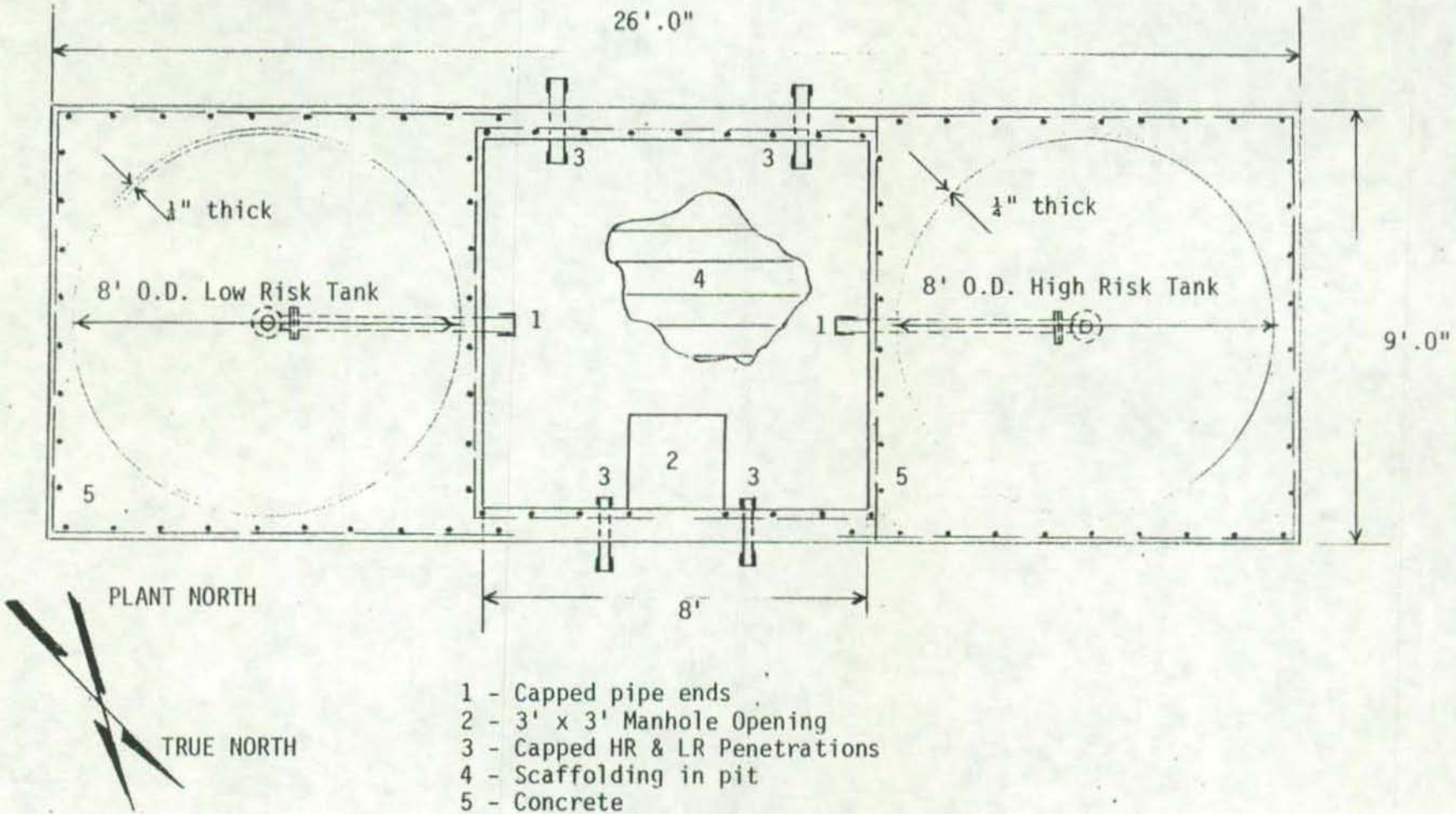
(Looking South)



NOTE: Scaffolding built in pit in four foot levels

BUILDING 41 TANKS

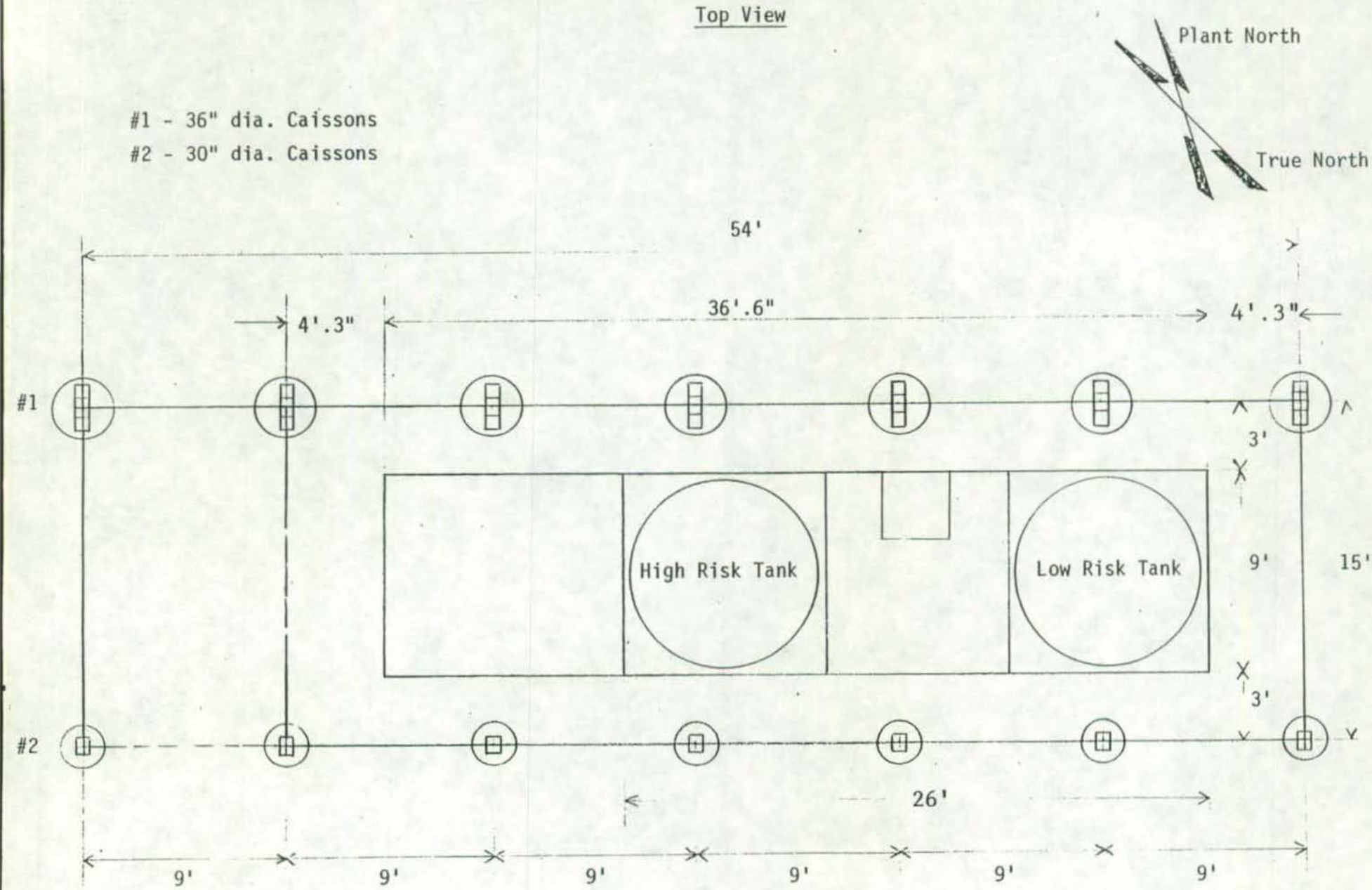
TOP VIEW



1 - Capped pipe ends
2 - 3' x 3' Manhole Opening
3 - Capped HR & LR Penetrations
4 - Scaffolding in pit
5 - Concrete

BLDG. 41 Enclosure - Bldg. 41 Ground Level

Top View



PROJECT WTSDRIS
PLOT TOTAL4
PAGE 1 SHEET 1

START 10OCT86
FINISH 18SEP89

D&I PROJECT FOR WTS AREA ONLY-ORIGINAL
DAVID A. ZORICH & PROJECT/S
MONSANTO RESEARCH CORP

SUMMARY P L A N N I N G SCHEDULE
SUMMARY BREAK ON LEVEL 4

MODE G/F
INTERVAL: 1 MONTH(S)

RUN: 18JAN87 08:31
PROJECT/E 85A3
SCHEDULE BAR CHART

86			87										88										89										90					
4			1			2			3			4	1			2			3			4	1			2			3			4	1			2			3
O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S

16000 3 HS SITE ..... 15JUL87 [ ] 11FEB88

16100 41 AREA ..... [10OCT86 21AUG87]

16200 WD HILLSIDE ..... [15MAR89 18SEP90]

16400 OTHER WTS AREAS ..... 30SEP88 [ ] 18JAN89

LEGEND

EARLY SCHEDULE [ ]

MILESTONE ◇

CRITICAL [ ]

DISCONTINUITY [ ]

CURRENT STATUS

XII. CURRENT STATUS

Significant progress has been made to date in the Decontamination and Decommissioning of the inactive areas of PP and R Buildings and the Waste Transfer System (WTS). The D&D objectives have been accomplished as planned with:

- No hazards to personnel, facilities, or environment (no significant injuries, radiation exposures, or releases).
- Continued identification and reduction of unencapsulated Pu-238 inventory at Mound (1783 grams or approximately 30,000 curies measured and removed through FY1986).
- Areas are being completed (R127, R128, R130, R131, R143, R145/147, R159B, and R198 Laboratories released for reuse and 282 gloveboxes (1,100 linear-feet) stripped, removed, packaged, and sent for disposal with an additional 8 gloveboxes cleaned and stripped for reuse to date).
- Removal of the PP Conveyor System completed (930 linear feet removed).
- Removal of underground lines completed (5,130 linear feet removed).
- The overall project was approximately 75% complete at the end of FY1986.

The details of the ANSPD(NE) and OMA D&D Programs by fiscal year are given on the following pages.

FY1978 ACCOMPLISHMENTS

- ANSPD D&D PROGRAM INITIATED
- ENGINEERING ESTIMATE and PLAN DEVELOPED
- DASMP (now ANSPD) D&D PLAN ISSUED
- INITIAL CLEANING OF ANSPD(NE) GLOVEBOXES COMPLETED
- R BUILDING CORRIDOR MODIFICATION COMPLETED
- PP BUILDING AB AIRLOCKS and DOCK MODIFICATIONS COMPLETED

FY1979 ACCOMPLISHMENTS

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING A1 LABORATORY (17 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING F4 LABORATORY (5 gloveboxes stripped, removed, packaged, and sent for disposal).
- PP BUILDING EF AIRLOCKS and DOCK MODIFICATIONS COMPLETED.
- R BUILDING WASTE HANDLING and STORAGE AREA COMPLETED (BUILDING 68).
- GLOVEBOX 601 in PP BUILDING F1 LABORATORY PARTIALLY DECONTAMINATED, SEALED, and MODIFIED FOR REUSE BY ANSPD ACTIVE PROGRAM (Original Plan was to remove and replace glovebox, i.e., cost savings).
- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING LABORATORY R-143 (4 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING LABORATORY R-145/147 (9 gloveboxes stripped, removed, packaged, and sent for disposal).
- OVERSIZED TRU PACKAGES TESTED and APPROVED
- OMA D&D ENGINEERING ESTIMATE and PLAN DEVELOPED

FY1980 ACCOMPLISHMENTS

A. ANSPD(NE) D&D PROGRAM

Most of the Inactive Areas were placed into standby for surveillance and maintenance during the reduced funding period in FY1980. Some limited D&D did continue:

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING A2 LABORATORY (4 gloveboxes stripped, sectioned, removed, packaged, and sent for disposal).

- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R-143 LABORATORY.
- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R-145/147 LABORATORY.

B. OMA D&D PROGRAM

- D&D PROGRAM INITIATED
- INITIAL CLEANING OF OMA GLOVEBOXES INITIATED IN PP BUILDING
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING D1 LABORATORY (9 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING D2 LABORATORY (4 gloveboxes stripped and removed; 1 glovebox to be reused and the other 3 gloveboxes were packaged and sent for disposal. 2 other gloveboxes that are part of the D3 Laboratory system remain).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING E1 LABORATORY (4 gloveboxes stripped, removed; 1 glovebox was reused and the other 3 gloveboxes were packaged and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING E2 LABORATORY (10 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX DECONTAMINATION PHASE COMPLETED IN PP BUILDING 111 LABORATORY (5 gloveboxes cleaned and stripped for future use).
- EQUIPMENT, SERVICES, AND PIPING REMOVAL INITIATED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS
- COST OF A PP BUILDING DOCK CONSTRUCTION AVOIDED (PP Building CD Airlock and Dock modification avoided by internal building modifications).
- GLOVEBOX SECTIONING TECHNIQUES BEING DEVELOPED
- CONCRETE DECONTAMINATION TECHNIQUES BEING DEVELOPED

FY1981 ACCOMPLISHMENTS

A. ANSPD(NE) D&D PROGRAM (OMA SUPPLEMENTAL FUNDING)

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R143 and R145/147 LABORATORIES (released for reuse).
- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING R127 LABORATORY (12 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING B1 LABORATORY (5 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING C1 LABORATORY (7 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING C2 LABORATORY (7 gloveboxes stripped, removed, packaged, and sent for disposal).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL RESTARTED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS

- PARTIAL STRUCTURAL DECONTAMINATION (AND ISOLATION) INITIATED IN PP BUILDING (service lines that are under where gloveboxes were located are being removed from the concrete second floor, the area decontaminated, and new concrete poured).

B. OMA D&D PROGRAM

- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING R159 LABORATORY (29 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING B3 LABORATORY (7 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE INITIATED IN PP BUILDING E3 LABORATORY (3 out of 9 gloveboxes stripped, removed and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING B2 LABORATORY (9 gloveboxes stripped, removed, packaged, and sent for disposal).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS

- PARTIAL STRUCTURAL DECONTAMINATION (AND ISOLATION) INITIATED IN PP BUILDING (service lines that are under where gloveboxes were located are being removed from the concrete second floor, the area decontaminated, and new concrete poured).

C. OMA/NE GENERAL

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, plasma cutting glovebox sectioning, service line removal, glovebox equipment removal, size reduction, and waste packaging).

- CONTACTS BEING MAINTAINED WITH LEAD D&D CONTRACTORS ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

- COORDINATED ANSPD (NE) AND OMA D&D PROGRAM PLAN UPDATED

FY 1982 ACCOMPLISHMENTS

A. ANSPD(NE) D&D PROGRAM

- STRUCTURAL DECONTAMINATION PHASE INTIATED IN R BUILDING R127 LABORATORY.

- GLOVEBOX REMOVAL PHASE INITIATED IN R BUILDING R130 LABORATORY (6 out of 10 gloveboxes stripped, removed, packaged, and sent for disposal).

- WTS UNDERGROUND LINE REMOVAL PHASE INITATIED (60 ft of lines removed from creek area).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING C3 LABORATORY (8 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING C4 LABORATORY (5 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING F2 LABORATORY (2 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING F3 LABORATORY (2 gloveboxes stripped, removed, packaged, and sent for disposal).

B. OMA D&D PROGRAM

- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILIDNG R159 (south end, north end being used as waste staging area).

- GLOVEBOX REMOVAL PHASES INITIATED IN OMA/NE COMMON SUPPORT AREAS (see details below).

C. OMA/NE GENERAL AND COMMON SUPPORT AREAS

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING A3 LABORATORY (2 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING B4 LABORATORY (8 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING D3 LABORATORY (12 gloveboxes, stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING E3 LABORATORY (remaining 6 gloveboxes stripped, removed, packaged, and sent for disposal).

- GLOVEBOX REMOVAL PHASE INITIATED IN OTHER COMMON SUPPORT PP BUILDING LABORATORIES (13, 14, B3 - 5 gloveboxes stripped, removed, packaged, and sent for disposal).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.

- CONVEYOR REMOVAL PHASE INITIATED IN PP BUILDING (services being removed).

- PARTIAL STRUCTURAL DECONTAMINATION (AND ISOLATION) CONTINUED IN PP BUILDING (service lines that are under where gloveboxes were located are being removed from the concrete second floor, the area decontaminated, and new concrete poured).

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, plasma cutting, glovebox sectioning, service line, removal, glovebox equipment removal, size reduction, and waste packaging).

- CONTACTS BEING MAINTAINED WITH LEAD D&D CONTRACTORS ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN UPDATED.

FY 1983 ACCOMPLISHMENTS

A. ANSPD (NE) D&D PROGRAM

- WTS UNDERGROUND LINE REMOVAL PHASE CONTINUED (1690 linear feet removed - 1750 linear feet LTD).
- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING R 130 LABORATORY (4 remaining gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING R 131 LABORATORY (19 gloveboxes stripped, removed, packaged and sent for disposal).
- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R 127 LABORATORY (released for reuse).
- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R 130 LABORATORY.
- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R 131 LABORATORY.

B. OMA D&D PROGRAM

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R 159B LABORATORY (released for reuse).

C. OMA/NE GENERAL AND COMMON SUPPORT AREAS

- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 13 LABORATORY (2 remaining gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 14 LABORATORY (2 remaining gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 52 LABORATORY (7 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 122 LABORATORY (1 glovebox stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 130 LABORATORY (2 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 177 LABORATORY (3 gloveboxes stripped, removed, packaged, and sent for disposal).
- GLOVEBOX REMOVAL PHASE COMPLETED IN PP BUILDING PP 178 LABORATORY (3 gloveboxes stripped, removed, packaged, and sent for disposal).
- CONVEYOR REMOVAL PHASE INITIATED IN PP BUILDING (600 out of 930 linear feet stripped, removed, size reduced, packaged and sent for disposal).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.

- PARTIAL STRUCTURAL DECONTAMINATION (AND ISOLATION) CONTINUED IN PP BUILDING (service lines that were under where gloveboxes were located were removed from the concrete second floor, the area decontaminated, and new concrete poured).

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, plasma cutting, glovebox sectioning, service line, removal, glovebox equipment removal, size reduction, and waste packaging).

- CONTACTS BEING MAINTAINED WITH LEAD D&D CONTRACTORS ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

  - Presented two papers on D&D techniques at the 1982 International Decommissioning Symposium at Seattle, Washington on October 12, 1982 (see Appendix C for papers).

  - Hosted Surplus Facilities Management Program's (SFMP) Annual Budget and Program Planning Conference with tours of Mound's D&D Projects on November 9-11, 1982.

- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN UPDATED.

FY 1984 ACCOMPLISHMENTS

A. ANSPD (NE) D&D PROGRAM

- WTS UNDERGROUND LINE REMOVAL PHASE CONTINUED (2,044 linear feet removed - 3,794 linear feet LTD).

- WTS BUILDING 41 CONTAINMENT STRUCTURE DESIGNED AND CONSTRUCTED.

- STRUCTURAL DECONTAMINATION PHASE CONTINUED IN R BUILDING R 130 LABORATORY.

- STRUCTURAL DECONTAMINATION PHASE CONTINUED IN R BUILDING R 131 LABORATORY.

- GLOVEBOX REMOVAL PHASE INITIATED IN R BUILDING R 120 LABORATORY.

B. OMA/NE GENERAL AND COMMON SUPPORT AREAS

- CONVEYOR REMOVAL PHASE COMPLETED IN PP BUILDING (330 linear feet - 930 linear feet LTD stripped, removed, size reduced, packaged and sent for disposal).

- GLOVEBOX REMOVAL PHASE COMPLETED IN THE LAST PP BUILDING LABORATORY - PP34 (4 GLOVEBOXES STRIPPED, REMOVED, PACKAGED, AND SENT FOR DISPOSAL).

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN 13 PP BUILDING LABORATORIES - 3,200 SQ. FT. (PP-128, 130, 142E, 158E, 159, 160, 162, 163, 164, 175, 176, 177, 178).

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, glovebox sectioning, service line removal, size reduction, soil removal, and waste packaging).

- EQUIPMENT SERVICES, AND PIPING REMOVAL AND STRUCTURAL DECONTAMINATION CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.

- CONTACTS BEING MAINTAINED WITH LEAD D&D CONTRACTORS ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN UPDATED.

FY 1985 ACCOMPLISHMENTS

A. ANSPD (NE) D&D PROGRAM

- WTS UNDERGROUND LINE REMOVAL PHASE CONTINUED (1091 linear feet removed - 4885 linear feet LTD).

- WTS BUILDING 41 INTERNAL DECOMMISSIONING COMPLETED AND THE ABOVE-GROUND STRUCTURE REMOVED.

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R128 LABORATORY (released for reuse).

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R 130 LABORATORY (released for reuse).

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN R BUILDING R 131 LABORATORY (released for reuse).

- GLOVEBOX REMOVAL PHASE COMPLETED IN R BUILDING R 120 LABORATORY (26 gloveboxes stripped, removed, packaged and sent for disposal).

- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R120 LABORATORY.

- STRUCTURAL DECONTAMINATION PHASE INITIATED IN R BUILDING R118,123A ROOMS.

B. OMA/NEW GENERAL AND COMMON SUPPORT AREAS

- THREE FILTER-BANKS (AJ-112, 114, 115) REMOVED IN PP BUILDING.

- EQUIPMENT SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.

- STRUCTURAL DECONTAMINATION PHASE COMPLETED IN 15 PP BUILDING LABORATORIES (PP-124, 126, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158W.)

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, glovebox sectioning, service line removal, size reduction, soil removal, and waste packaging).

- CONTACT BEING MAINTAINED WITH LEAD D&D CONTRACTORS ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN UPDATED.

FY 1986 ACCOMPLISHMENTS

A. ANSPD (NE) D&D PROGRAM

- REMOVAL OF CONTAMINATED SOIL ASSOCIATED WITH WTS UNDERGROUND LINE CONTINUED.

- WTS UNDERGROUND LINE REMOVAL PHASE COMPLETED (244 linear feet removed-5129 linear feet LTD).

- WTS BUILDING 41 UNDERGROUND TANKS REMOVED.

B. OMA/NEW GENERAL AND COMMON SUPPORT AREAS

- STRUCTURAL DECONTAMINATION PHASE INITIATED AND COMPLETED IN FIFTEEN PP BUILDING LABORATORIES AND SUPPORT AREAS (PP-6W, 51, 52, 102, 103, 105, 106, 119, 121, 122, 135, 140, 143, 144, and 145).

- EQUIPMENT, SERVICES, AND PIPING REMOVAL CONTINUED IN OTHER PP BUILDING LABORATORIES AND SERVICE CORRIDORS.

- D&D TECHNIQUES CONTINUE TO BE DEVELOPED AND REFINED (contamination control, radiation control, service line removal, size reduction, soil removal, and waste packaging).

- CONTACT BEING MAINTAINED WITH LEAD D&D CONTRACTORS (NATIONAL AND INTERNATIONAL) ON NEW TECHNOLOGIES, EQUIPMENT, AND METHODS.

- COORDINATED ANSPD(NE) AND OMA D&D PROGRAM PLAN AND BASELINE UPDATE INITIATED.

FUTURE PLANS

As the structural decontamination phase is completed in each of the laboratories in R Building, these areas become available for new occupants (beginning in FY1981).

Since the D&D Program involves almost all of the areas in PP Building (as opposed to isolated rooms in R Building), the D&D areas will not be ready for new occupants until the end of the Program. Figures 31 and 32 show conceptually what the building will look like when D&D is completed.

The continuing radioactive operations on the second floor of PP Building and the building's radiological support functions on the first floor will be located within an inverted U-shape low-risk or normal radiological control area. The remaining areas of the PP Building will be under minimum radiological control[1] and negative filtered ventilation in order to provide assurance of confinement of residual contamination should migration occur.

Most of the second floor minimum control area will be open and is uncommitted at this time. The area would be available for nonradioactive work or for radioactive work by connecting onto the inverted U or low-risk control area.

A large portion of the first floor equipment area will also be open for either radioactive or nonradioactive work.

[1]Minimum radiological control refers to air sampling, wipe and direct monitoring to verify that any residual contamination remains sealed. Special radiological clothing should not be required in these areas but personnel will monitor their hands and feet when exiting the building.

LEGEND - POST D & D

- MINIMUM CONTROL AREA
- OPEN UNCOMMITTED MINIMUM CONTROL AREA
- LOW RISK CONTROL AREAS

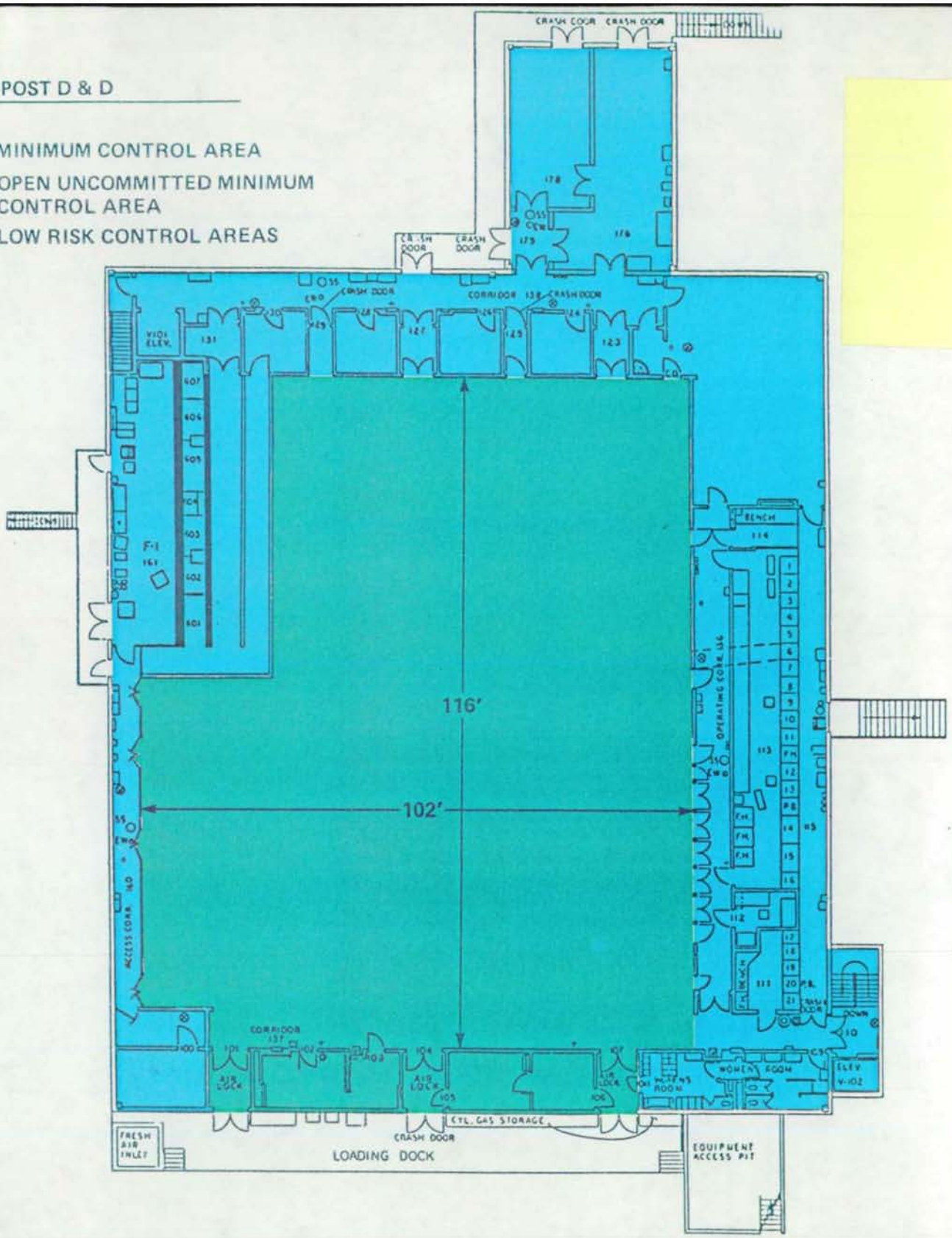


FIGURE 31

XII-11

MONSANTO RESEARCH CORPORATION
MOUND
MIAMISBURG, OHIO

BLDG. 38
PLUTONIUM PROCESSING
2ND FLOOR

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

LEGEND

- MINIMUM CONTROL AREA
- OPEN UNCOMMITTED MINIMUM CONTROL AREA
- LOW RISK CONTROL AREAS

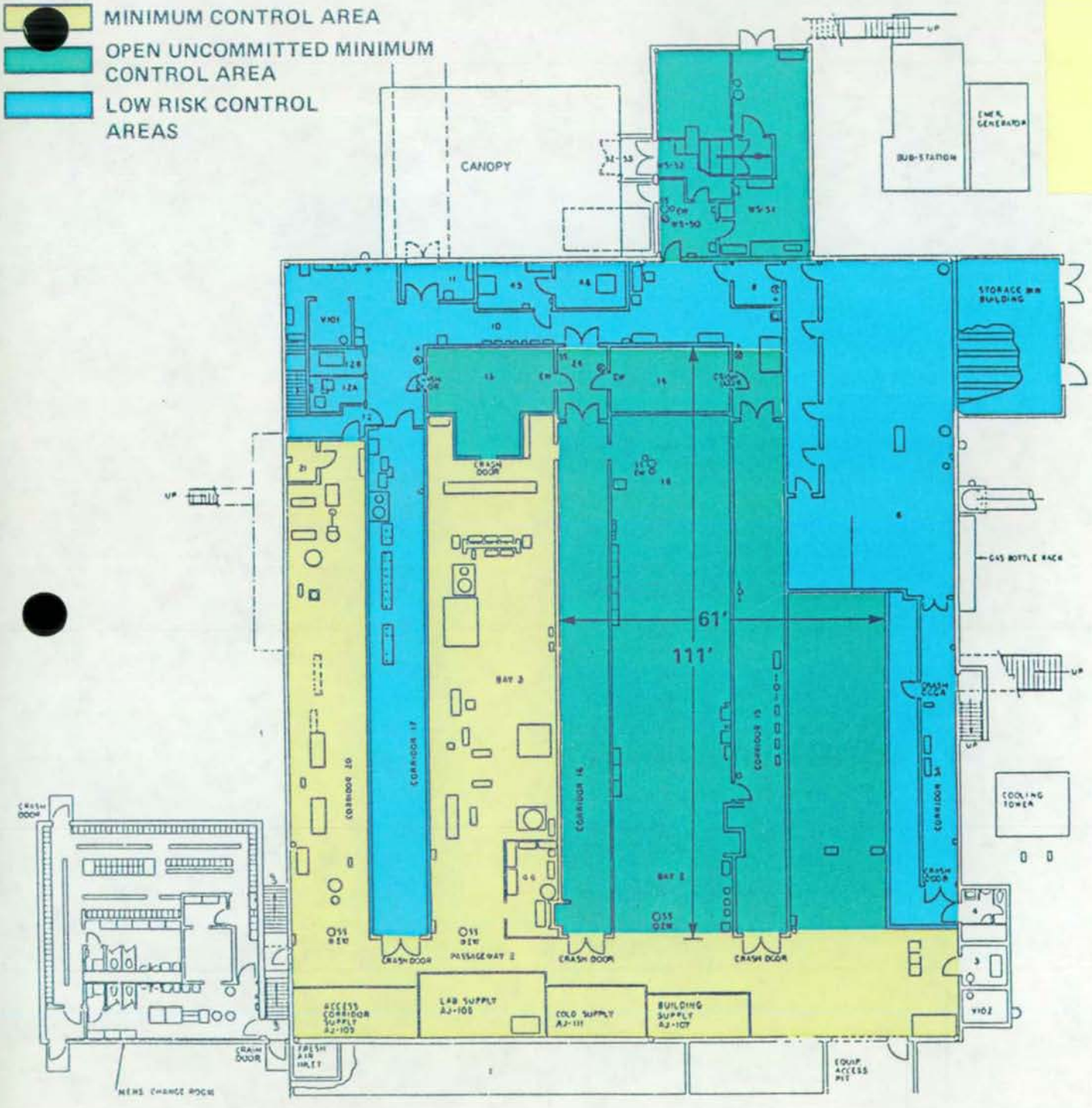


FIGURE 32

XII-12

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

MONSANTO RESEARCH CORPORATION
MOUND
MIAMISBURG, OHIO

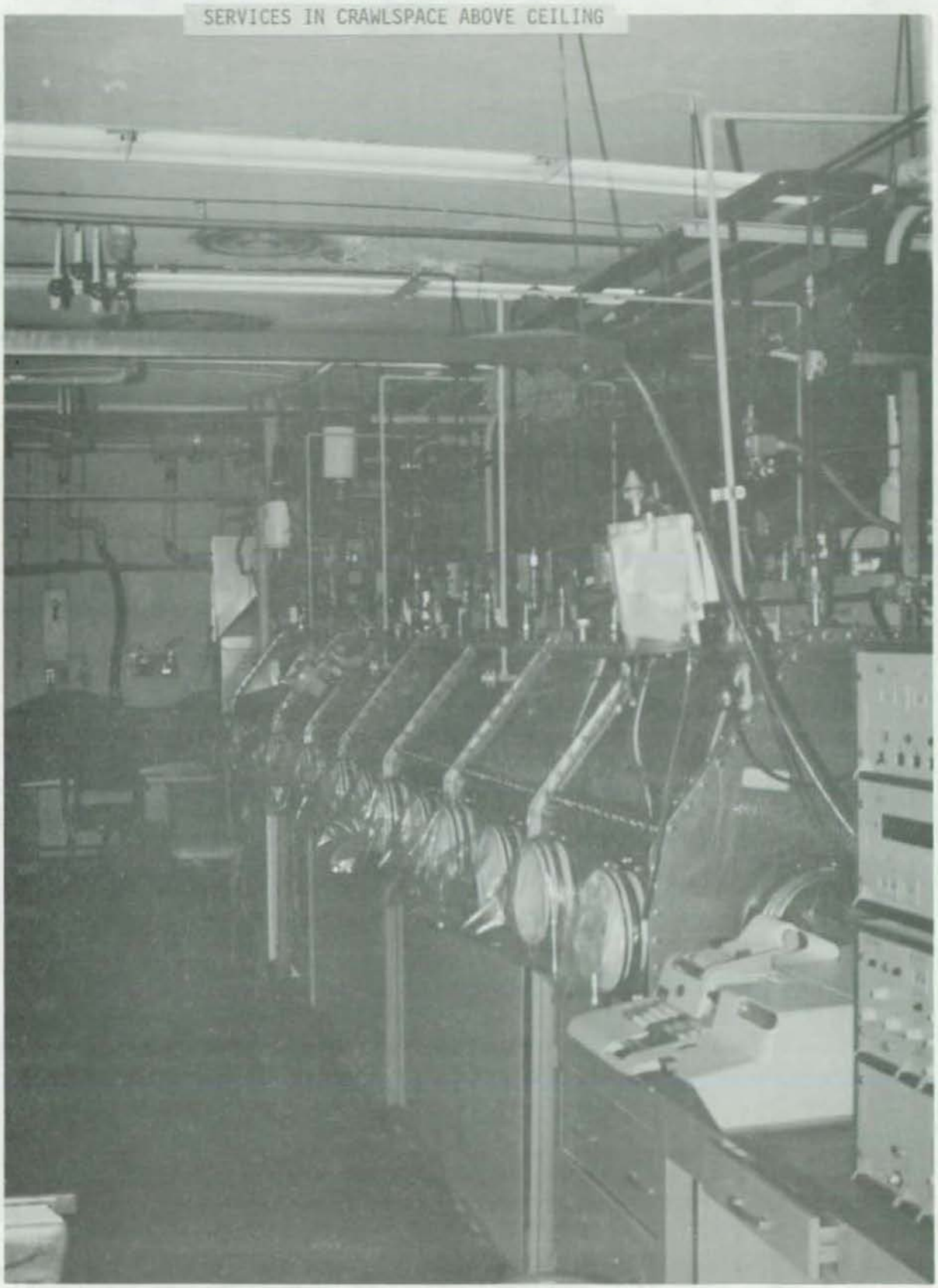
BLDG. 38
PLUTONIUM PROCESSING
1ST FLOOR

APPENDIX A

TYPICAL UNSHIELDED FIBERGLASS GLOVEBOXES
(PP-A1 Lab)

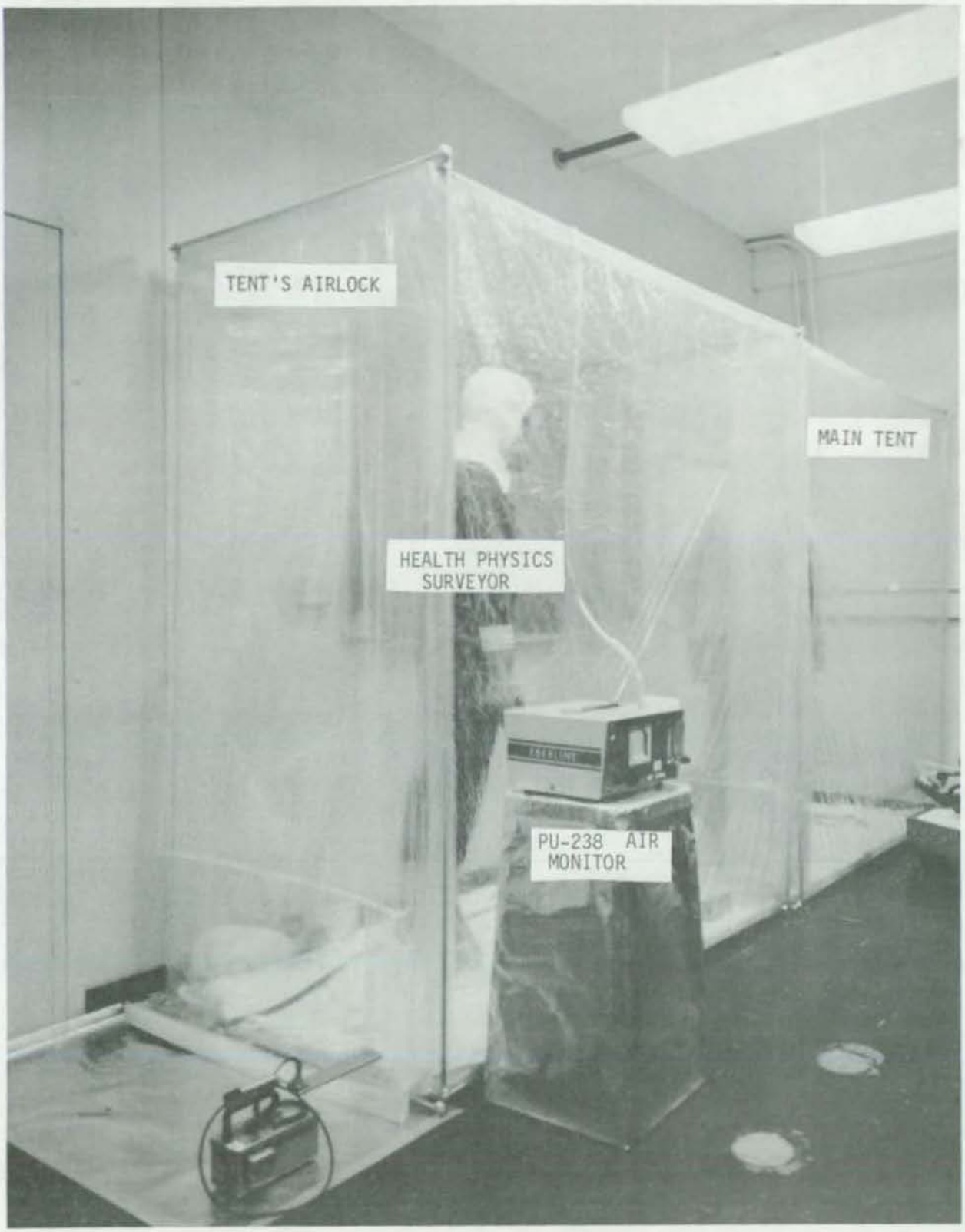
TYPICAL 4-IN. SHIELDED STAINLESS STEEL
GLOVEBOXES (PP-E3 Lab)

TYPICAL 12-to16-IN. SHIELDED STAINLESS
STEEL MANIPULATOR GLOVEBOXES
(PP-A2 Lab)



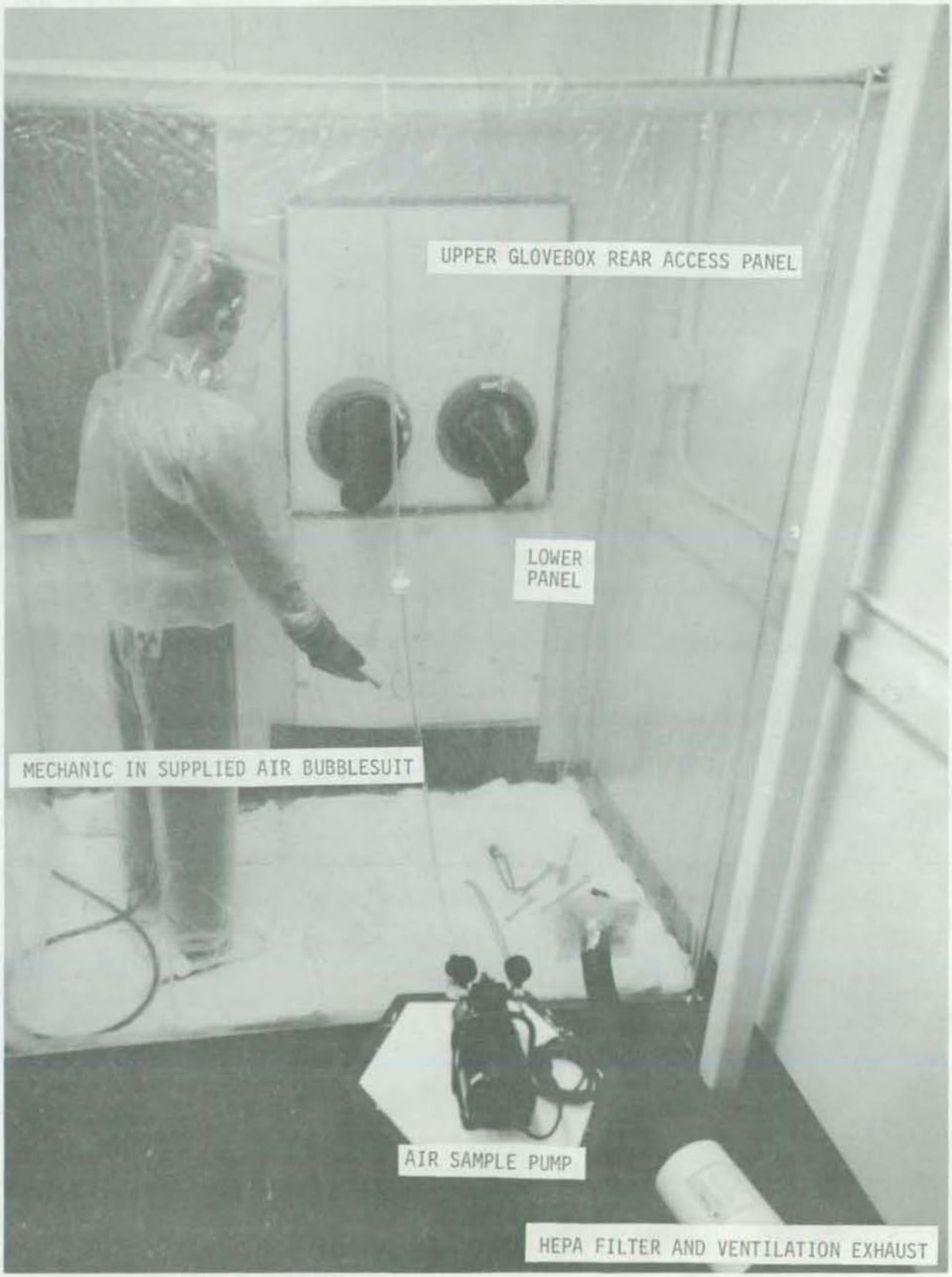
TYPICAL R BUILDING LABORATORY (R-120)

UNDERGROUND LINES CROSSING CREEK AREA
(REMOVED IN FY1982)



SIMULATED REMOVAL OF EQUIPMENT FROM
GLOVEBOXES

CLOSE UP OF TENT'S AIRLOCK



CLOSE UP OF MAIN TENT

APPENDIX B

APPENDIX B

DESCRIPTION OF COMMON (OMA/NEW) SUPPORT SYSTEMS IN PP BUILDING

There are several common support systems in the PP Building that have been used to support both ANSPD(NEW) and OMA processing programs and that continue to support the D&D of the dedicated inactive NEW and OMA gloveboxes and laboratories. These common systems and facilities that require D&D or modification are as follows:

Glovebox Waste Processing - Includes the processing of liquid and solid D&D waste (TRU waste and recoverable scrap). Waste is transferred to the D-3 Laboratory for incineration (pager, rags, etc.) or concentration (liquids) in the E-3 and D-3 Laboratories. The concentration of radioactivity in the waste is measured in the B-4 Laboratory.

Waste Packaging - Solid recoverable scrap is packaged in the E-3 Laboratory using special fixtures and TRU glovebox waste is packaged in the B-4 Laboratory. Low-level liquids primarily from the building drainage system are sent to the Waste Disposal (WD) Building for treatment. LSA waste is compacted in PP-46 and 47 or incinerated at the WD Building and/or loaded into waste containers for shipment.

Material Transfer - Solid glovebox waste is transferred between the gloveboxes being D&D'd and support gloveboxes in B-4, D-3 and E-3 Laboratories via an overhead conveyor approximately 900 feet in length. Material is introduced into and out of the glovebox conveyor sysem in the A-3 Laboratory. Liquids are transferred via the house vacuum systems in PP-14.

Ventilation Systems - Ventilation is maintained within D&D and support areas via the following systems:

- Glovebox Corrosive Vapor Scrubbing System in PP-13
- Supply Air Filter Banks
- Air Conditioning and Heating Systems
- Four Exhaust Filter Banks that service operating and access corridors, laboratories, and gloveboxes.

Process Systems - Several building process support systems are used by D&D and include chilled water, tempered water, sanitary system, storm sewer system, low-level liquid radioactive waste drain systems, acid/caustic supply system, process air system, lighting and electrical distribution, fire protection and detection, air sampling and monitoring systems, communication systems, and security systems.

Summary - In summary, there are numerous systems throughout the PP Building that support the D&D of dedicated NEW/OMA processing areas and gloveboxes. These common support areas include 187 linear feet of gloveboxes, major pieces of equipment (fans, pumps, motors, tanks, evaporators, scrubbers, etc.), actual miles of piping, the entire first floor of PP Building, and major laboratory areas on the second floor.

The nature and physical layout of the common support systems dictate that the following D&D sequence be followed with some overlapping:

- Removal of most of the dedicated NEW and OMA processing areas and initial structural decontamination.
- Removal of the highly contaminated support systems which in some cases, requires the installation of temporary systems for D&D or permanent systems for ongoing operations and surveillance.
- Removal of the rest of the significantly contaminated support systems including temporary installations.
- Final structural decontamination and isolation of residual contamination of areas vacated by the support systems.
- Final installation of surveillance services.

APPENDIX C

APPENDIX C TABLE OF CONTENTS

- "A Summary Review of Mound Laboratory's Experience In D&D of Radioactive Facilities, 1949-1973". August, 1975 C- 1
- "Mound's Decommissioning Experience, Tooling, and Techniques". October, 1982 C- 8
- "The Use of Urethane Foam in the Decontamination and Decommissioning of Nuclear Facilities". October, 1982 C-17
- "Tools for Decontamination and Decommissioning of Nuclear Facilities". November, 1986. C-21

APPENDIX C

(This paper was presented at the ERDA Conference on Decontamination and Decommissioning (D&D) of ERDA Facilities, Idaho Falls, Idaho, August 19-21, 1975)

A SUMMARY REVIEW OF MOUND LABORATORY'S EXPERIENCE IN D&D OF RADIOACTIVE FACILITIES 1949-1973

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ABSTRACT

The objective of Mound Laboratory's Decontamination and Decommissioning (D&D) projects has been the effective termination of radioactive material processing facilities with no significant personnel exposures or environmental releases. This objective must be met with available resources and manpower.

Mound has effectively decontaminated and/or decommissioned four major facilities in the 1949 through 1973 time period. Many minor areas were also decontaminated and/or decommissioned during this period. The major D&D projects involved the following isotopes: polonium-210, radium-226, actinium-227, and plutonium-238.

To achieve a D&D status, Mound has employed several control and decontamination techniques such as: "Navy Cocooning," entombment, removal, foaming, bagging, tents, chutes, portable exhausters, dry ice, vents, bubble suits, three-zones, fire watches, painting and sealing, in-line cleaning, high pressure water blaster, and chemical cleaning.

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*Mound Laboratory is operated by Monsanto Research Corporation for the U.S. Energy Research and Development Administration under Contract No. E-33-1-GEN-53.

A SUMMARY REVIEW OF MOUND LABORATORY'S EXPERIENCE IN D&D OF RADIOACTIVE FACILITIES, 1949-1973

J. M. Garner & W. P. Davis

Introduction - Mound Laboratory has completed four major Decontamination and Decommissioning (D&D) projects of ERDA facilities over the years in addition to several minor D&D projects.

The four major D&D projects were:

1. Two polonium-210 processing facilities.
2. A radium-226 and actinium-227 processing and waste disposal facility.
3. A third polonium-210 processing facility.

The details of these four major projects are described in the following sections.

Polonium-210 Facilities - Units III and IV were used to process polonium-210 from 1944 through 1949[1,2]. Unit III contained approximately 35,000 ft.^{2} of contaminated floor space and was decontaminated and decommissioned from 1949 to 1950 under the direction of AEC/Oak Ridge by conventional scrubbing and removal techniques. The main building was returned to the original owners (The Dayton Board of Education) in 1950. The outer smaller buildings were removed (including footer), and the area was backfilled.

Unit IV was approximately 16,000 ft^2. The building was decontaminated as much as possible by conventional scrubbing and removal techniques. The structure and footer were then removed, and the area was backfilled. The site was returned to the original owner (The Talbott Family) in 1950.

Monitoring included air samples, wipe and direct contamination surveys, water and urine samples. End results of D&D was N/D (nondetectable) removable alpha and less than 5×10^3 dis/min/100 cm^2 fixed alpha (5×10^4 on Unit IV). Followup surveys shows N/D due to the short (138-day) half-life.

Personnel protection included clothing and respiratory (half and full face masks) protection. Clothing was basically two-piece whites, coveralls, gloves, control shoes, shoecovers, and booties.

Radium-226 and Actinium-227 Facility - The "Cave" and associated waste disposal facilities were used to process radium-226 and actinium-227 from 1952 to 1954. The Cave and associated facilities contained approximately 4,000 $ft.^2$ of contaminated floor space and was D&D'd under the direction of the AEC/DAO by conventional scrubbing, removal, "Navy Cocooning," and entombment techniques. The D&D was performed during the 1955 through 1957 time period (equipment in "Navy Cocoons" was on hold until 1957) with available manpower. A portion of the Cave structure (where high level material was processed) was entombed in 12 in. of concrete. The remainder of the facility was decontaminated to N/D removable and less than 400 dis/min/100 cm^2 fixed alpha contamination. This portion is now used for other programs.

Monitoring included air samplers, radon sampling, wipe and direct contamination surveys, gamma surveys, and urine samples.

Personnel protection included clothing and respiration protection (half and full face supplied-air masks, bubble suit). The Mound-Snyder supplied-air bubble suit was developed and used on this project.

Plutonium-238 Facility - The SM Facility was used to process plutonium-238 for space programs from 1961 to 1968.

The SM Facility contained approximately 15,000 ft.^{2} of contaminated floor area (585 linear feet of gloveboxes) and was D&D'd under the direction of the AEC/DAO office by employing several control and decontamination techniques such as: removal, foaming, bagging, tents, chutes, portable exhausters, dry ice, vents, bubble suits, three-zones, fire watches, painting and sealing, in-line cleaning, high pressure water blaster, and chemical cleaning. The Facility is now awaiting final disposition by ERDA. The D&D was performed during the 1968 through 1972 time period (work emphasis on later years).

Monitoring included air samplers, wipe and direct contamination surveys, γ-n surveys, soil and water samplers, nosewipes, urine samples, WBC, film badges, etc. The current contamination level inside the facility is less than 10,000 dis/min/100 cm^2 removable alpha and less than 400,000 dis/min60 cm^2 fixed alpha. (Painting was not used.)

Personnel protection included clothing and respiratory protection. This protection included: two-piece whites, coveralls, two-piece plastic suits, two-piece supplied-air bubble suits, shoecovers, booties, control shoes, head covers, and filtered and supplied-air respiratory protection.

A Third Polonium-210 Facility - The "T" Facility was used to process polonium-210 for commercial sale and space programs to 1972.

The radioactive processing section was approximately 32,000 ft.^{2} for two floors (236 linear ft. of gloveboxes) and was D&D'd under the direction of the AEC/DAO office by conventional scrubbing and removal techniques. The D&D was performed during the 1971 through 1973 time period. The facility is now used for both radoactive and nonradioactive work.

Monitoring included air samples, wipe and direct contamination surveys, γ-n surveys, soil and water samplers, urine samples, WBC, film badges, etc. The area was decontaminated to N/D removable alpha and N/D fixed. Painting was allowed only on surfaces less than 4,000 dis/min (decayed to N/D by end of project).

Personnel protection included clothing and respiratory (filtered and supplies air) protection.

Special Techniques - Several techniques were found to be effective in controlling and reducing the spread of contamination during decontamination and decommission work.

Equipment and structures contaminated with short half-life material were removed for storage at a controlled area until decay had reduced contamination levels to N/D.

Sealing equipment and structures was used for containment purposes. The Navy Cocooning method was used in the earlier days, but has now been replaced with foaming. Other materials such as asphalt, concrete, and paint can be used on items that are to be discarded or are contaminated with a short half-life material.

Containment can be achieved by using plastic bags and enclosures. These enclosures were especially helpful when working outside the building.

Temporary access methods such as a chute improved efficiency.

Portable exhausters such as Spencer turbines and large industrial vacuum cleaners with absolute filters provided added negative differential to small work areas.

The use of dry ice to remove tile minimized the spread of contamination.

Small respirator filters were used as vents when equipment was foamed.

The Mound-Snyder supplied-air bubble suit provided personnel with maximum respiratory and contamination protection.

The use of three separate zones of contamination levels proved to be effective in contamination control.

A 24-hr, seven-days a week, "fire watch" was provided on occasion to increase ability (in addition to automatic alarms) to detect potentially hazardous conditions.

In-line glovebox cleaning and separation of equipment proved to be very successful. Even high pressure washing can be used if the gloveboxes are not deteriorated.

A variable high pressure water blaster was used to reduce decontamination time. Wet sandblasting was used on a limited basis because of problems with lines and drains plugging.

Chemical cleaning such as paint removers and acid solutions also reduced decontamination time. Mechanical paint chippers were used only on a limited basis because they were time consuming.

The exact methods used for D&D work will depend on an evaluation of several factors; half-life of contaminants, type, specific activity, quantity of contamination, the presence of other radioactive and nonradioactive contaminats, location, and desired end result.

Summary - In conclusion, Mound Laboratory has completed four major Decontamination and Decommissioning projects. These projects were accomplished in an effective manner by use of these contamination control techniques, procedures, and decontamination techniques. As a result, there were no significant personnel exposures and no significant impact on the environment as verified by data from the following monitoring programs: stack sampling, on-site and off-site monitoring stations, bioassay sampling, and dosimetry data.

The D&D projects were also completed with minimum impact on operational resources and manpower.

References

1. Report No. 3 of Steering Committee for Disposal of Units III and IV, MLM-461, Mound Laboratory, April 17, 1950.

2. Completion Report for Disposal of Unit III, MLM-393, Mound Laboratory, October 32, 1949.

(This paper was presented at the DOE 1982 International Decommissioning Symposium, Seattle Washington, October 10-14, 1982)

MOUND'S DECOMMISSIONING EXPERIENCE, TOOLING, AND TECHNIQUES

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ABSTRACT

Monsanto Research Corporation (MRC), which operates Mound for the Department of Energy (DOE), has been decommissioning radioactively contaminated facilities since 1949.

We are currently decommissioning three plutonium-238 contaminated facilities (approximately 50,000 ft^2) that contained 1100 linear ft of gloveboxes; 900 linear ft of conveyor housing; 2650 linear ft of dual underground liquid waste lines; and associated contaminated piping, services, equipment, structures, and soil. As of June, 1982, over 29,000 Ci of plutonium-238 have been removed in waste and scrap residues.

As a result of the current and previous decommissioning projects, valuable experience has been gained in tooling and techniques. Special techniques have been developed in planning, exposure control, contamination control, equipment removal, structural decontamination, and waste packaging.

INTRODUCTION

Mound is a Department of Energy installation located in Miamisburg, Ohio. The site (306 acres) is located in a residential/agricultural area of suburban Dayton, Ohio. The facility is operated by Monsanto Research Corporation for the DOE in support of weapons and nonweapons programs.

Monsanto has been involved with radioactive operations since 1944 and the resulting decommissioning operations since 1949. We are currently decommissioning three facilities that were used primarily for the processing and encapsulation of plutonium-238 heat sources for various programs, such as the heat sources used in space applications (SNAP, PIONEER, TRANSIT, VIKING, and VOYAGER).

The multimillion/multiyear project involves the extensive decontamination and decommissioning (D&D) of inactive areas of three facilities: Plutonium Processing (PP) Building, Research (R) Building, and Waste Transfer System (WTS). The project was initiated in 1978 and is expected to be completed in 1988.

The PP Building is a two-floor (38,000 ft^2) reinforced concrete and concrete block building built in 1967 to process plutonium-238. Approximately 95% of the building will be decommissioned for potential future reuse with the remaining 5% staying operational.

*Mound is operated by Monsanto Research Corporation for the U.S. Department of Energy under Contract No. DE-AC04-76-DP00053.

The R Building is a one-floor (54,000 ft^2) concrete block and brick building built in 1948 to research, develop, and process various isotopes. Approximately 10% of the building is being decommissioned for current and potential reuse with the remaining 90% staying operational.

The WTS is an inactive underground liquid waste transfer system built in 1967 and consists of two underground lines (2,650 ft each) buried from 6 to 25 ft below ground and a one-level 600 ft^2 concrete block lift station (Building 41) with two underground tanks.

The total project (PP, R, WTS) involves the removal of 1,100 linear ft of gloveboxes; 900 linear ft of conveyor housing; 2,650 linear ft of dual underground liquid waste lines; and associated contaminated piping, services, equipment, structures, and soil. Estimated waste volumes generated by the decommissioning project are: 200,000 ft^3 <10 nCi/g and 150,000 ft^3 >10 nCi/g.

Extensive D&D includes cleaning and removal of internal glovebox equipment and services, removal of gloveboxes, removal of associated laboratory equipment and services, structural decontamination, and disposal of wastes from the PP and R Buildings. Contamination in the inactive areas is reduced to an "as low as reasonably achievable" (ALARA) level, and remaining contamination is permanently sealed so that the areas can be reused with minimal restrictions (restricted release).

The final exposed average contamination levels in these facilites after decontamination and sealing will be:

Wipe - $\leq$20 dis/min/100 cm^2
Direct - $\leq$3000 dis/min/60 cm^2
External Radiation - $\leq$1 mr/hr at surface

These levels are being normally met (except for cracks and crevices) before sealing. Unrestricted release was not considered since this would require demolition of the PP and R Buildings which are used for ongoing programs and could be reused for future DOE programs. Demolition would be required because of known and potential contamination (in structural members, underneath the facilities, and in cracks and crevices) and the inability to detect and remove this contamination without destroying the integrity of the structure. However, complete D&D was considered the only feasible approach for the Waste Transfer System which is unusable because of previous leaks.

Since complete removal is planned for the Waste Transfer System and surrounding contaminated soil, it should be possible to reduce the contamination level to near unrestricted levels for soil (conditional release).

To date, approximately 850 linear ft of gloveboxes (with associated external glovebox equipment, piping, and services) have been cleaned, stripped of piping and equipment, sectioned if required, packaged, and removed from the site. Also laboratory areas have been completed and are being reused by other DOE programs. In accomplishing this, there have been no significant radiation exposures or environmental releases.

There are several unique characteristics of the current project.

- The site is in a residential/agricultural area; thus outside decommissioning activities are restricted. (Site boundary is as close as 300 ft.)

- Normal operations continue in the PP and R Buildings, so decommissioning activities are also restricted.

- Most gloveboxes are two-level (operating level and equipment level) and are larger than a standard 4 ft x 4 ft x 7 ft shipping container.

- Although oversized shipping containers were used, some large gloveboxes required sectioning before packaging.

- All equipment, piping, and services must be removed from the gloveboxes before packaging (burial storage facility requirement).

- Two separate funding agencies within DOE (weapons and non-weapons) require coordinated funding and planning.

- Contamination involved is primarily plutonium-238, a high-specific-activity transuranic isotope (16.8 Ci/g) requiring special personnel protection and waste packaging.

- The WTS underground lines (and associated contaminated soil) are located up to 25 ft below the surface on hilly (up to 140-ft elevation change) terrain which requires special excavation procedures.

- Weather conditions (wind, rain, snow) and temperatures (typically -10°F to 100°F) restrict outside decommissioning activities.

As a result of these unique characteristics and our previous experience in decommissioning facilities, several techniques were developed in each of the following areas: planning, exposure control, contamination control, equipment removal, structural decontamination, and waste packaging.

PLANNING

Direct management involvement and commitment in the decommissioning project starts at the director level and continues down to the D&D Management Team. The interdepartment Management Team consists of a representative from each of the three main departments directly involved (Nuclear Operations, Engineering, and Administrative Services). Each member of the D&D Management Team serves as the interface with his respective department. This matrix Management Team formally meets with the involved Directors on a monthly basis to discuss status, accomplishments, problems, and plans. The Team also meets bimonthly with the DOE Area Manager and his staff. This is in addition to the normal weekly and monthly written reports sent to our management and the DOE.

In addition to the formal monthly, quarterly, semiannual, and annual reviews of D&D plans by MRC directors and DOE management, plans are formally reviewed weekly in each of the major D&D areas by direct supervisors; as well as special planning sessions held for unusual decommissioning activities along with prejob conferences with the personnel who will be performing the work.

Decommissioning activities are controlled by using special work permits such as the "Radiation Control Area Maintenance Permit." This permit requires interdepartmental review and approval to ensure that jobs are thoroughly preplanned, adequate training and safety analysis have been performed, and proper precautions are being taken.

Special procedures are required for any unusual decommissioning operation not covered by existing work procedures. These procedures require interdepartmental review and approval. In addition, special training is required for any new and complex techniques employed. For critical operations, a "mock-up" or nonradioactive test is made prior to actual operations.

The D&D planning efforts include quality assurance and other control methods to ensure adequacy, consistency, change approval, and reporting. Operations are routinely audited by Environmental, Health and Safety, Quality, Financial, and Management representatives within the company, by an independent DOE contractor, by DOE Area and Field Offices, and by DOE Headquarters.

Another planning aid has been the use of exception and trend reporting to increase management awareness and response to potential problem areas. These reports cover such areas as radiation exposures, effluents, safety performance, milestone status, and cost versus budget.

One area of planning has been personnel resources. Whenever possible, use is made of personnel with prior operations experience, personnel experienced with decommissioning operations (including consultants and offsite contacts), and personnel experienced with plutonium-238 and other radioisotopes. For new personnel, intensive training and certification are required. Frequent retraining orientations and seminars are presented to operations personnel to reaffirm established techniques and demonstrate new techniques.

EXPOSURE CONTROL

Again as in planning, direct management involvement and commitment in exposure control start at the director level in the Executive Safety Committee's commitment to keeping exposures and effluents "as low as reasonably achievable" (ALARA). ALARA goals are set yearly after an interdepartmental review and evaluation. Monthly trend and exception reports indicate potential problem areas for management review and followup.

A key part of planning for any D&D activity is exposure control. This planning for exposure control includes training and selection of experienced personnel for critical activities, communication of known or suspected hazards, analysis of hazards, procedure review, contamination control precautions, work permits, adequate monitoring, and reporting.

Specific exposure control equipment and techniques include remote operations (including long-handled tools); portable and personnel shielding (including lead-loaded gloves and aprons); respiratory protection (full-face mask and supplied-air suits); protective equipment (clothing, portable enclosures, local exhausters, contamination fixatives); and special techniques for contamination control, equipment removal, structural decontamination, and waste packaging (see appropriate section for additional details).

Exposure monitoring is accomplished with both in situ and personnel TLD dosimetry (including extremities), industrial hygiene monitors, selective plutonium-238 air monitors, fixed position and personnel air samples, alpha/gamma/neutron instrumentation and measurements, and personnel bioassay samples (nosewipes, urine, blood, sputum, fecal, and whole-body counting).

CONTAMINATION CONTROL

After as much of the radioactive material as possible is removed from gloveboxes, equipment, and piping by standard cleaning and flushing techniques, temporary enclosures, fixation, and ventilation become the primary means of contamination control during subsequent removals.

Temporary enclosures are constructed for containment around all separations of gloveboxes, equipment, and piping with a high potential for contamination release. These enclosures range in size from a sealed plastic bag to a series of large rooms with separate HEPA (high efficiency particulate air) filtered exhaust systems (when personnel access is required). The large enclosures are constructed with either fire retardant wood or sheet metal framing covered by heavy clear plastic. In some cases, permanent airlocks are added to building corridors to increase contamination containment and increase air pressure differentials.

Contamination fixation is used during glovebox, equipment, and piping removal after conventional decontamination methods prove ineffective in reducing contamination levels. The fixation agent used depends on the application and includes light water misting, strippable paint, and urethane foam.

A light water misting is used to contain dusting or to clean in areas which could not be cleaned prior to breaching.

Strippable paint is used primarily on contaminated building structures as a temporary fixation until final decontamination can be accomplished.

Fire-retardant urethane foam is used as a fixative inside gloveboxes after equipment, piping, and services are removed, and the interior surfaces are cleaned. This fixative minimizes potential contamination spread during later glovebox separation, packaging, and shipment. Strippable paint is not used because of potential long-term radiolysis of the paint inside gloveboxes. In addition, only a minimal layer (1-2 in.) of foam is used to minimize future potential waste-reprocessing problems at the burial storage facility.

Urethane foam is also inserted at separation points in large diameter piping to provide a contamination barrier during subsequent cutting.

A third use for urethane foam is as a shoring material in waste packages (primarily at the four corners, middle of the side, and top). Again, a minimal amount of urethane foam is used to minimize future potential waste-reprocessing problems at the burial storage facility.

Existing building and/or portable ventilation systems are used to contain contamination. Portable HEPA-filtered ventilation systems are used primarily for temporary enclosures and range in size from 25 to 500 ft^3/min.

A minimum three-zone concept is also used in contamination control. Each zone represents a certain level of contamination and resulting protection. The first zone is the immediate work area that needs the highest level of protection (air flow, personnel, and controls). The second zone is a buffer zone or airlock, and the third zone is the noncontaminated or low-potential zone. The first zone is normally the enclosure being breached, and the second and third zones are plastic enclosures with the room area being an additional zone.

Administrative control levels are set for airborne, removable, and gamma/neutron radiation in work areas. If the levels are exceeded, then work is stopped until the levels have been reduced.

EQUIPMENT REMOVAL

Equipment, piping, and services must be removed from the inside of all gloveboxes (burial facility requirement). Since most of the gloveboxes contain two levels (standard operating level and an isolated lower equipment level in the glovebox well), equipment removal required personnel to enter the glovebox well (a highly contaminated atmosphere) from the rear to clean, disconnect, and remove equipment. A plasma cutting technique was developed to cut out sections of the operating glovebox floor to gain access to the equipment well to eliminate the need for initial personnel entrance. All plasma cutting is performed using the standard glovebox gloves.

Plasma was chosen for cutting since the resulting smoke generation is much less than that generated by a standard cutting torch (thereby reducing the particulate accumulation and eventual plugging of the glovebox exhaust HEPA filters). In addition, there is not as much heating of surrounding metal (because of the faster cutting), and the resulting cut edges are not as jagged.

Once access is gained to the equipment well, piping and services are disconnected using long-handled tools, and equipment is moved (with glovebox hoists) in order to clean the equipment and glovebox well. Personnel then gain entry into the well (via a ventilated enclosure) to remove the equipment.

The equipment is then loaded and secured on a wooden platform (pallet) outside the glovebox (and inside a plastic ventilated enclosure which is collapsed around the platform for containment which eliminates the need for bagging). The equipment pallet is then loaded into a waste container. This precludes personnel from having to physically carry equipment to the waste container.

After the equipment is removed from the glovebox, it is sometimes necessary to section the glovebox since some are larger than the waste container.

Initially a foam wall was applied where the glovebox was to be sectioned, isolating contamination during the cutting operation. In addition the safety plate glass glovebox windows were replaced with Plexiglas (methyl acrylate plastic) in areas where the cut was to be made. The outside was cut with a reciprocating saw (inside a temporary enclosure), and the foam wall was cut with a piano wire. The exposed end pieces of the glovebox were capped with sheet metal, and the individual glovebox sections were then packaged into the waste container.

This sectioning technique was very successful but time consuming. In a modified technique, the foam wall was eliminated from sectioning. The interior surfaces of the glovebox are coated with a 1 to 2 in. layer of urethane foam while being exhausted through the normal supply filters. Then before the stainless steel glovebox is cut, a layer of decontamination soap foam is applied to the cut area and cutting blade to contain filings. As a cut is made, the area previously cut is cleaned with a damp rag and sealed with a plastic sleeve and tape. The glovebox is then turned on its side to complete the cut. After cutting is completed, the sections are separated within the plastic sleeve, and the sleeve is crimped, cut, and sealed. Then sheet metal caps are placed over the cut and bagged ends. Replacement of the safety plate glass glovebox windows in the cutting area was also unnecessary, as development showed there is no breakage if the outside of the window is taped with plastic tape, the inner surface is foamed, and a special glass cutting blade is used.

To separate piping external to the glovebox, several techniques are used depending on the potential for spread of contamination. In low-potential cases, the pipes are cut, with damp rags and/or plastic bags used for containment. In high-potential cases, copper pipes less than 1 in. and stainless steel pipes less than 1/2 in. are cut, using a crimping tool, and capped. For larger pipes, a small hole is drilled, urethane foam is injected in the hole, and then the pipe is cut after the foam has cured. The cut ends can then be capped. Piping and services are cut down enough to fit in standard 4 ft x 4 ft x 7 ft waste packages. The internal areas of larger ductwork are painted (to contain contamination), separated, and cut in half (diagonal usually) in order to efficiently fit inside standard waste containers (boxes).

For transporting equipment, a variety of lifting devices, moving dollies, and hoists are used. In addition, the previously discussed equipment platform is used for transporting glovebox equipment to the waste container. Glovebox combustible waste is reduced to ash in a glovebox incinerator. Most external glovebox combustible waste is either incinerated or compacted.

STRUCTURAL DECONTAMINATION

In the first step of structural decontamination, all unnecessary penetrations (pipes, ducts, conduit) are removed (back to operating headers), and the opening is monitored, decontaminated, and sealed. In contaminated areas, false ceilings are removed, and, although no concrete ceilings have been decontaminated yet, plans are to remove any paint. If the ceiling area is still contaminated, a layer of concrete will be removed using mechanical equipment for large areas and a hand scabbler for isolated spots.

In decontaminating walls, the first choice is removal because of void spaces. For poured concrete walls, the paint is removed using paint remover, general contamination can be mechanically removed, and isolated spots can be scabbled.

In decontaminating floors, removal of the floor covering (and mastic) or paint removes most of the contamination. If the floor is still generally contaminated, a floor scabbler is used. If it is highly contaminated, removal of 1 to 2 in. of concrete is usually more efficient. Isolated contamination spots are then removed with a hand scabbler and vacuum sweeper.

Door frames and doors are removed in highly suspect areas. If there is not a double door into large areas, a temporary one is installed to allow waste containers to be moved in and out. Floor drains are also removed.

Since this type of work is very dusty, contaminated dust control is important. This dust is controlled using local exhausters, light water sprays, and immediate vacuum cleaning.

Core samples of soil under first floors are taken to verify the condition of soil and remaining underground drain systems.

If isolation of remaining contamination in cracks, crevices, and structural members is permitted, the first step is the documentation of the levels and location. The spot is then coated with an identifying color as a future reminder. Then the surface is permanently sealed, and a sign is posted on the exterior surface; again as a future reminder.

The use of an independent contractor to verify remaining contamination provides assurance of Mound's monitoring results and documentation for future reference and questions.

WASTE PACKAGING

A variety of waste containers are being used for the estimated 350,000 ft^3 of waste to be generated by the project. Low level waste is packaged in either a 55-gal steel drum or a plywood box. Most plywood boxes are 4 ft (W) x 4 ft (H) x 7 ft (L). If the waste has a high density, a half-box 4 ft (W) x 2 ft (H) x 7 ft (L) is used to lower the package weight. In a few cases, other sizes are used to preclude unnecessary size reduction or provide an efficient packing fraction.

For transuranic waste, a 20-yr retrievable package is used. Again, a 55-gal steel drum or box is used. The 55-gal drum uses thicker steel and a 90-mil high-density polyethylene liner (with a press-fit lid sealed with adhesive).

The boxes used are fiberglass-coated, heavy-construction, plywood boxes. It is expected that these will be replaced by a corrugated steel box (to be sealed by welding) in 1983.

Most of the fiberglass/plywood boxes are 4 ft (W) x 4 ft (H) x 7 ft (L). However, a limited number of larger boxes were previously used to preclude the size reduction of many large gloveboxes. Three larger sizes were used with the largest being slightly less than 6 ft (W) x 9 ft (H) x 12 ft (L).

Various hoists and dollies are used to load large pieces of equipment into the waste packages. The equipment platform described earlier is also used to facilitate loading.

A minimal amount of urethane foam (that was described earlier) is used as a flexible and efficient shoring material.

Large airlocks are constructed within the buildings to facilitate the loading of the waste packages and to provide contamination control.

A gamma scan and final fiberglassing facility (with a common turntable) was constructed to determine isotopic content and apply the final fiberglass seal on the box lid or sections of the box that were used for entrance.

CONCLUSION

Progress to date on the project (50% completed) has verified the importance of adequate planning (with flexibility for the unexpected), matrix organization for effective implementation and control, experienced and trained personnel with innovative abilities, frequent communications at all levels of management, management commitment to safety and ALARA exposures, contamination control techniques and equipment, variety of waste container sizes, and independent verification of radiological conditions.

(This paper was presented at the DOE 1983 International Decommissioning Symposium, Seattle, Washington, October 10-14, 1982)

THE USE OF URETHANE FOAM IN THE DECONTAMINATION AND DECOMMISSIONING OF NUCLEAR FACILITIES

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ABSTRACT

The decontamination and decommissioning (D&D) of nuclear facilities described here is taking place at Mound Facility, an installation operated for the Department of Energy by Monsanto Research Corporation, and located in southwestern Ohio.

The D&D work at Mound is underway in three areas: the Plutonium Processing Building, the Research Building, and the Waste Transfer System. All areas will be returned to a condition suitable for reallocating the area for other efforts. This work, started in 1978, is a multimillion-dollar effort scheduled to continue through 1987.

Urethane foam is being used in a two-part spray system. It is used to coat interior surfaces of gloveboxes for the purpose of 'fixing' contamination. This reduces the effort and cost of providing a safe and easily handled package. It is also used as packing material to stabilize the loads inside shipping containers. These urethane foams have proven to be cost-effective and time-saving.

INTRODUCTION

Portable equipment for generating urethane foam has been in use for 15 to 20 years for a large number of applications, such as roof systems, tank insulation, and building insulation. Still another, out-of-the ordinary industrial application is its use in the decontamination and decommissioning (D&D) of radioactive facilities at Mound Facility.

The purpose of D&D is to safely clean and/or dispose of surplus radioactively contaminated facilities and equipment in order to reduce environmental, safety, and health risks to the environment, the public, and personnel. Its goal is the reuse of existing contaminated facilities, if possible.

Mound's D&D Program, now planned to continue through FY-1987, currently emphasizes the D&D of three major facilities: the Plutonium Processing Building, the Research Building, and the Waste Transfer System. Mound Facility, located in Miamisburg, a city of 18,000, between Cincinnati and Dayton, Ohio, is a part of the weapons complex of the Albuquerque Operations Office of the Department of Energy. In addition to its role in the area of weapons components, Mound has been very much involved in the production of radioactive heat sources for the National Aeronautics and Space Administration (NASA).

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*Mound Facility is operated by Monsanto Research Corporation for the U.S. Department of Energy under Contract No. DE-AC04-76-DP00053.

Several years ago, NASA was searching for a reliable source of electrical energy for its space programs. Although solar cells, which convert the energy of the sun directly into electrical energy, had been used successfully, they presented certain problems. A space vehicle or probe orbiting a planet would lose its power during the time the sun's rays were cut off by the planet's shadow. Also NASA was planning probes of the distant planets, such as the recent Voyager trip to Saturn. The huge distance from the sun would require an unacceptable weight of solar cells to provide the required power. NASA felt that, if they could obtain a reliable source of heat, it could be converted to create adequate electrical energy. Their choice was the radioactive isotope plutonium-238 which gives off about 1/2 watt of heat per gram of mass.

Mound's mission was to process the plutonium-238 into a number of special fuel forms, and then encapsulate them in several layers of exotic metals for containment and protection. Some of the more interesting and challenging space missions that were powered and/or heated by Mound's heat sources were:

Transit - A Navy navigation satellite.
Viking - The Mars unmanned landings.
Voyager - The fly-bys of Jupiter and Saturn.
Apollo missions 11-17.

In addition, NASA had the astronauts set up seismic instruments to record and transmit the shocks felt when the moon was struck by meteors. The instruments and radio for transmitting the data back to earth are powered by a radioisotopic thermoelectric generator (RTG). The generator was designed and built by General Electric Corporation and the heat source by Mound. This RTG or nuclear battery was designed to provide the full power required for a period of ten years.

Currently Mound is producing a heat source encapsulation for the Solar Polar Mission, a probe of the sun's polar regions. However, since Mound no longer processes the fuel forms, the Plutonium Processing Building where this work was done is being decontaminated and decommissioned so that it can be put to other use.

DISCUSSION

Mound had developed experience over the years with D&D operations of facilities involving various types of radioactive materials. The type of material and its level of activity dictate the means used to clean it up.

For example, the isotope polonium-210 presents minimal problems, because it decomposes so fast (half of it decomposes in approximately four months -- called half-life) that very small quantities of residual material would decompose completely within a few years.

Plutonium-238, on the other hand, has a half-life of about 87 years and even very small residual quantities are considered unsafe. Some previous D&D of plutonium-238 facilities had indicated we would have some serious problems in handling, packaging, and shipping the contamined equipment to the government burial grounds. The criteria for packaging and shipping can be expressed simply as "make it safe under all conditions." The planning and estimating for D&D was based on the procedures outlined below:

1. Clean and remove the interior surfaces equipment, and any noncritical interior structural members, then prepare and package.

2. Clean all interior surfaces within the enclosure (glovebox) of gross quantities by sweeping and scrubbing.

3. "Fix" residual quantities of plutonium on interior surfaces with the application of sprayed urethane foam.

4. Clean and remove exterior piping, valves, conduit, and support equipment, then prepare and package.

5. Loosen gloveboxes from their positions, and either cut in two, if too long, or prepare for loading.

6. Load gloveboxes into transuranic (TRU) type shipping containers.

7. Package and stabilize loads within shipping containers by the use of sprayed urethane foam.

Procedures 3 and 7 outlined above call for the use of sprayed urethane foam in two different applications: one on the interior surface (Procedure 3) and the other for packaging (Procedure 7). The foam formulation we use has a flame-spread rating of 25 and a smoke density of 375 as per ASTM E 84 Tunnel Test.

Procedure 3 uses the urethane foam on the interior surfaces of the gloveboxes to "fix" any residual quantities of contamination in place. This eliminates some cleaning operations on interior surfaces without sacrificing safety in any respect.

Implementation of this procedure presented two problems. First, the contaminated interior environment has to remain separated from the uncontaminated outside. The method worked out to solve this problem adapted a bagging technique commonly used in radioactive work. The foam gun being used was a Model 'D' Gusmer which has an air cap that blows off foam from the gun tip. The cap was used to secure the plastic bag in place around the gun. Then the open end of the bag was put on a gloveport and clamped on securely. The bag can be made any convenient length so that a long glovebox can be foamed from one port location. The coating operation is worked back to the entry port. When all surfaces are coated, the gun is withdrawn from the bag, the cap removed, the small hole taped over, and the bag secured. Second, the Model 'D' gun was constructed in a manner that made access through a gloveport difficult. We talked with our supplier about this, and they modified the gun by remotely locating the trigger. This reduced one dimension of the gun so that it would easily pass through the gloveports. The remote triggering also made the gun more maneuverable in our uses.

The foaming also solved a related problem by allowing us to cut gloveboxes that are too long for any of our containers. Some gloveboxes are up to 20 ft long. We can cut these contaminated boxes apart without a problem, with proper preparations. These practices, related to procedure 3, have saved us many manhours and minimized personnel exposures greatly.

Procedure 7 outlined above involves the use of sprayed urethane foam in packaging. Because our range of sizes (both shipping containers and loads) is so wide, void sizes range widely too. The standard transuranic (TRU) shipping container is 4 ft wide x 4 ft high x 7 ft long, and the largest Type 1 (TRU) container is 6 ft wide x 9 ft high x 11-1/2 ft long. Because of this wide range, sprayed urethane foam seemed to be the most versatile packaging system for our needs. It protects against damage during shipment by truck and/or rail. The gross weight is kept low by the prudent use of the 1-1/2-pound density foam. The four corners and a pad on top are foamed between the load and the lid, except on longer loads where foam is applied at the sides. In our first attempts at packaging with foam, the exothermic heat buildup caused some problems. These were overcome with procedural changes and additional operator training.

CONCLUSION

Our experience thus far with sprayed urethane foams has been very favorable. The savings in time and labor will help cut costs and schedule times by 10% overall.

(This paper was presented at the American Nuclear Society's 1986 Winter Meeting, Washington, D.C., November 16-20, 1986)

TOOLS FOR DECONTAMINATION AND DECOMISSIONING OF NUCLEAR FACILITIES

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ABSTRACT
The Decontamination & Decommissioning (D&D) of nuclear facilities requires many different tools. These can vary from small hand tools to the heavy equipment used to remove concrete and soil. Tools for D&D should be reliable, versatile, economical, and easily disposed of in case they become contaminated. In our search to find tools to do the work proficiently, many tools were considered. The ongoing effort to improve old procedures and develop new ones, as new and unusual equipment was needed, allowed us to get the job done in a timely and cost-effective manner.

For the Decontamination & Decomissioning (D&D) of a typical laboratory area at Mound, a variety of tools and equipment was needed to accomplish this project in a timely and cost-effective manner. These operations have been performed, in some form, in about 35 different laboratory areas at Mound.

The Decontamination & Decommissioning of facilities at Mound were focused in three areas that handled quantities of plutonium 238: the building in which feed stock for RTG's was produced, the building that contained the research portion of the heat source program, and the lines that handled waste materials between the feed stock building and the Waste Solidification area about a half mile away. These areas had approximately 1100 linear feet of gloveboxes. There were many miles of piping and hundreds of square feet of floor space.

The project was originally started in 1977 with the first estimates of what there was to be done and how we proposed to do it. The philosophy of the D&D work at Mound was formed early on, so that all concerned would have a guide for decision making. Many decisions concerning tooling and procedures were affected by this original statement of policy.

THE PURPOSE OF D&D IS TO SAFELY CLEAN AND/OR DISPOSE OF SURPLUS RADIOACTIVELY CONTAMINATED FACILITIES AND EQUIPMENT IN ORDER TO REDUCE ENVIRONMENTAL SAFETY AND HEALTH RISKS TO THE ENVIRONMENT, PUBLIC, AND PERSONNEL AND IN ORDER TO REUSE EXISTING FACILITIES, IF POSSIBLE.

Many months were spent talking to operating personnel, measuring equipment and gloveboxes, going over original building blueprints, reading Health Physics reports of past incidents, talking to equipment vendors, talking to people at other sites, discussing possible procedures, charting schedules and budgets, and, finally, preparing detailed estimates and budgets for submission and approvals.

The months that followed were spent ordering materials, tooling, and equipment; finalizing procedures; and identifying the areas in which training was needed.

It was necessary to plan for training in the use of special equipment and for time to develop proficiency in the use of the various types of new equipment. Techniques and procedures were changed and improved upon as experience was gained. New methods of doing ordinary work were formed as the operations personnel got into the job. Time saving and cost effective improvements were made in such areas as interior foaming of gloveboxes, piping removal, removal and loading of equipment from gloveboxes, glovebox separation and size reduction techniques, and Health Physics procedures.

New and unusual uses of original tools and equipment proved to be the area of most improvement. Some of these innovations were using reinforcing cutters to cut and pinch off tubing in one operation, then adding a plastic cap filled with RTV; using building foam

[a]Mound is operated by Monsanto Research Corporation for the U.S. Department of Energy under Contract No. DE-AC04-76-DP00053.

products to seal larger diameter piping before it is cut; using ordinary crosscut saws to separate fiberglass gloveboxes; using electric breaker hammers in place of air-operated to reduce the unnecessary spread of dust in concrete removal work; using absolute vacuum cleaners to drop larger particles of concrete directly into 55-gal drums; using garden sprays to wet areas of scabbling to hold down dust.

The job indicated the type and kind of tooling needed. These jobs are listed below with examples of the type of tooling and equipment used for each.

1. Prepare and remove glovebox services and equipment. The services included transfer lines, reagent supply lines, and process services. Equipment consisted of pumps, compressors, stills, radiofrequency heaters, and storage tanks. The interconnecting lines that serviced the gloveboxes were removed using various cutting techniques and tools. Equipment was removed with a variety of material handling equipment and loaded onto wooden skids to facilitate loading and packaging. Small piping was removed using reinforcing rod cutters to pinch, seal, and separate the tubing; a cap filled with RTV was then placed over each end and taped in place. This method replaced the use of expensive stainless steel Tylock fittings to seal the tubing. Larger diameter tubing and piping, 2 in. to 4 in. in diameter, was drilled (3/16 in. hole) and filled with construction insulation (urethane foam) so that it could be cut at the foam barrier, then capped with plastic caps filled with RTV which were taped in place.

2. Prepare and remove support services and equipment. Exterior services were flushed, prepared, stabilized, and removed for packaging. Many of the techniques from glovebox work were used here. Other methods were skidding equipment to save space and labor, using various material handling equipment to ease the job of removal, and carrying items to the boxes. Interior surfaces of ductwork were coated before removal using airless spray-painting equipment.

3. Clean interior surfaces of gloveboxes. The old standbys, rags and water (mild acids), were used to decontaminate and clean interior surfaces. Floor sections and supports were removed by plasma torch to allow foaming the upper and lower portions of gloveboxes from one gloveport. This made the foaming operation much more efficient.

4. Fix residual contamination on interior with urethane foam. Spray equipment was used to apply Class A urethane foam to the clean and dried surfaces. Alteration of the common bag-in technique allowed use of a modified foam spray gun inside the gloveboxes. A thin layer of foam was applied to all interior surfaces of the gloveboxes to "fix" any residual contamination in place. The foam provided protection of the embedded contamination during transport to the burial site.

5. Prepare, remove, and package interior surfaces and equipment. Exterior services and equipment preparation, removal, and packaging followed a procedure similar to that for the interior services. As they were, however, outside an enclosure, additional care had to be taken to protect against any release to the environment. Bagging of cuts and using the reinforcing rod cutters to pinch the ends shut helped to improve control of contamination during removal operations.

6. Loosen gloveboxes and either size-reduce or package. Various lifting and material handling devices were used to loosen and move the gloveboxes and to reduce their size. The simple Rol-a-lift device saved many hours in handling time. Vacuum cleaners provided negative pressure during cutting and separation and greatly simplified the size reduction of seven oversize gloveboxes. The foam applied in the earlier operations also improved the safety and efficiency of the operation.

7. Load gloveboxes into transuramic (TRU) shipping containers. Loading gloveboxes required equipment similar to that used in step 6 as gloveboxes were moved into shipping containers. Rol-a-lifts and gantry type cranes were used to move gloveboxes and equipment into position and to position ends of larger trash boxes for sealing. Long ramps were fabricated to speed and simplify the loading operation.

8. Package and stabilize loads using urethane foam as dunnage. Packaging gloveboxes and equipment required a minimum of tooling. Urethane foam was used to greatly simplify this operation. The various sizes of gloveboxes and equipment presented a challenge to stabilize loads. Because the foam could be sprayed into very small spaces or built up to fill very large void areas, it solved our problem. Foam again proved to save time and manpower because of the ease of application. The foam works well with large low density packages such as gloveboxes, conduits, and pipe.

9. Remove and/or relocate major building support equipment. During major service removal and/or relocation, many cutting devices were used. Also used were foam to plug pipes; concrete removal equipment to reach services under floors; and material handling equipment to move, package, and/or relocate large pieces of equipment.

10. Decontaminate and protect building structural surfaces. The structural decontamination involved primarily the major services being removed and the concrete structure

cleaned, sandblasted, and scabbled. Concrete floors were scabbled to remove gross contamination before the surfaces were saw cut. Electric breaking hammers were then used to break up the concrete slabs for removal and packaging. Water spray was used where contamination levels warranted.

Because of possible structural damage, impact type cleaning was minimized on ceilings and walls. Ceiling and wall surfaces were primarily sandblasted to remove paint and expose the concrete. If additional cleaning was necessary on these surfaces, sandblasting or localized scabbling was used to clean cracks and around penetrations.

The waste handling facility was a challenge to remove. This had been a pumphouse with two large concrete tanks with steel liners. The foundation for the building had been constructed into the ground to a depth of 17 ft. Steel shoring was used to allow complete removal of the tanks and foundation structures. A remotely operated mining machine was used to remove the concrete and dirt from the excavation, making it unnecessary for personnel to be in the area full time. The operator of this machine is connected to it by up to 60 ft of control cord which connects to the joystick control box. The machine itself requires a 440-V electrical supply. The machine operates like a backhoe with shovel and breaking hammer attached to a hydraulically operated boom. The machine can lift itself out of a 12 ft deep hole.

SUMMARY

Tooling and its proficient use are the mainstay of our D&D efforts. Careful selection of tools and equipment increased efficiency. Proper training of personnel and ample training time to become proficient are all important in the successful decontamination and decommissioning of large areas.

The ongoing effort to improve old procedures and develop new ones, as new and unusual equipment was needed, allowed us to get the job done in a timely and cost-effective manner.

APPENDIX D

APPENDIX D

RADIATION CONTROL AREA MAINTENANCE PERMIT

MAINTENANCE FOREMAN (PART A)

PERMIT Date Shift	LOCATION

DESCRIPTION OF WORK TO BE DONE:

MAINTENANCE PERSONNEL ASSIGNED

NAME	HP AREA ORIENT.	HP NO.	NAME	HP AREA ORIENT.	HP NO.

HEALTH PHYSICS (PART B)

RADIOLOGICAL CONDITIONS: ☐ Airborne Contamination ☐ Loose Surface Contamination ☐ Penetrating Radiation

SURVEY COVERAGE REQUIRED? ☐ YES ☐ NO

☐ Full Time ☐ Intermittent

☐ Only at Start ☐ Only on Completion

SUBMIT URINE SAMPLE ON:

Date _____ Before _____

PROTECTIVE MEASURES

☐ Radiation Area Clothing	☐ Extremity Dosimeters	☐ Respirator	☐ Shower
☐ Plastic Suit	☐ Socks	☐ Breathing Position	☐ Additional Shielding
☐ Paper Suit	☐ Shoecovers	☐ Around Neck	☐ Other
☐ Bubble Suit	☐ Rubber Gloves & Liners	☐ Supplied Air Mask	_____
☐ TLD Dosimeter	☐ Head Covering	☐ Aux. Ventilation	_____
☐ Nose Wipes		☐ Full Face Mask	_____

NUCLEAR OP., ENGINEERING, HEALTH PHYSICS (PART C)

SUPPLEMENTARY REVIEW

Each signing party shall review the job for the need of additional safety analysis in the following areas:

☐ SAFETY (i.e., electrical, mechanical, eye protection, acids or corrosive chemicals involved, sling permit, leather gloves, etc.) _____

☐ FIRE PROTECTION (i.e., welding permit required, explosive atmosphere test required, combustibles removed, foam permit required, etc.) _____

☐ INDUSTRIAL HYGIENE (i.e., toxic chemicals, particulates or vapors, noise level, vent, aux. lighting, etc.) _____

☐ CRITICALITY

☐ OTHER _____

(PART D)

SUPERVISORY APPROVALS REQUIRED	PRE-JOB CONFERENCE REQUIRED	SPECIAL INSTRUCTIONS:	SIGNATURES
Maintenance	☐ Yes ☐ No		
Operating	☐ Yes ☐ No		
Health Physics	☐ Yes ☐ No		

(PART E)

APPROVALS	JOB SITE APPROVAL										Date Comp.	
	INITIAL	DATE	INITIAL	DATE	INITIAL	DATE	INITIAL	DATE	INITIAL	DATE	INITIAL	DATE
Operations												
H.P. Surveyor												

Report back to Health Physics surveyor and return remaining copies of the permit to him when job is completed.

SIGNATURE OF SURVEYOR ON COMPLETION OF JOB

A new permit will be issued should any incident, new information, unforseen happening, etc. change significantly the radiological exposure potential of this job.

Identify new man. Check for restrictions before assigning man to job.

All signatures required before assigned work is begun.

MRC-ML-812 (12-80) 17-1168

APPENDIX E

APPENDIX E

TECHNICAL MANUAL
MD-70205
TRU WASTE MANAGMENT

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002	TRU Waste Container Marking and Labeling Specifications
100	SERIES: CONTAINER PROCUREMENT AND STORAGE
101	TRU Waste Container Procurement
102	TRU Waste Container Requisition and Distribution
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APPENDIX E

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213	TRU Waste Drum Sealing and Identification
214	TRU Waste Drum Survey, Labeling, and Interim Storage
218	TRU Waste Metal Box Loading and Sealing
300	SERIES: STAGING, ON SITE MOVING, AND SHIPPING
301	TRU Waste Package Inspection Prior to Loading for Offsite Shipment
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306	Onsite Moving of Radioactive Waste
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500	SERIES: SAMPLING AND ANALYSIS
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TECHNICAL MANUAL
MD-70204
LOW-LEVEL WASTE MANAGEMENT

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403	Collection and Storage of Low-Level Liquid Waste in PP-Building
404	PP-Building 10-kgal Storage Tank Sampling
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406	Compacting Trash, 10-100 nCi/g (PP-Building)
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APPENDIX F

APPENDIX F

MEMORANDUM OF UNDERSTANDING

between

The Office of Military Application (OMA)

and

The Office of Terminal Waste Disposal and Remedial Action (NE-20)

for

The Coordinated Decommissioning

of

Inactive Advanced Nuclear Systems and Products Division (ANSPD)

and OMA Areas

at

The Mound Facility

November 1982

Approved:

F E Coffman

Franklin E. Coffman
Acting Director, Office of
Terminal Waste Disposal
and Remedial Action

Approved:

for Maurice J. Roth

Major General William W. Hoover, USAF
Director of Military Application

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4. Richland Operations Office/Surplus Facilities Management Program Office
5. Dayton Area Office
6. Monsanto Research Corporation
7. Office of Surplus Facilities Management

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C. Albuquerque Operations Office

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F. Monsanto Research Corporation

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B. Impacts of Schedule Delay

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I. PURPOSE

A. General

A General Accounting Office (GAO) inquiry led to a Department of Energy (DOE) directive to Mound to cease unencapsulated Plutonium-238 work at the end of FY 1979. The affected buildings were used by the Advanced Nuclear Systems and Projects Division (ANSPD) and the Office of Military Application (OMA). The decision was made by the United States DOE after consultation with Monsanto Research Corporation (MRC) to decommission the affected, inactive areas. These inactive areas include:

- Portions of Plutonium Processing (PP) Building -- both ANSPD and OMA areas.
- Portions of Research (R) Building -- both ANSPD and OMA areas.
- All the Waste Transfer System (including Building 41) between the PP and WD (Waste Disposal) Buildings -- ANSPD areas.

The decommissioning of these buildings could best be carried out by coordinating the efforts of OMA and the Office of Terminal Waste Disposal and Remedial Action (NE-20) which is now responsible for the inactive ANSPD facilities at Mound.

Advantages of this coordinated or integrated approach would be:

1. All resources could be planned together to reduce risks to personnel and the environment.
2. The PP Building could be restored for reuse more quickly.

3. Common systems between the ANSPD and OMA could be removed quickly.

4. Support systems (vapor, vacuum, air, conveyor and ventilation) would be removed as a unit when no longer needed by ANSPD and OMA.

5. Gloveboxes, service piping, and building systems, interrelated between ANSPD and OMA, could be removed as total systems.

6. Recontamination of decontaminated areas could be prevented.

7. Manpower utilization could be maximized between ANSPD and OMA.

8. Large-scale quantities of Pu^{238} would be efficiently removed to meet DOE directives.

To accomplish the task, Monsanto prepared a long-range plan to decommission the PP and R buildings and the waste transfer line. Actual decommissioning of the ANSPD facilities began in FY 1978; the OMA portion was started in FY 1980.

B. Objectives

The objective of this Memorandum of Understanding is to provide for the coordinated completion of the planned decommissioning operations in the PP, R, and Waste Transfer System. This requires decommissioning of numerous laboratories and support areas in the PP and R Buildings. These areas and their responsible funding organizations are:

ANSPD (NE-20) Inactive Areas

- PP Building - A1, A2, B1, C1, C2, C3, C4, E1A, F1 (part), F2, F3, F4, 122, 177, and 178 laboratories and associated services located on the first and second floors of PP Building (approximately 330 linear feet of gloveboxes).

- R Building - 120, 127, 130, 131, 143, and 147 laboratories and associated services (approximately 320 linear feet of gloveboxes).

- Waste Transfer System - Underground liquid waste transfer lines and lift station (Building 41) from PP Building to the WD Building (approximately 5300 linear feet of underground lines).

OMA Inactive Areas

- PP Building - A3, B2, B3, B4, D1, D2, D3, E1, E2, E3, 111, and 130 laboratories and associated rooms and services located on the first and second floors of PP Building (approximately 360 linear feet of gloveboxes which includes 185 linear feet of support gloveboxes common to both NE-20 and OMA).

- R Building - 159 laboratories and associated services (approximately 100 linear feet of gloveboxes).

An evaluation was made of various disposition modes and associated costs. These disposition modes were:

- Readiness (to return to processing of unencapsulated plutonium)

- Partial Decontamination (standby)

- Extensive Decontamination

The decommissioning mode chosen was extensive decontamination. Extensive decontamination includes the removal of internal glovebox piping and equipment, the gloveboxes themselves, and contaminated services, and an intensive decontamination of the facility to "as low as reasonably achievable" levels. Since complete decontamination for unrestricted use would require removal of the entire structure, the facility will be left "tainted"; i.e., small amounts of residual contamination would remain. The building would remain under minimal radiological control and negative pressure to protect personnel and the environment.

The final exposed average contamination levels in the facilities after this decontamination and sealing will be:

Wipe - $\leq$20dis/min/100cm^2
Direct - $\leq$3000dis/min/60cm^2
External radiation - $\leq$1mr/hr at surface

Since there is no identifiable need for the ANSPD (NE-20) or OMA "Inactive Areas," there will not be any need to place these areas in a "readiness" or "partial decontamination" condition. Therefore, planning and decommissioning were started to place these areas in an "extensive decontamination" condition.

II. PROJECT DESCRIPTION

The decontamination and decommissioning (D&D) of the inactive ANSPD (NE-20) areas at Mound Facility involve three separate facilities. These facilities are: 1) portions of the Plutonium Processing (PP) Building; 2) the Waste Transfer System, including Building 41; and 3) portions of the Research (R) Building. Locations of these facilities are shown in Figure I. Building floor plans, showing organizational responsibilities, are included as Appendix C.

The PP Building is a two-floor (38,000 ft^2), reinforced concrete block building built in 1967. Radiochemical (primarily plutonium-238) processing operations began in 1968. These ANSPD operations included process development, process engineering, production operations, encapsulation, scrap recycling, material transfer, waste handling, measurement, and analytical activities primarily for the production of heat sources.

Most of the building became inactive when encapsulated plutonium-238 operations were located to other sites leaving two laboratories in operation. These two remaining primary laboratories have only encapsulated plutonium-238 or small quantities of other isotopes. The other 27 out of 29 laboratories and support areas are in various stages of D&D and encompass 32,000 ft^2 out of the 38,000 ft^2 building area.

The processing operations were performed in gloveboxes on the second floor of the building with associated support equipment and services on the first floor. Gloveboxes were connected by a continuous overhead conveyor. Primary services on the first floor were waste processing and packaging, ventilation, material (liquid) transfer, electrical distribution, and miscellaneous process services.

The ANSPD (NE-20) areas of R Building designated for decommissioning represent areas in which ANSPD activities have been conducted. These activities included process development, process engineering, and production operations such as particle coating, vacuum hot pressing fuel forms, metallography, and encapsulation.

The Waste Transfer System was designed to handle the liquid wastes generated in the PP Building by transferring them by gravity through underground lines to receiving tanks in Building 41. Building 41 is a lift station located between the PP and WD facilities and consists of two large receiving tanks and supporting equipment, such as pumps and control devices. The liquid waste was pumped from the receiving tanks to the WD Building for processing.

The Waste Transfer System was declared excess after the Waste Solidification Facility for processing acid/caustic transuranic wastes was made operational and the transfer of low-level liquid wastes from PP Building to WD Building by a tanker truck was begun.

The D&D of the inactive OMA areas at Mound Facility involve two separate facilities. These facilities are: 1) portion of the PP Building; and 2) a portion of the R Building. The locations of these facilities are shown in Figure 1.

These OMA areas included activities such as process development, process engineering, production operations, analytical metallography and encapsulation.

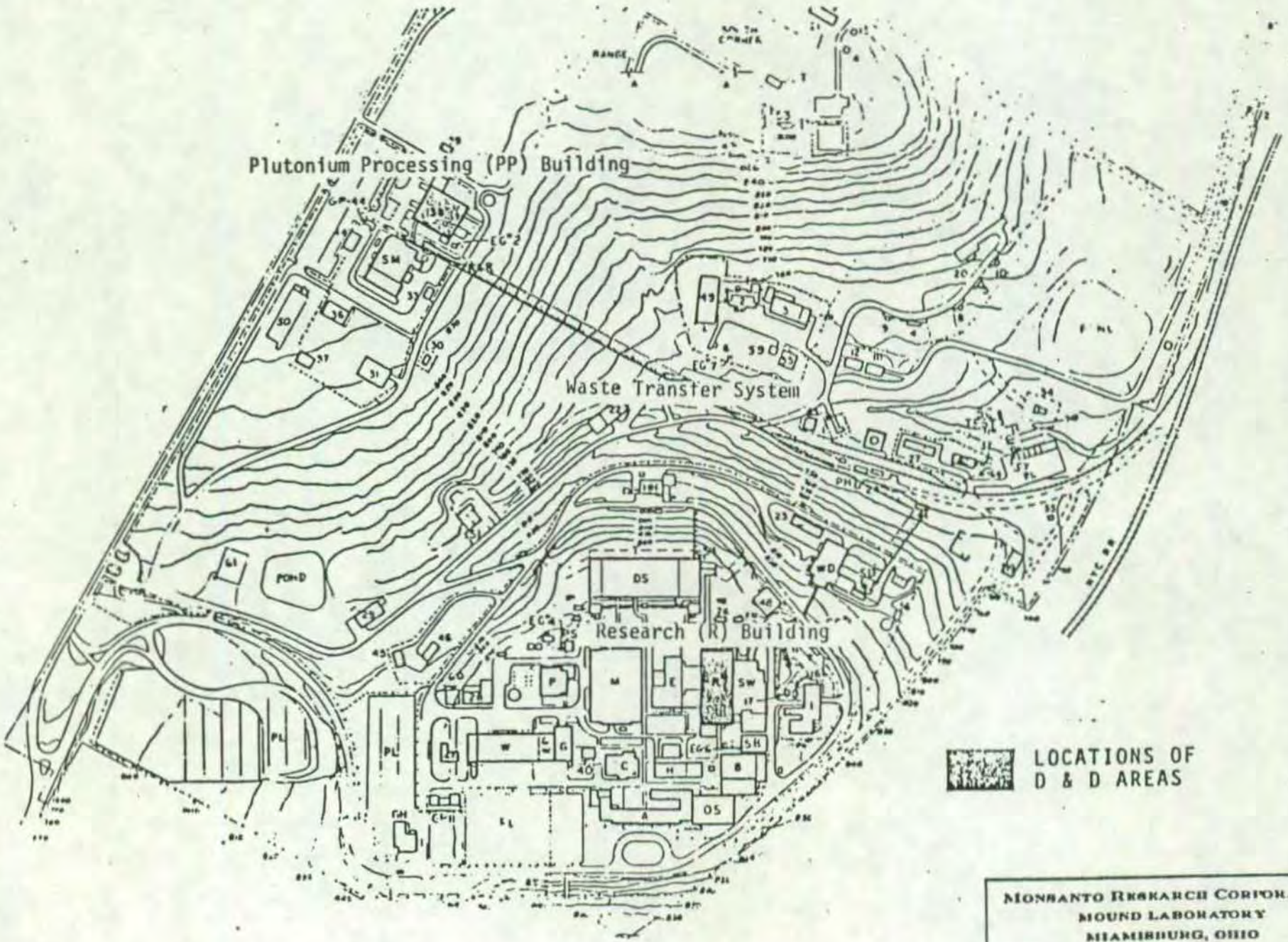


Figure I

MONSANTO RESEARCH CORPORATION
MOUND LABORATORY
MIAMISBURG, OHIO

SITE PLAN

III. ORGANIZATIONS

A. Key Personnel

1. Defense Programs

   a. Assistant Secretary for Defense Programs
   b. Director of Military Application (OMA)
   c. Chief of Production Management (DP 222.2)

2. Nuclear Energy

   a. Assistant Secretary for Nuclear Energy
   b. Director, Office of Terminal Waste Disposal and Remedial Action and Fuel Cycle Systems
   c. Director, Remedial Actions Program Office (RAPO)
   d. Program Manager, Surplus Facilities Management Program (SFMP)

3. Albuquerque Operations Office (AL)

   a. Manager, AL
   b. Assistant Manager for Plans and Resources
   c. Director, Resources Management Division
   d. Project Manager, OMA and SFMP

4. Richland Operations Office (RL)

   a. Manager, RL
   b. Assistant Manager for Technical Operations (AMTO)
   c. Director, Surplus Facilities Management Program Office (SFMPO)
   d. Program Engineer, Mound Facility Decommissioning Program

5. Dayton Area Office (DAO)

   a. Manager, DAO
   b. Chief, Operations Branch
   c. Project Engineer

6. Monsanto Research Corporation (MRC)

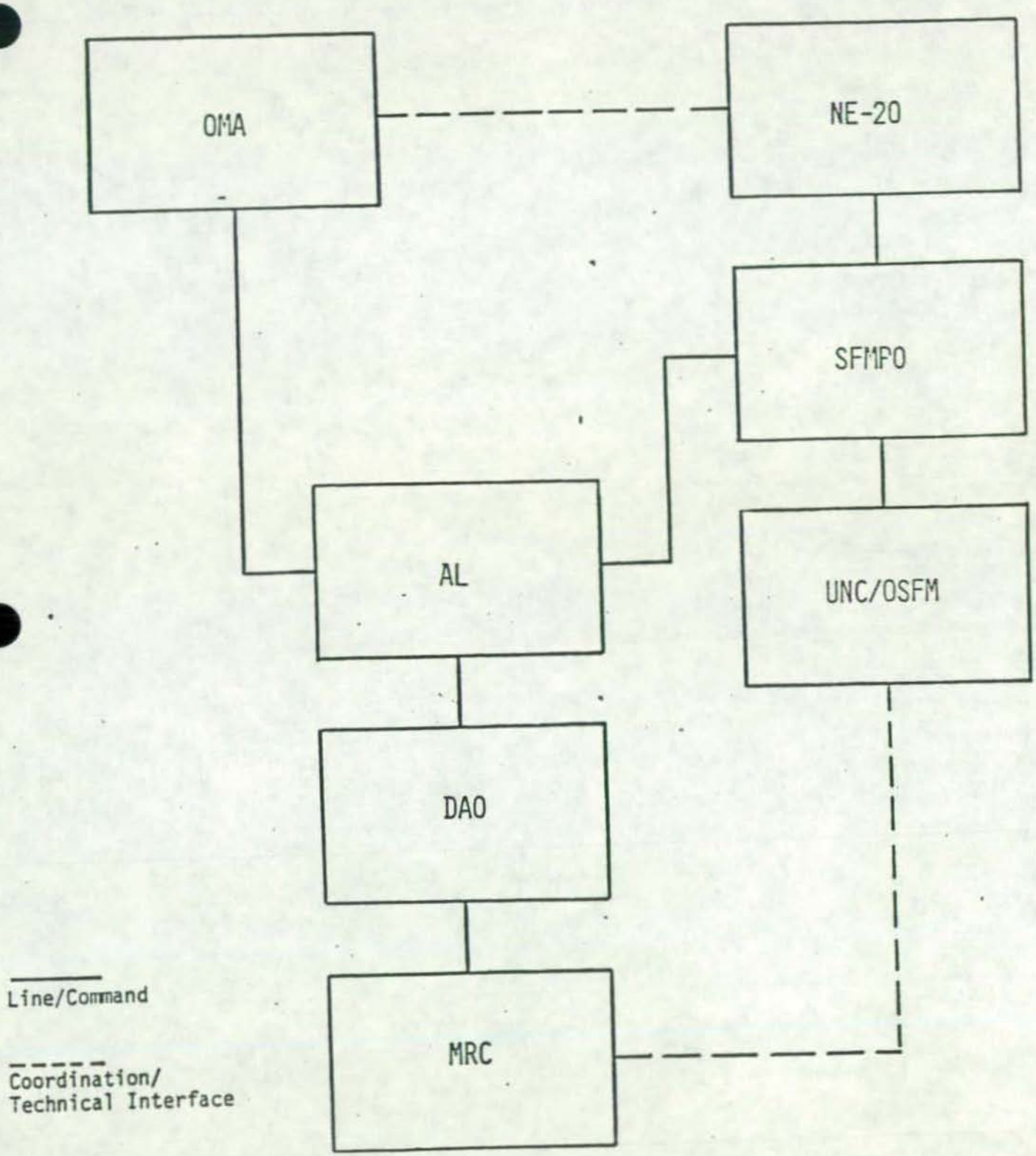
   a. Director, Mound Facility
   b. Director, Nuclear Operations
   c. Manager, Nuclear Technology
   d. Plutonium Handling Manager
   e. Decommissioning Project Manager

7. UNC Nuclear Industries/Office of Surplus Facilities Management

   a. Director, OSFM
   b. Manager, Planning Division
   c. Planning Analyst responsible for Mound Facility Decommissioning

ORGANIZATIONAL INTERFACES

FIGURE 2



IV. RESPONSIBILITIES AND AUTHORITIES

A. Defense Programs/OMA

1. Provide direction to AL including review and approval of the current "Coordinated ANSPD (NE) and OMA Decontamination and Decommissioning (D&D) Plan", prepared by Monsanto Research Corporation for the U.S. Department of Energy under U.S. Government Contract No. DE-AC04-76-DP00053.

2. Approve any subsequent modifications of the D&D plan referenced in IV.A.1 (above).

3. Provide the OMA share of the funding adequate to accomplish work consistent with the plans and schedules as outlined in the D&D plan. The work involved includes decommissioning of both OMA processing systems in the R Building and the PP Building and, in the PP Building, some common support systems. The common support systems are described in Appendix A of this agreement.

4. Approve any modification or additions to this agreement.

B. Office of Terminal Waste Disposal and Remedial Action

1. Provide direction to SFMPO including review and approval of the current "Coordinated ANSPD (NE) and OMA Decontamination and Decommissioning (D&D) Plan", prepared by Monsanto Research Corporation for the U.S. Department of Energy under U.S. Government Contract No. DE-AC04-76-DP00053.

2. Approve any subsequent modifications of the D&D plan referenced in IV.B.1 (above).

3. Provide the NE-20 share of the funding adequate to accomplish work consistent with the plans and schedules as outlined in the D&D plan. The work involved includes decommissioning of the Waste Transfer System, processing systems in the R Building and PP Building and, in the PP Building, some common support systems. The common support systems are described in Appendix A of this agreement.

4. Approve any modifications or additions to this agreement.

C. Albuquerque Operations Office

1. Provides project management for Mound Facility Decommissioning activities.

2. Project Manager (AL) acts as functional interface between OMA Program Manager and Director, SFMPO.

3. Provides monthly reports to both OMA and RL-SFMPO which include:

- Narrative Report of Problems
- Cost Status
- Schedule Status
- Technical Performance Status
- Variance Analysis

D. Dayton Area Office (DAO)

1. Provides onsite project direction for Mound Facility Decommissioning activities.

2. Project Engineer (DAO) acts as functional interface between AL Project Manager and Monsanto Research Corporation (MRC) Decommissioning Project Manager.

3. Provides monthly reports to AL which include:

- Narrative Report of Problems
- Cost Status
- Schedule Status
- Technical Performance Status
- Variance Analysis

E. Surplus Facilities Management Program Office (SFMPO)

1. Provides program administration and management for NE-20 portion of Mound D&D project.

2. Develops, recommends, and justifies a project plan and budget which will support the NE-20 work outlined in the coordinated ANSPD and OMA D&D Plan.

3. Monitors decommissioning progress to insure effective utilization of SFMP resources at Mound Facility.

F. Monsanto Research Corporation

1. Provides contract administration and management.

2. Develops program and budget requirements.

3. Updates and reissues the coordinated ANSPD and OMA D&D Plan referenced in IV.B.1 for approval as required.

4. Provides monthly reports to DOE/DAO which include:

- Narrative Report of Problems
- Cost Schedule
- Schedule Status
- Technical Performance Status
- Variance Analysis

G. UNC Nuclear Industries/Office of Surplus Facilities Management (OSFM)

1. Provides technical assistance to SFMPO.
2. Maintains technical interface with Monsanto.
3. Monitors project progress.

V. FUNDING REQUIREMENTS

A. Coordinated Plan

The resource requirements for NE-20 and OMA are shown by fiscal year in Table I. This table will be modified by annual revision of the project plan.

B. Impacts of Schedule Delay

Any significant deviations (i.e., due to lack of funding) from the coordinated plan could result in any or all of the following impacts:

1. Delayed project completion.
2. Increased project costs.
3. Loss of experienced decommissioning personnel.
4. Increased health and safety risks due to deteriorating systems.

The most significant impacts are the delay in accomplishing the intent of the DOE directive to terminate unencapsulated Plutonium-238 work at the end of 1979 and the invalidation of the coordinated decontamination and decommissioning plan to accomplish this directive. Due to the close integration of gloveboxes and support equipment, the only efficient approach is a synchronized removal effort. Lack of synchronization between the two programs (OMA and NE-20) would cause interrelated systems (gloveboxes, piping, etc.) to be removed out of sequence, would require extended use of common support systems, and could spread contamination to cleaned areas.

This invalidation would occur as a result of one organization (OMA or SFMP) falling significantly behind in funding, which would impact the planned schedule and thereby cause interference with the decommissioning operations.

This has become increasingly important as the original completion date for decommissioning of dedicated OMA systems is being maintained, while the NE-20 schedule has slipped one year in NE-20 areas because of reduced funding in FY 1980. Reduced NE-20 funding in FY 1981 was supplemented by OMA to maintain the intent of the coordinated NE-20/OMA plan in the PP Building. Any future significant funding reductions by either funding organization would greatly shift last user responsibilities and D&D costs for the PP Building's common support systems. Currently, NE-20 has a responsibility for 30 percent and OMA has a responsibility for 70 percent of the D&D of the PP Building's common support system, based on the last user concept.

The common support systems must remain in place in the PP Building until all decommissioning operations which rely upon them are complete. Under the coordinated plan, costs for decommissioning the

common support systems are distributed proportionate to their last organization usage. Distribution of funding obligations could vary significantly should one organization complete decommissioning operations (on schedule) while the other organization requires use of the common support systems for one or more additional years. The following stipulations shall therefore apply:

a. The organization which is behind schedule would then be responsible for all costs associated with continued use of the common support systems and also for all costs which result from the delay in decommissioning them;

b. either organization would retain the ability to compensate for falling behind in funding during one fiscal year by providing adequate makeup funds during the following year or years;

c. should either organization fall behind by more than one year, and thereby require unilateral use of the common support systems for that additional period, then the costs of decommissioning those systems would become the obligation of the defaulting organization.

VI. REPORTING REQUIREMENTS

MRC will provide monthly progress status and cost reports, delineated by each funding organization (OMA and NE-20) in accordance with the Uniform Contractor Reporting System (UCRS) and normal AL Field Office reporting procedures. These reports are to be transmitted by ALO to OMA and RL-SFMPO.

VII. BASELINE MILESTONES

Figure 3 outlines the milestone baseline for both funding organizations in this project. The detailed milestone schedules are shown in Appendix B. This decommissioning project schedule includes both the OMA and NE-20 decommissioning responsibilities, coordinated to provide the most efficient combined effort for both NE-20 and OMA. This is accomplished by following a logical sequence of decommissioning steps in areas of joint ownership rather than performing each program's decommissioning steps separately and in different time frames. This schedule will be modified by annual revision of the project plan as necessary.

DECONTAMINATION AND DECOMMISSIONING NE-20 (ANSPD) AND OMA INACTIVE AREAS

MOUND FACILITY

PROGRAM PLAN RESOURCE REQUIREMENTS* BY FISCAL YEAR

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	TOTALS
PP,R WTS												
NE-20 (ANSPD)												
Dollars (x1000)	3000	3000	1500[2]	1700[3]	3000[4]	3820	4240	3840	3840	3565	2455	33,960
Direct Personnel[1]	33	44	18	18	37	41	41	38	38	36	21	365
PP & R OMA												
Dollars (x1000)	—	170	2170	3985[3]	3100	3480	3850	3820	3820	3820	2020	30,235
Direct Personnel[1]	—	2	34	57	38	39	39	38	38	38	20	343
TOTALS												
Dollars (x1000)	3000	3170	3670	5685	6100	7300	8090	7660	7660	7385	4475	64,195
Direct Personnel[1]	33	46	52	75	75	80	80	76	76	74	41	708

*FY1984 and beyond in FY1984 dollars

[1]Direct Personnel includes Nuclear Operations, Engineering, and Health Physics Personnel.

[2]Most NE-20 areas in standby during reduced FY 1980 funding year.

[3]OMA supplemented NE-20 standby funding level ($1,700K) by $1,000K (and 19MY) of the $3,900K to maintain the schedule of the "Coordinated NE-20/OMA D&D Plan" in PP Building for FY 1981.

[4]Funding reduced ($300K) from $3,300K.

COORDINATED D & D OF INACTIVE NE-20 (ANSPD) AND OMA AREAS

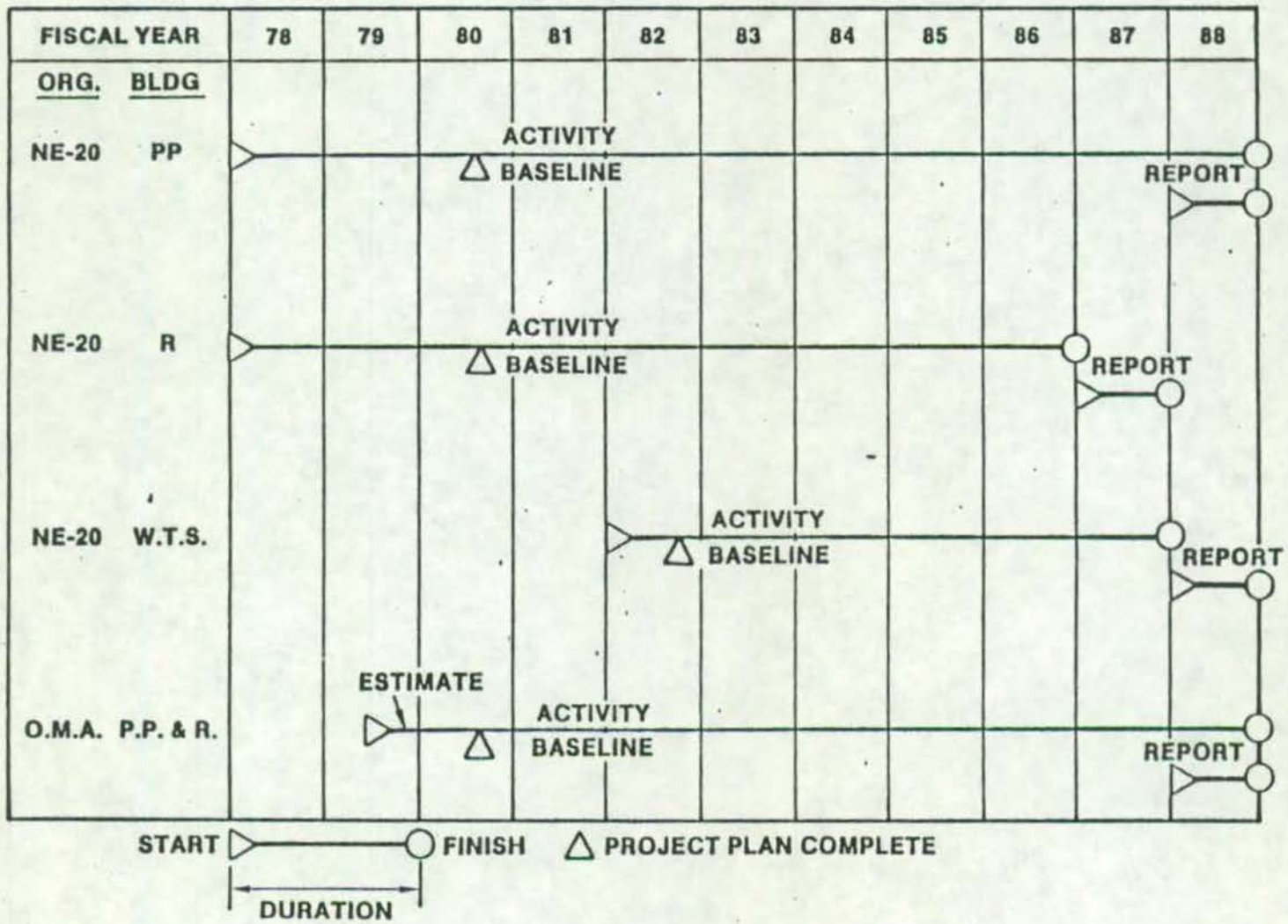


FIGURE 3

APPENDIX A

DESCRIPTION OF COMMON OFFICE OF TERMINAL WASTE DISPOSAL AND REMEDIAL ACTION (NE-20) AND OFFICE OF MILITARY APPLICATION (OMA) SUPPORT SYSTEMS IN PLUTONIUM PROCESSING (PP) BUILDING

There are several common support systems in the PP Building that have been used to support both the Advanced Nuclear Systems and Projects Division (ANSPD)(NE-20) and OMA processing programs and that continue to support the decommissioning of the dedicated inactive NE-20 and OMA gloveboxes and laboratories. A description of these common systems and facilities that require decommissioning or modification follows:

Glovebox Waste Processing - Includes the processing of liquid and solid decommissioning waste (transuranic (TRU) waste and recoverable scrap). Waste is transferred to the D-3 Laboratory for incineration (paper, rags, etc.) or concentration (liquids) in the E-3 and D-3 Laboratories. The concentration of radioactivity in the waste is measured in the B-4 Laboratory.

Waste Packaging - Solid recoverable scrap is packaged in the E-3 Laboratory using special fixtures and TRU glovebox waste is packaged in the B-4 Laboratory. Low-level liquids primarily from the building drainage system are sent to the Waste Disposal (WD) Building for treatment. Low Specific Activity waste is compacted in PP-46 and 47 and/or loaded into waste containers for shipment.

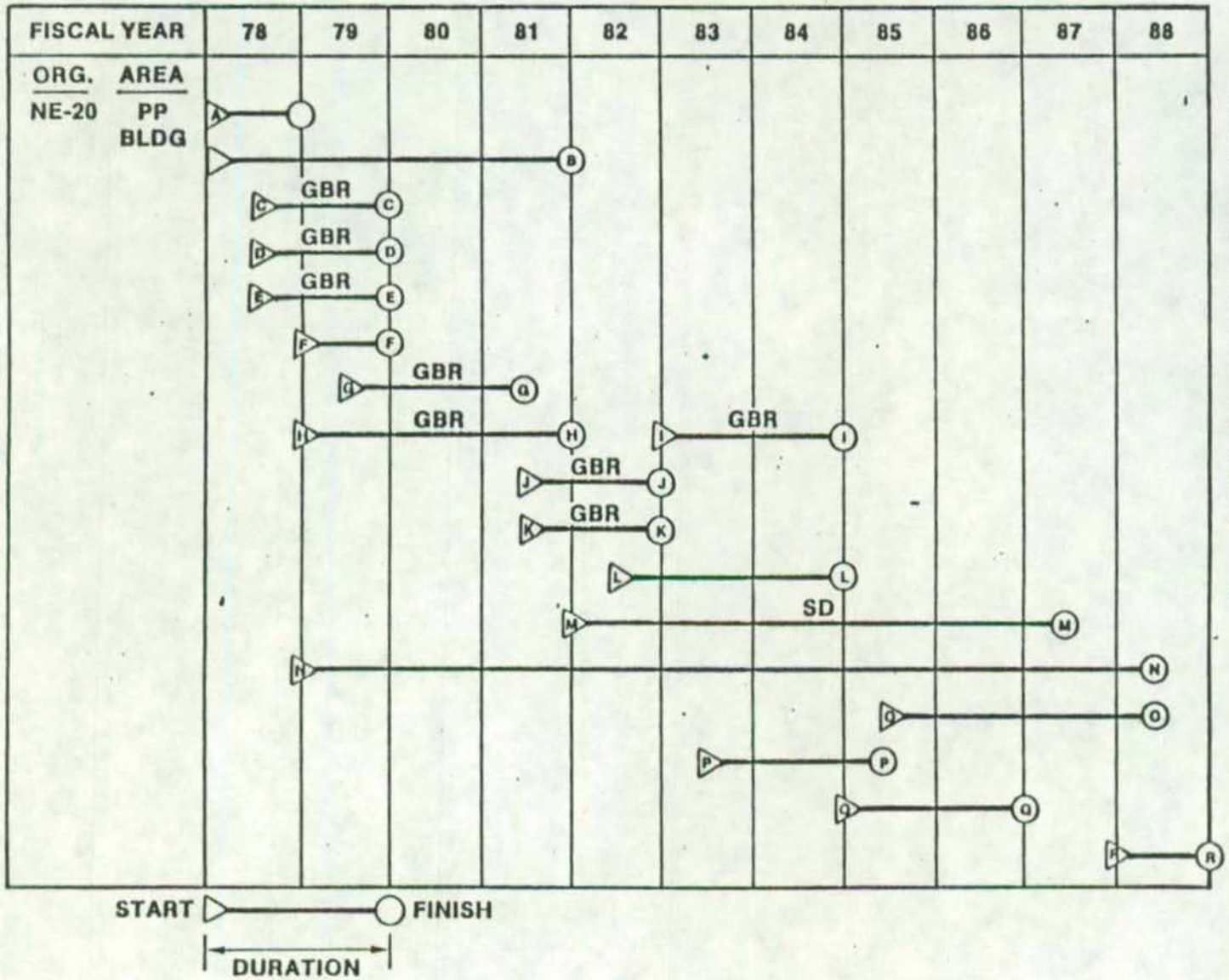
Material Transfer - Solid glovebox waste is transferred between the gloveboxes being decommissioning and support gloveboxes in B-4, D-3, and E-3 Laboratories via an overhead conveyor approximately 900 feet in length. Material is introduced into and out of the glovebox conveyor system in the A-3 Laboratory. Liquids are transferred via the house vacuum systems in PP-14.

Ventilation Systems - Ventilation is maintained within decommissioning and support areas via the following systems:

- Glovebox Corrosive Vapor Scrubbing System in PP-13
- Supply Air Filter Banks
- Air Conditioning and Heating Systems
- Four Exhaust Filter Banks that service operating and access corridors, laboratories, and gloveboxes.

Process Systems - Several building process support systems are used by decommissioning and include chilled water, tempered water, sanitary system, storm sewer system, low-level liquid radioactive waste drain systems, acid/caustic supply system, process air system, lighting and electrical distribution, fire protection and detection, air sampling and monitoring systems, communication systems, and security systems.

D & D OF INACTIVE OMA AREAS



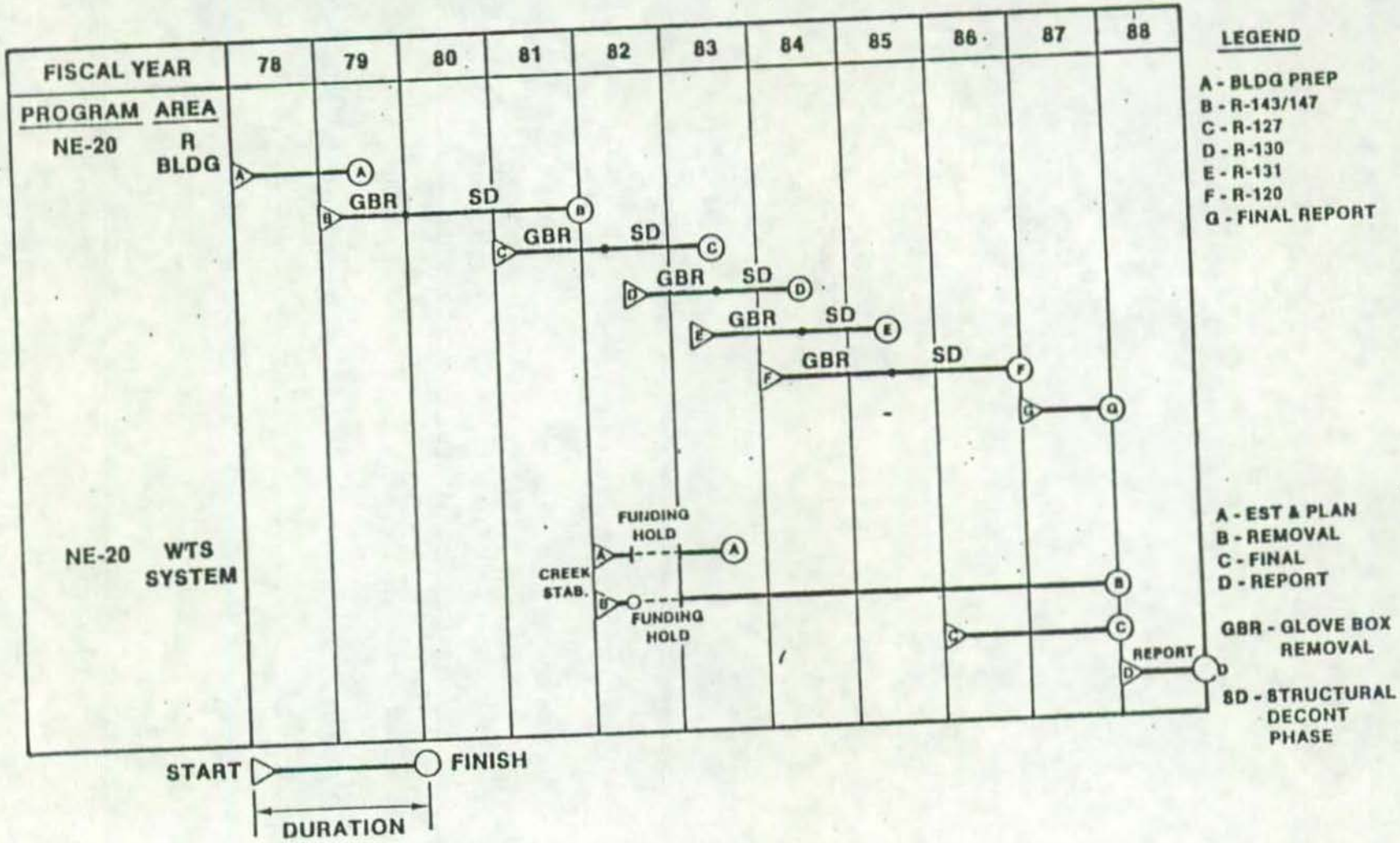
LEGEND

A - PLAN
B - BLDG PREP
C - E -1A
D - A-1
E - F-4
G - A-2
H - B-1
I - RMS 176, 177 & 178
J - F-2 & 3
K - C-1
L - C-2, 3 & 4
M - STRUCT. DECON.
N - ISOLATION
O - MISC. SUPPORT
P - CONVEYOR
Q - DRAINS
R - FINAL REPORT

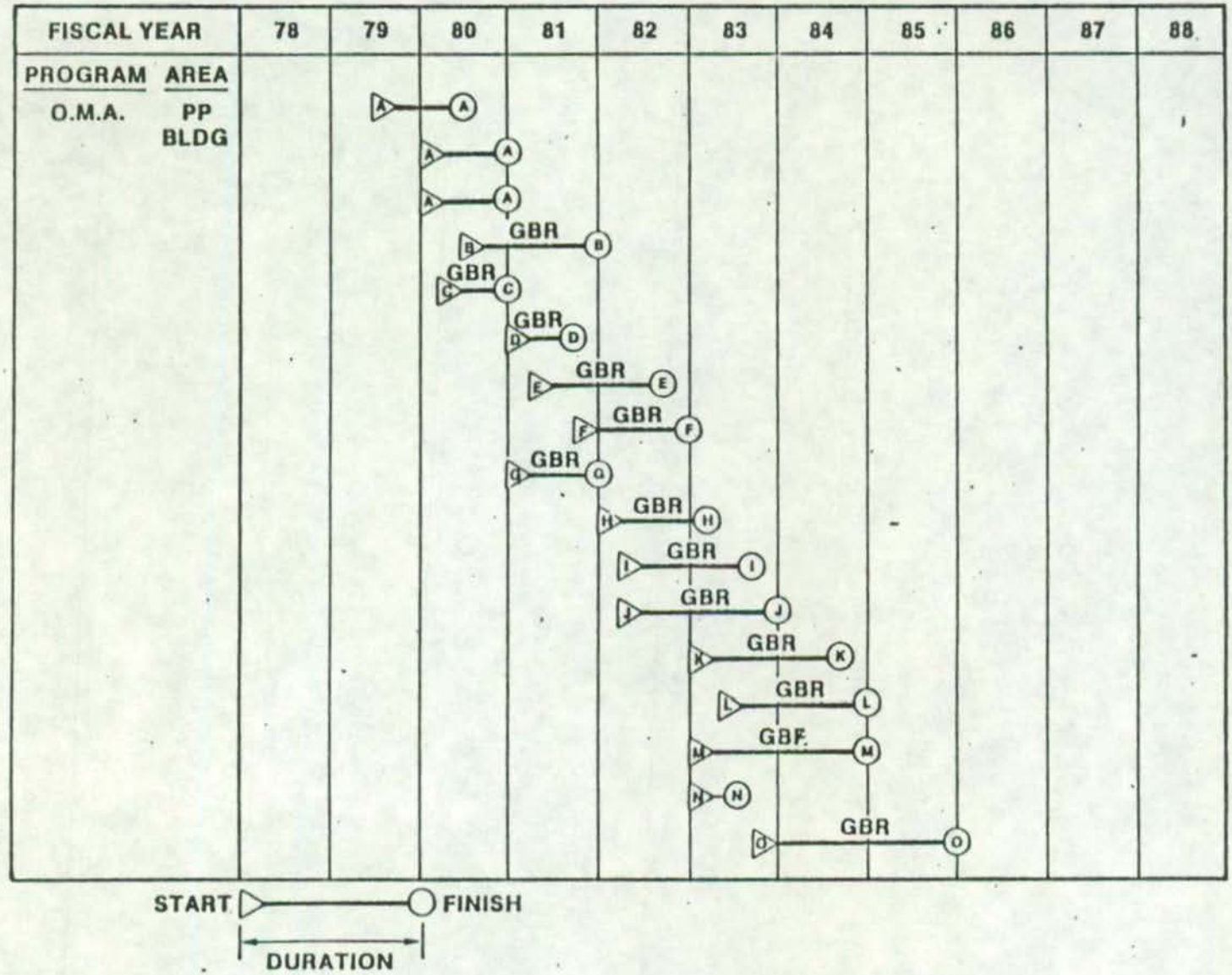
GBR - GLOVE BOX REMOVAL PHASE

SD - STRUCTURAL DECON PHASE

D & D OF INACTIVE NE-20 (ANSPD) AREAS (cont)



D & D OF INACTIVE NE-20 (ANSPD) AREAS

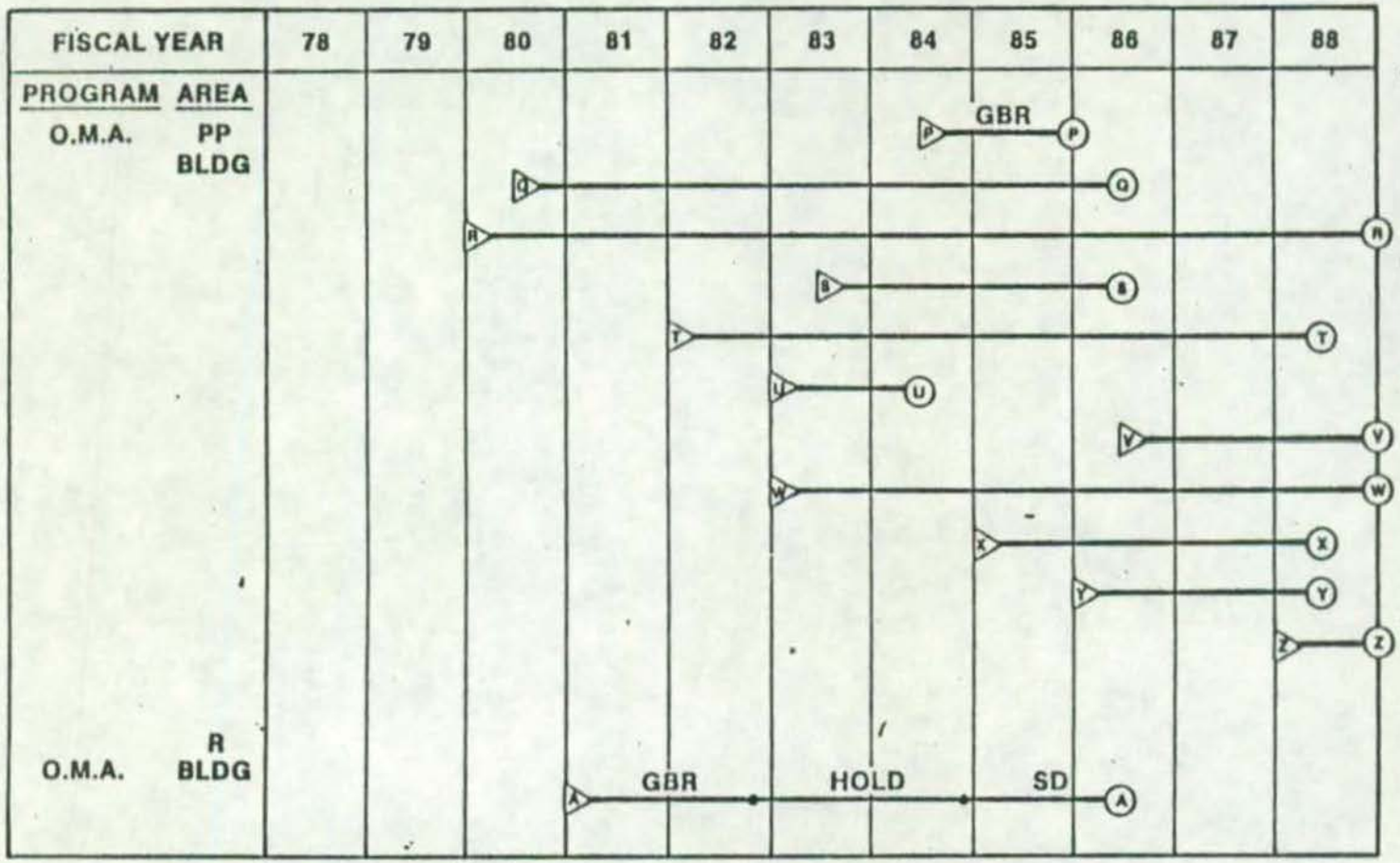


LEGEND

A - PLAN
A^1 - E-1
A^2 - RM III
B - E-2
C - D-2
D - A-3
E - B-3
F - D-1
G - DOCK MOD.
H - B-2
I - E-3
J - RMS 122/130
K - B-4
L - D-3
M - COMPACTORS
N - DOCK MOD
O - VAG & CV

GBR - GLOVE BOX REMOVAL PHASE

D & D OF INACTIVE OMA AREAS (cont)



LEGEND (cont)

P - W.S.
Q - MISC. SERVICE
R - ELECTRIC
S - CONVEYOR
T - STRUCT. DECON.
U - RM 34
V - SPRINKLERS
W - HVAC
X - DRAINS
Y - ISOLATION
Z - FINAL REPORT

LEGEND

A - R-159

GBR - GLOVE BOX REMOVAL
SD - STRUCTURAL DECONTAMINATION PHASE

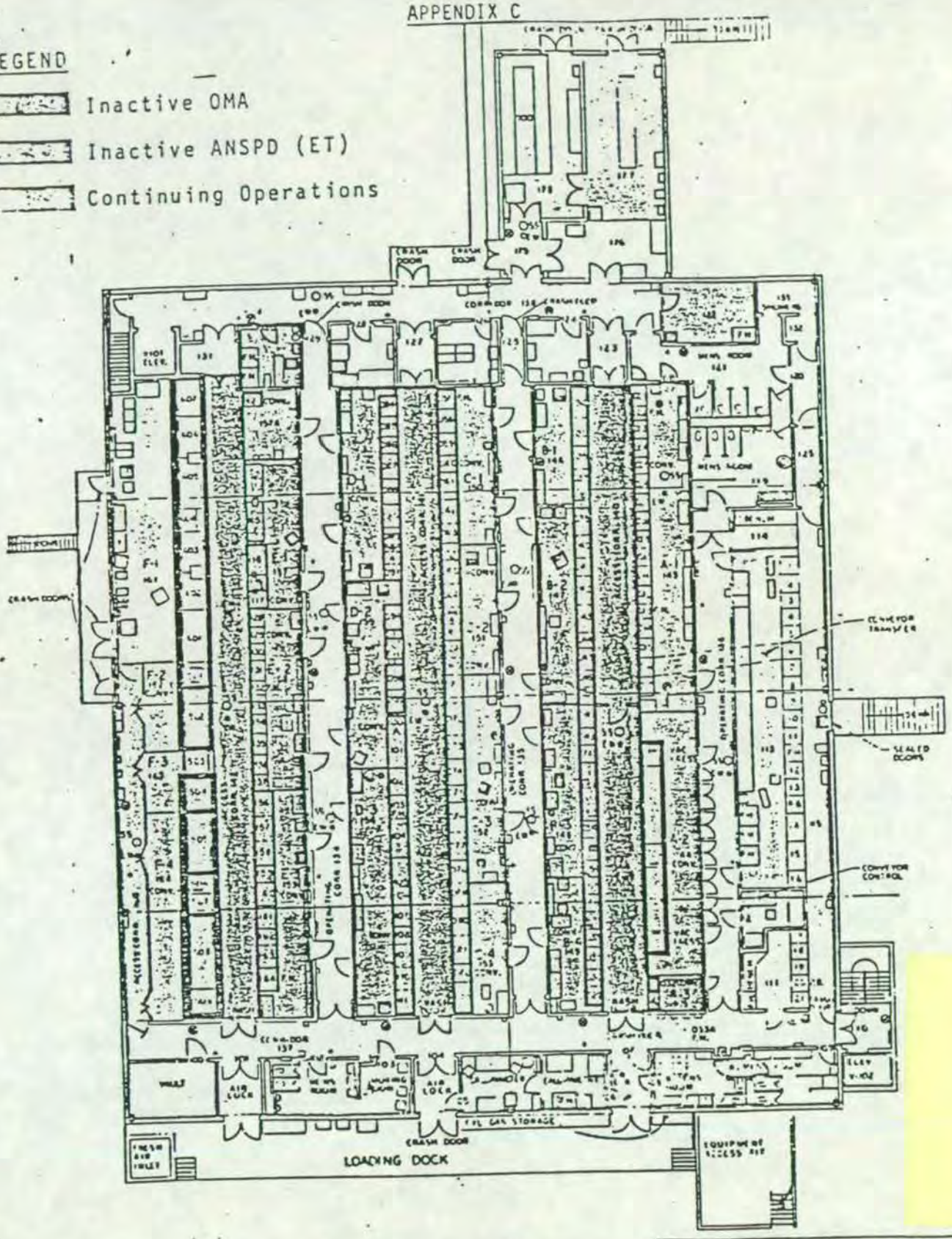
APPENDIX C

LEGEND

Inactive OMA

Inactive ANSPD (ET)

Continuing Operations

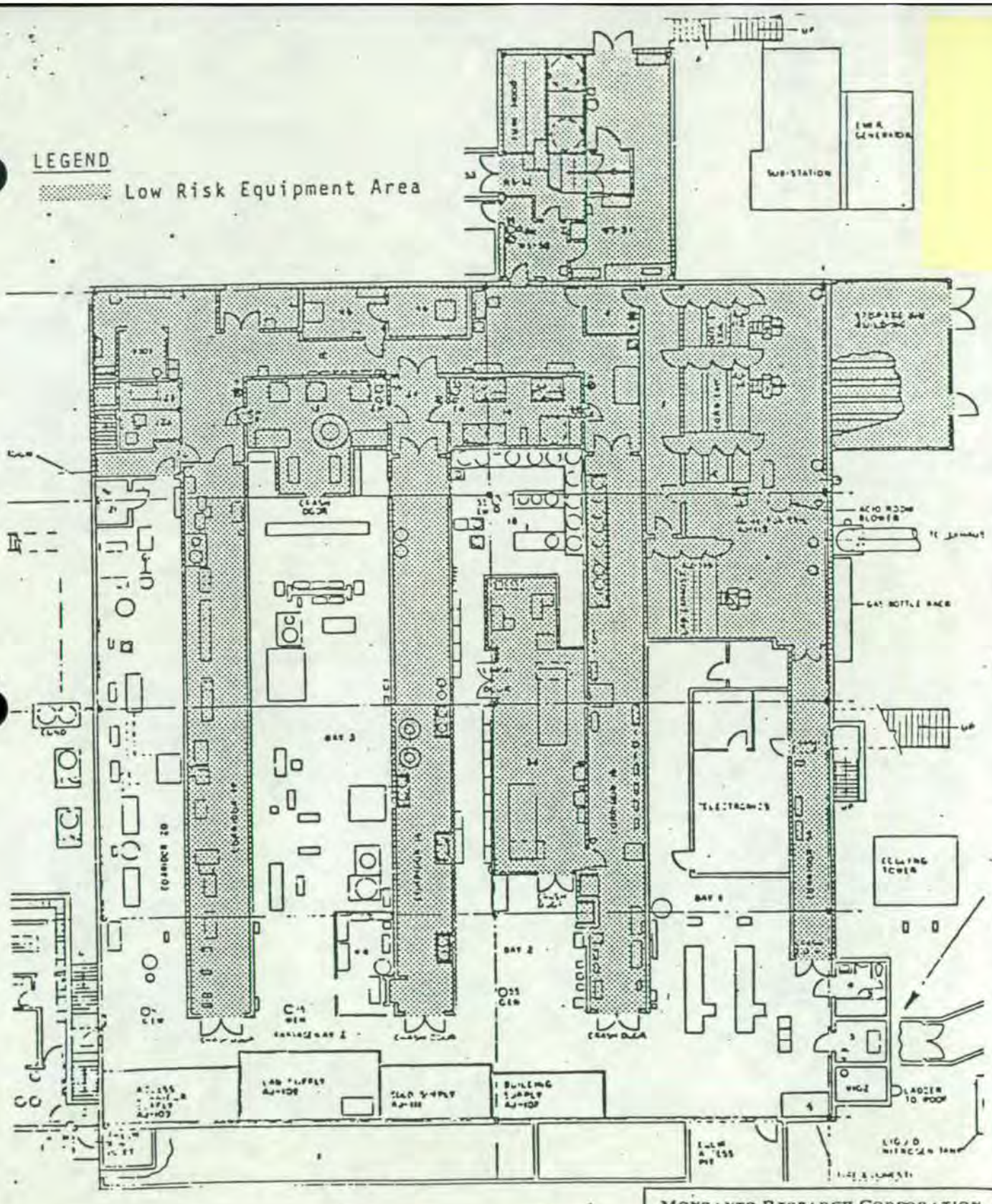


38

~~UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION~~

MONSANTO RESEARCH CORPORATION
MOUND LABORATORY
MIAMISBURG, OHIO

BLDG. 38
PLUTONIUM PROCESSING
Second Floor.

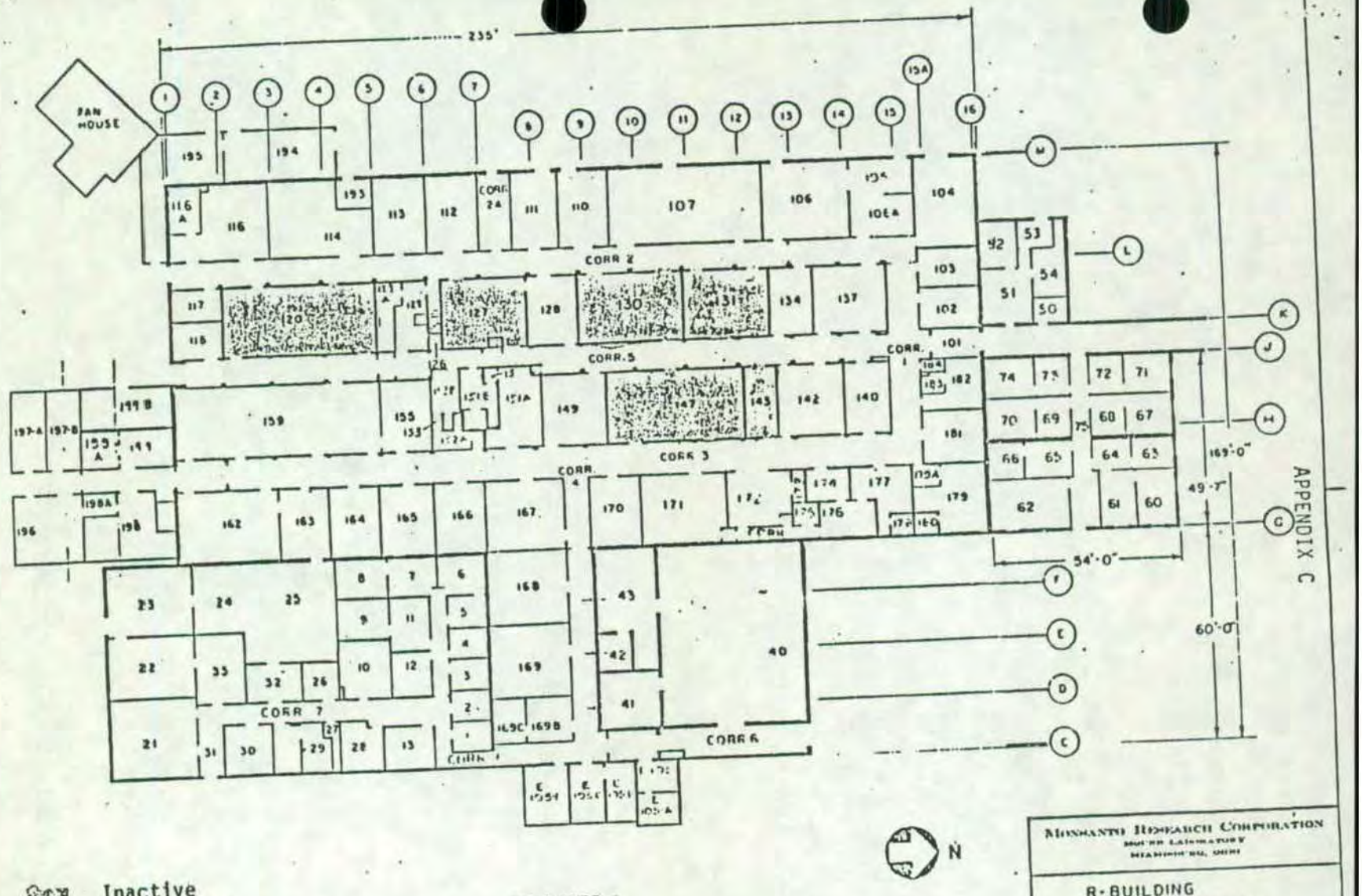


UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

MONSANTO RESEARCH CORPORATION
MOUND LABORATORY
MIAMISBURG, OHIO

BLDG. 38
PLUTONIUM PROCESSING
First Floor

C-2



APPENDIX C

C-3

F-28

UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION

APPENDIX G

APPENDIX G

PROPOSED FY 1987 BASELINE COMPARED TO PREVIOUS FY 1980 BASELINE

SUMMARY

The ANSPD/NE portion of the coordinated extensive decontamination and decommissioning (D&D) of the inactive and radioactively contaminated areas in the Plutonium Processing (PP) Building and Research (R) Building began in FY 1978 (both planning and decommissioning activities) with the OMA portion of planning beginning in FY 1979 and actual decommissioning in FY 1980. Because of an ANSPD funding reduction in FY 1980 to standby levels, a revised baseline was prepared and approved in April, 1980 (see attached sections). This FY 1980 baseline has been used until recently for the overall funding and schedule requirements. The NE decommissioning efforts on the Waste Transfer System (WTS) began in FY 1982.

The FY 1980 baseline schedule had been maintained until late FY 1985. The overall schedule then began to slip, initially, because of the loss of experienced personnel at the end of FY 1985. It was hoped to regain the schedule slip in FY 1986 when trained replacement personnel became available. However additional personnel were not available in FY 1986 because of Gramm-Rudman restrictions on Mound's headcount. Also contaminated soil volume estimates and burial costs for the Waste Transfer System project were dramatically increasing. In addition, structural decontamination efforts in the Plutonium Processing Building were initiated in the support areas of the first floor and were proving to be much more difficult than estimated in FY 1980. It became apparent that the use of the project's total contingency and internal stretching of subproject schedules were no longer adequate to maintain

the overall FY 1980 baseline schedule and costs. The remaining project costs were then reestimated and more realistic contingencies included and a new schedule forecasted. this revised baseline has been included in this program plan in order that the additional resources required in FY 1989 and FY 1990 may be included in the FY 1989 Budget Submission.

SCHEDULE CHANGES

Plutonium Processing (PP) Building Project:

The FY 1980 baseline schedule showed a completion date of September, 1988. The revised baseline schedule shows a completion one year later in September, 1989. The additional twelve (12) months are because of a previous two (2) month schedule slip and ten (10) months for the increased difficulty in structural decontamination of the process support areas on the first floor. Additional details are:

Contamination was detected in hollow spaces that ran underneath each glovebox that was located on the second floor. The hollow spaces can only be reached and decontaminated from the first floor and require removal of concrete spacers under the prestressed concrete tees that are the ceiling of the first floor (and the floor of the second floor). This requires an intensive and longer effort to decontaminate.

Contamination has penetrated deeper than originally estimated into the walls and floor from contaminated liquid leaks and requires longer to decontaminate.

The removal of service penetrations in load bearing support walls that the prestressed concrete tee ceiling rests on require special procedures and additional work to prevent undermining the support of the concrete tees.

Decontamination of wall surfaces is taking much longer than expected. It is much faster to remove the walls as was the case on the second floor and in R Building. However, the internal walls on the first floor of PP Building are load bearing walls and cannot be removed.

Decontamination in the support areas is also taking longer because of the physical space restrictions since many services remain to support the building and ongoing operations.

The discovery that many sleeves for service penetrations are contaminated both internally and externally and now require removal rather than decontamination.

Research (R) Building Project:

The FY 1980 baseline showed a completion date of September, 1986. The revised baseline schedule shows a completion date two (2) years later in September, 1988. The additional twenty four (24) months are because of previous schedule extensions in prior years, removal of unexpected ductwork, ventilation problems, and diversion of resources to the Waste Transfer System (WTS) project. These schedule delays did not significantly increase costs. Additional details are:

The schedule was slipped six (6) months to allow for the inclusion of the Defense Program (DP) funded decommissioning effort in R-149 into a coordinated and cost efficient decommissioning plan for areas in the R Building.

Ventilation ductwork was discovered in the crawlspace above the areas being decommissioned that was contaminated and not shown on building drawings. Also problems with the building ventilation air pressure differentials required additional schedule slippage. These factors slipped the schedule four (4) months.

Manpower resources were diverted from decommissioning efforts in the R Building in order to remove the unexpected contaminated soil volumes being encountered on the WTS project and still maintain the total PP/R/WTS project completion date of September, 1988. The diversion of resources caused a fourteen (14) month schedule extension.

Waste Transfer System (WTS) Project:

The FY 1980 baseline schedule showed a completion date of September, 1987. The revised baseline schedule shows a completion date of September, 1990. The additional thirty six (36) months are because of the significant increase in contaminated soil volumes, inaccurate as-built drawings, physical location restrictions, weather delays, significant increases in burial costs, and increasing environmental restrictions. Additional details are:

Waste volumes were originally estimated to be approximately 50,000 ft^3 based on available radiological characterization data and are currently estimated to be approximately 300,000 ft^3 based on more extensive characterization of the nonhomogeneous contaminated soil from previous leakages of the underground lines and tanks.

Inaccurate as-built drawings required additional time and cost to excavate deeper to locate the underground lines and to excavate around plant service lines not indicated accurately on the drawings.

The physical locations (deep excavations, on hillsides, and the nearness of plant personnel, services and buildings) of some contaminated soil spots required comprehensive precautions such as: extensive shoring for personnel safety, water diversion devices, runoff retention ponds, and weather protection.

Unpredictable weather (high winds, heavy rains) caused delays in the schedule.

There have been and will continue to be significant increases in shipping and burial costs at offsite DOE radioactive waste storage and burial sites (INEL, NTS and WIPP). Additional costs have been incurred in modifying ATMX railcars to meet new transportation requirements. The WIPP facility requires the use of more expensive TRU waste packages and the

certification of wastes. In addition burial charges for LSA waste have increased significantly (from $2.00/ft^3 in FY 1984 to $4.00/ft^3 in FY 1987 and to $6.00/ft^3 in FY 1988).

Increasing environmental protection concerns have resulted in soil removal activities to proceed more cautiously, at a slower rate, and with more costly precautions.

The overall PP/R/WTS program was forecasted to be 82% complete by the end of FY 1986. Because of the previously mentioned schedule impacts and scope increases, the overall project was estimated to be 75% complete at the end of FY 1986.

COST CHANGES

The FY 1980 baseline total cost was estimated to be $31.5M for NE in FY 1982 dollars for FY 1982 and beyond. This corresponds to $36.5M in FY 1989 dollars for FY 1989 and beyond. The current estimate is $44.3M which is a $7.8M increase because of the previously mentioned schedule impacts on the WTS and PP projects.

The FY 1980 baseline total cost was estimated to be $25.7M for OMA in FY 1982 dollars for FY 1982 and beyond. This corresponds to $32.7M in FY 1989 dollars for FY 1989 and beyond. The current estimate is $37.9M which is an $5.2M increase because of the previously mentioned schedule impacts on the PP building project.

The increases by project and funding agency are:

PP BUILDING PROJECT

	NE	OMA
Proposed Baseline	$19.0M	$37.9M
FY 1980 Baseline	$17.2M	$32.7M
Increase	$ 1.8M	$ 5.2M

R BUILDING PROJECT

	NE
Proposed Baseline	$ 9.2M
FY 1980 Baseline	$ 9.2M
Increase	$ 0 M

WTS PROJECT

	NE
Proposed Baseline	$16.0M
FY 1980 Baseline	$10.0M
Increase	$ 6.0M

MANAGEMENT CHANGES

Several management changes have been made in FY 1987 in order to increase communication and control of the projects:

The total program has been separated into three major projects (PP, R, and WTS). Progress, cost, contingency and its utilization, and changes are being reported by individual project.

Project schedules are being entered into a sophisticated computer project scheduling software program ("Project 2"). This will provide more accurate cost and schedule estimates in addition to denoting critical paths and progress.

A Change Control Board will be used to control, document and communicate utilization of contingency and changes to schedule and scope.

Centralization of the decommissioning personnel and management into Mound's Engineering Department will provide for more effective utilization of resources.

COORDINATED ANSPD(ET) AND OMA

DECONTAMINATION AND DECOMMISSIONING (D&D) PLAN

Prepared by: W. P. Davis
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Submitted by: B. R. Kokenge

April 30, 1980

MONSANTO RESEARCH CORPORATION
A Subsidiary of Monsanto Company

MOUND FACILITY
Miamisburg, Ohio 45342

Operated for

UNITED STATES DEPARTMENT OF ENERGY

U. S. Government Contract No. DE-AC04-76-DP00053

DECONTAMINATION AND DECOMMISSIONING

ANSPD(ET) & OMA INACTIVE AREAS

MOUND FACILITY

RESOURCE REQUIREMENTS

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	TOTALS
PP, R, WTS ANSPD(ET)												
Dollars (X1000)	3000	3000	1500	2800[2]	3360[2]	3470	3470	3140	3140	2920	1710	31,510
Direct Personnel[1]	33	44	18	39	41	42	42	38	38	36	21	392
PP & R OMA												
Dollars (X1000)	--	170	2170	2880	3090	3160	3150	3130	3130	3130	1650	25,660
Direct Personnel[1]	--	2	34	35	38	39	39	38	38	38	20	321
TOTALS												
Dollars (X1000)	3000	3170	3670	5680	6450	6630	6620	6270	6270	6050	3360	57,170
Direct Personnel[1]	33	46	52	74	79	81	81	76	76	74	41	713

FY1982 and beyond in FY1982 dollars

[1]Direct Personnel includes Nuclear Operations, Engineering, and Health Physics Personnel

[2]Per DOE/ALO guidance and as submitted to ET in the Field Task Proposal/Agreement in February, 1980

TABLE I

D. Project Cost

Resource requirements for the decontamination and decommissioning of the inactive OMA and ANSPD(ET) areas at Mound Facility are given in TABLE I by fiscal year. A comparison is made below to previous estimates with an explanation of variances:

	FY81 Budget Submission Costs ($ in millions)	FY82 Budget[1] Submission Costs ($ in millions)	Total Change ($ in millions)
ANSPD(ET)	25.5	31.5	6.0
OMA	22.5	25.7	3.2
TOTAL	48.0	57.2	9.2

The $6.0M increase in the ANSPD(ET) costs are because of escalation[2] from FY1981 to 1982 dollars (~$1.9M), fuel adjustment (~$0.4M), and a one-year schedule extension and associated costs (~$3.7M) because of reduced FY1980 funding from the original request of $3.0M to basic standby or surveillance funding level of $1.5M.

The $3.2M increase in the OMA costs are mainly because of escalation[2] from FY1981 to 1982 dollars.

E. Other Projects

Several other D&D projects have been identified for Mound Facility that are to be funded in future years and are summarized in TABLE II. These projects are:

SM Building Demolition - Complete demolition of the Special Metallurgical Building (23,000 ft^2). The radiochemical processing building has been partially D&D'd (FY1968-1972) and requires complete demolition including an auxiliary building, underground tanks, and removal of contaminated soil.

---

[1]Reflects January, 1980 guidance received from DOE/ALO on ET proposed funding in FY81 and later years.

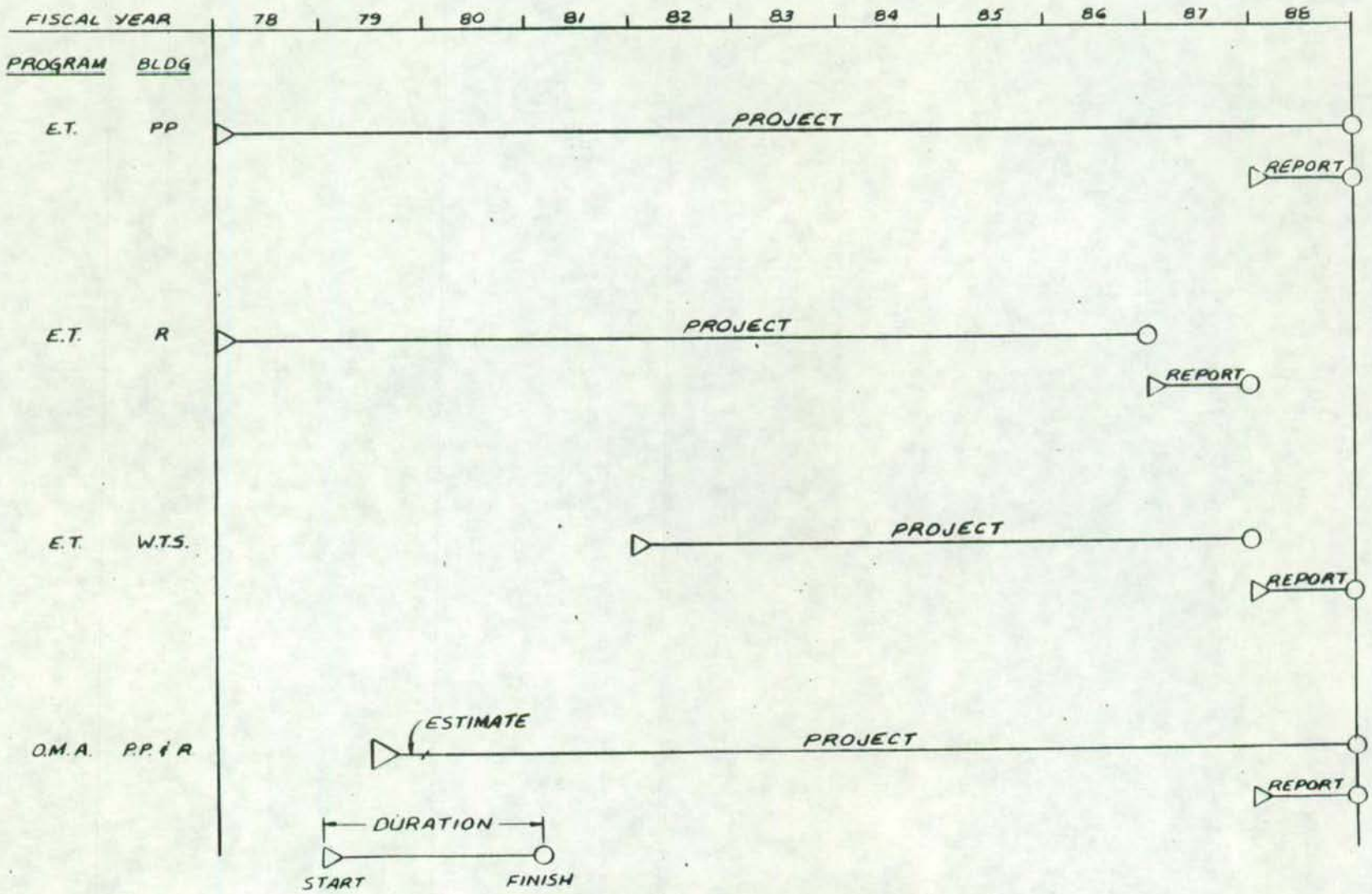
[2]FY1981 Budget Submission permitted escalation only through FY1981. FY1982 Budget Submission permits an additional ~10% escalation for FY1982 - 1988.

TABLE III

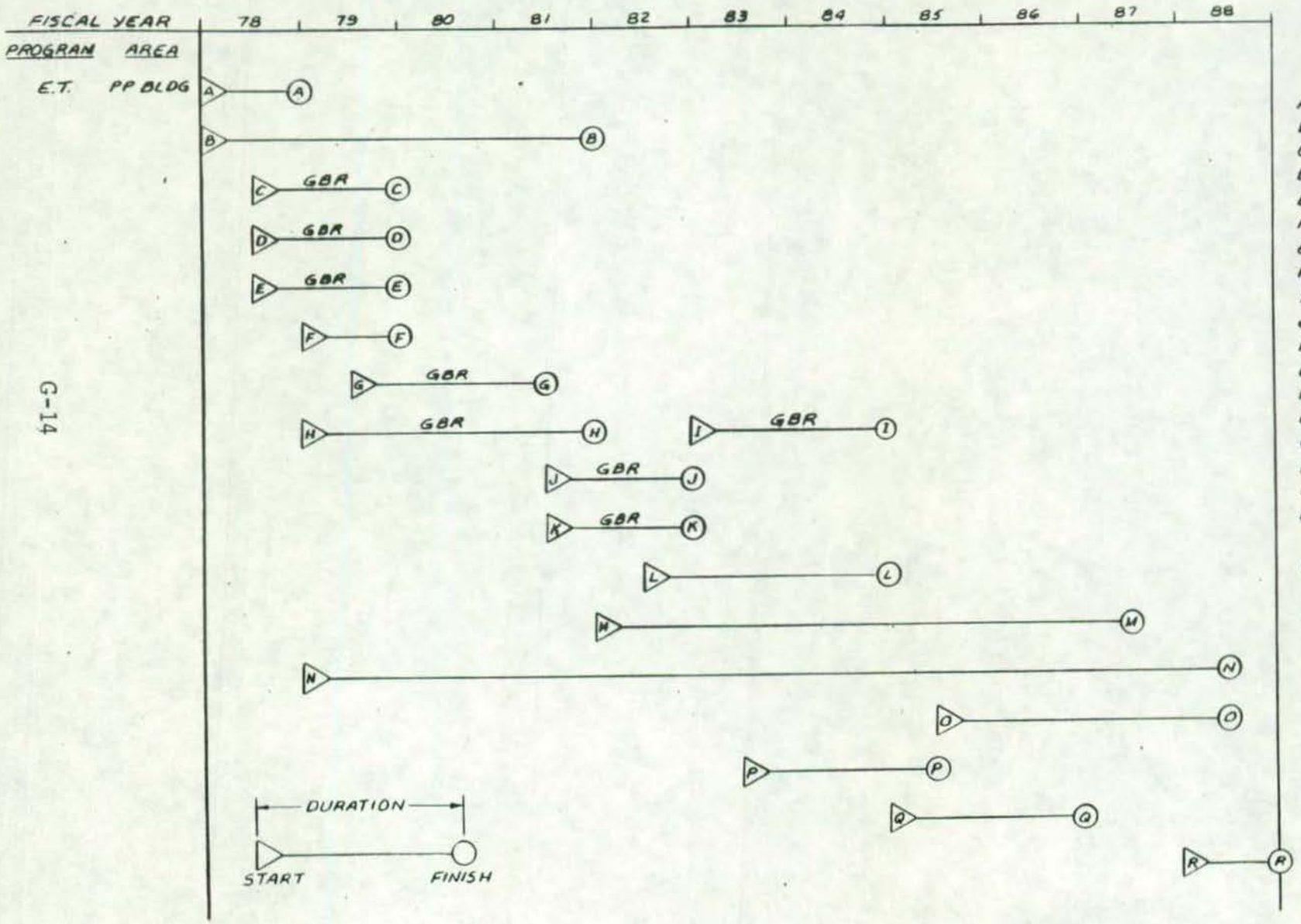
ESTIMATED WASTE VOLUMES
(Thousands of cubic feet)

Fiscal Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
ANSP(ET) LSA	8	8	3	11	11	17	17	17	13	8	3	116
OMA LSA	-	-	8	10	10	10	11	11	9	7	3	79
TOTAL LSA	8	8	11	21	21	27	28	28	22	15	6	195
ANSPD(ET) TRU	2	4	1	9	9	15	15	15	10	5	1	86
OMA TRU	-	-	6	9	9	9	9	9	6	3	1	61
TOTAL TRU	2	4	7	18	18	24	24	24	16	8	2	147

COORDINATED D&D OF INACTIVE ANSPD(ET)/OMA AREAS
(FULL PLAN)



C & D OF INACTIVE ANSPD(E T) AREAS
(FULL PLAN)



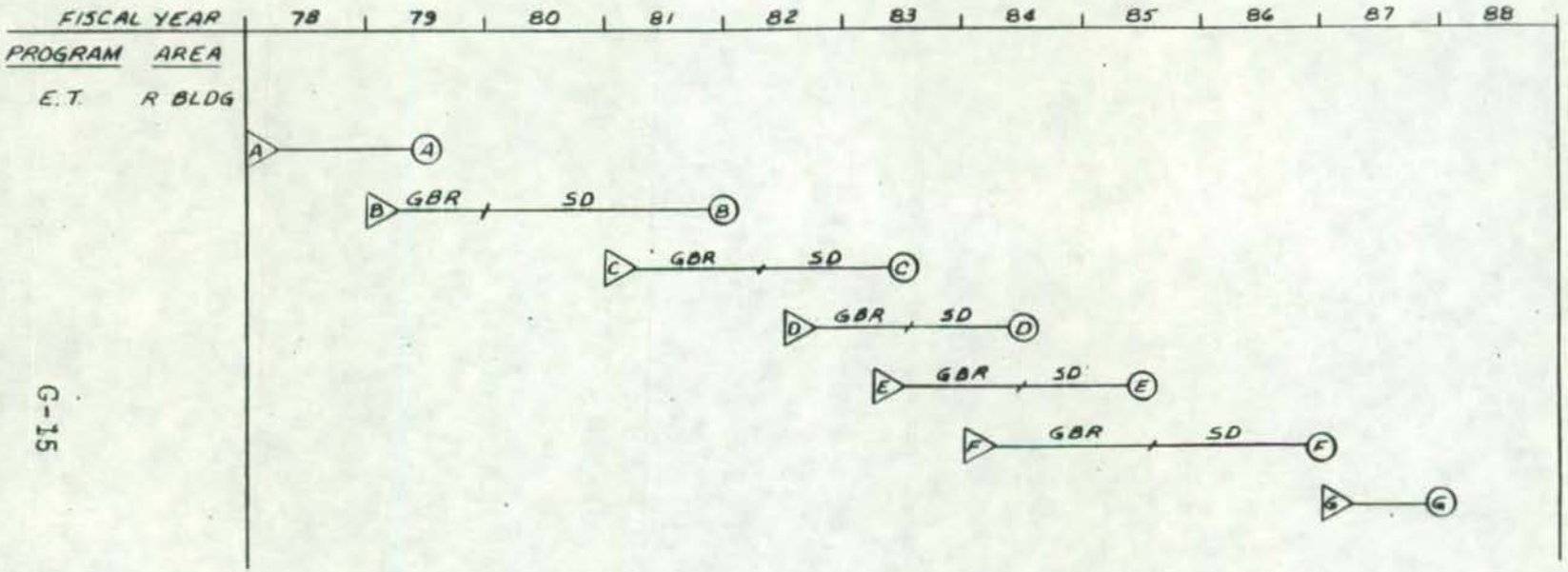
LEGEND

A - PLAN
B - BLDG PREP
C - E-1A
D - A-1
E - F-4
F - F-1
G - A-2
H - B-1
I - RMS 176, 177 & 178
J - F-2 & 3
K - C-1
L - C-2, 3 & 4
M - STRUCT. DECON.
N - ISOLATION
O - MISC. SUPPORT
P - CONVEYOR
Q - DRAINS
R - FINAL REPORT

GBR - GLOVE BOX REMOVAL PHASE

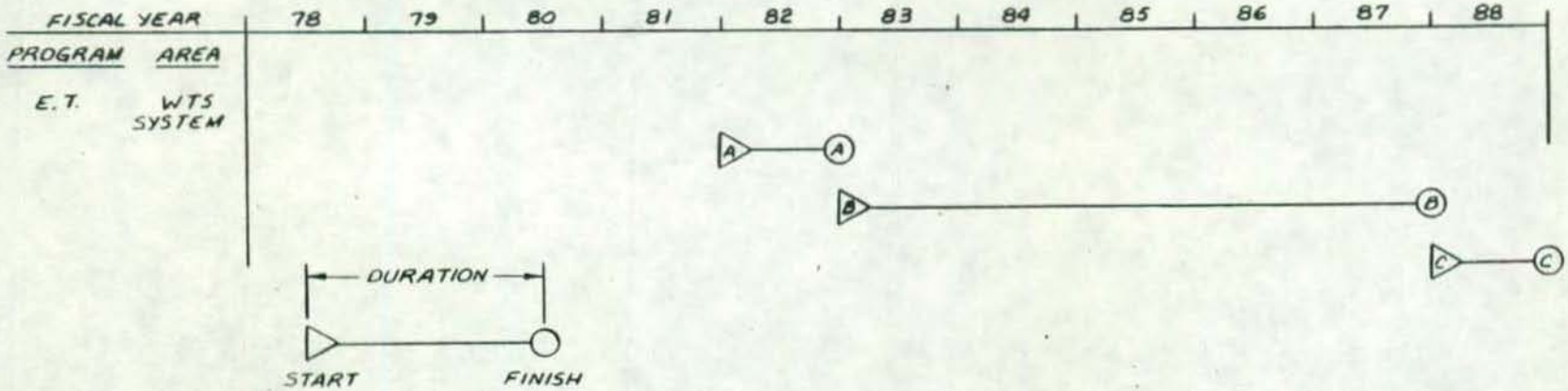
SD - STRUCTURAL DECONTAMINATION PHASE

D&D OF INACTIVE ANSDP(ET) AREAS
(FULL PLAN)



LEGEND

A - BLDG PREP
B - R-143/147
C - R-127
D - R-130
E - R-131
F - R-120
G - FINAL REPORT

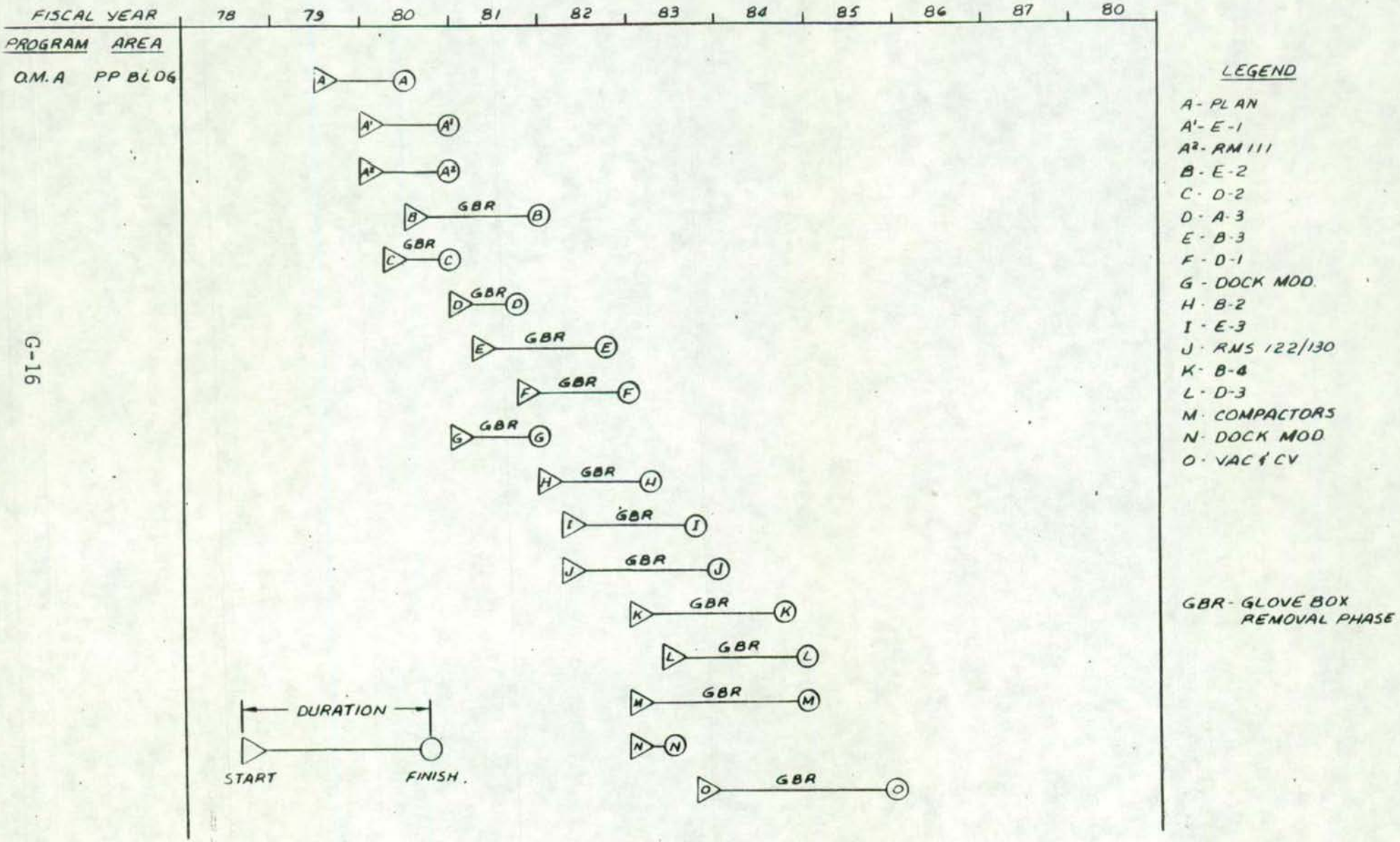


A - EST & PLAN
B - REMOVAL
C - FINAL REPORT

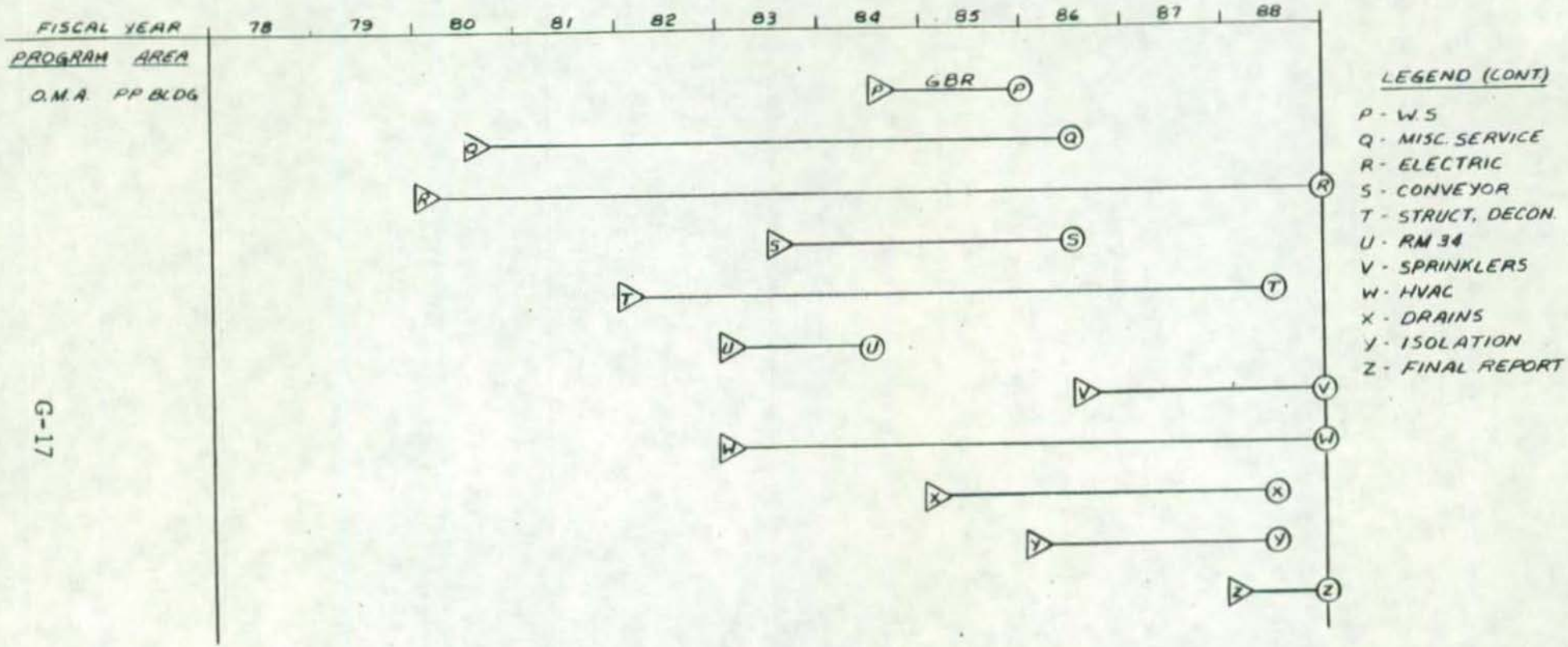
GBR - GLOVE BOX REMOVAL

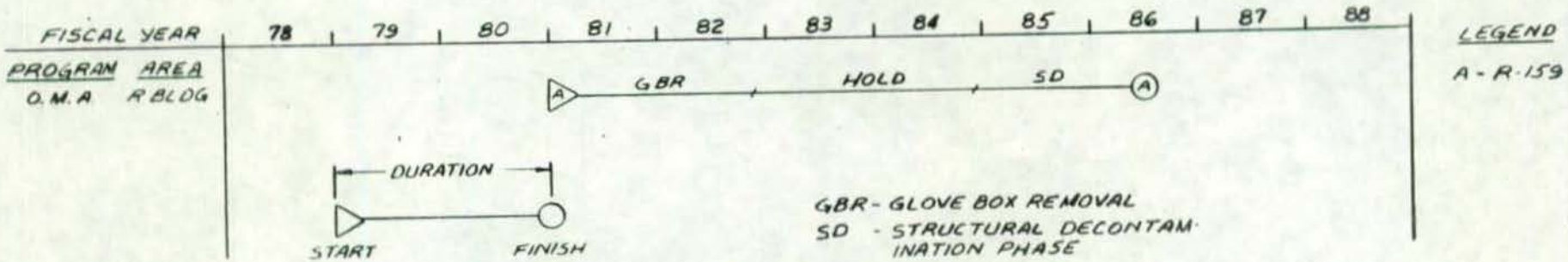
SD - STRUCTURAL DECONTAMINATION PHASE

D&D OF INACTIVE OMA AREAS
(FULL PLAN)



D&D OF INACTIVE OMA AREAS (CONT.)
(FULL PLAN)





APPENDIX H

APPENDIX I