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Abstract

Selected portions of 234-5Z ventilation ducting and service piping containing plutonium have been identified, in chronological order, for near-term removal and recovery of plutonium holdup material. A series of specific enhanced monitoring activities, primarily for exhaust stack manifold ducting, have also been identified. These combined activities are termed remedial actions. This project management plan provides the proposed baseline schedules, estimated cost and manpower resources required to complete these identified remedial actions.

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DATE MAR 20 1989
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Plutonium Finishing Plant (PFP) Remediation Project Management Plan

By

A. E. Schilling

March 1989

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1. Introduction and Scope

Selected active portions of the 234-5Z Building ventilation system, 26-inch process vacuum system and remaining portions of the older inactive 26-inch process vacuum system containing plutonium holdup have been identified (Ref. 1) for near-term remedial action. This remedial action includes removal/replacement of selected ventilation ducting/service piping, plutonium recovery from removed piping segments, enhanced monitoring of selected ventilation ducting, filter rooms and service piping and destructive laboratory analysis of physical specimens removed from piping segments with emphasis on ventilation ducting downstream of final HEPA filtration. Identified remedial actions will be performed simultaneously with Plutonium Finishing Plant (PFP) processing activities, including Plutonium Reclamation Facility (PRF), Remote Mechanical "C" (RMC) Line, Laboratory and Product Handling operations. To support simultaneous plant operations and selected remedial actions, some parallel ventilation ducting, intermediate filter box construction/installation and parallel 26-inch process vacuum line will be required to maintain plant operating continuity.

All available facts indicate that the plutonium accumulation in ventilation ducting and service piping in 234-5Z does not warrant immediate removal because of safety considerations. Furthermore, analysis of potential consequences of releasing plutonium dioxide from 234-5Z ventilation ducting due to a seismic event has concluded no impact on restart of the RMC Line (Ref. 7). However, cleanout and/or removal of selected piping segments is recommended (Ref. 1) based on ALARA principles and proactive management attention to reduce the potential challenges to both primary and final HEPA filtration while achieving a steady reduction in risk to employees, the public and the environment.

Other locations with known accumulation of plutonium material were reviewed prior to unlimited PFP operations startup in July 1988, and accepted as not constituting an undue risk relative to restart. These locations include the 242-Z Building, the 232-Z Building, and low level plutonium accumulation downstream of 234-5Z final HEPA filtration. Decontamination and Decommissioning (D&D) of the 242-Z Building is a separate project. The priority for D&D of the 232-Z Building and near-term actions necessary to isolate 232-Z final HEPA filters from the 291-Z Building are also discussed. Furthermore, actions necessary to obtain additional characterization data on downstream exhaust manifold ventilation ducting and

monitoring systems, such as in-line probes, additional Constant Air Monitors (CAMs) and increased nondestructive assay (NDA) measurements, are also included in this project.

This project management plan addresses the tasks required to complete remedial actions identified in Reference 1. Proposed time-line schedules, estimated cost and the manpower resources required to complete this project are also included.

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2. Executive Summary

Selected portions of 234-5Z ventilation ducting and service piping containing plutonium have been identified, in chronological order, for near-term removal and recovery of plutonium holdup material. A series of specific enhanced monitoring activities, primarily for exhaust stack manifold ducting, have also been identified. These combined activities are termed remedial actions. This project management plan provides the proposed baseline schedules, estimated cost, and manpower resources required to complete these identified remedial actions.

The resources identified provide an estimate of the funding and manpower requirements necessary to complete this project within the established timeframe. The estimated cost is 5.8 million in fiscal year 1989 functional dollars. The project duration is estimated at four years, from fiscal year 1989 through fiscal year 1992. Kaiser Engineering Hanford (KEH) personnel will be used to remove one of the identified piping segments. All other identified piping segments will be removed by Westinghouse Hanford Company (WHC) personnel.

The estimated cost and manpower resources for this project do not include funding for either the Decontamination and Decommissioning (D&D) of the 232-Z Building or the near-term isolation of this building from the 291-Z Building. The final cost and manpower resources for this project will not be firmly established until an engineering study on the 232-Z Building has been performed to identify the best isolation and subsequent D&D approach.

3. Discussion

3.1 Plutonium Holdup in 234-5Z Ventilation Ducting & Service Piping

Prior to unlimited PFP operations restart in July 1988, a review of the amount of plutonium accumulation in 234-5Z ventilation ducting and active service piping was made. This review was performed by examining portable NDA data collected from December 1986 through May 1988 on ventilation ducting and 26-inch process vacuum piping. Also, during February 1988, while replacing filter box 9AB in Room 262 with a new filter box, direct physical samples from the interior surfaces of the exhaust stack manifold system downstream from final HEPA filters were taken and destructively analyzed for plutonium content. More recently, in November and December 1988, additional NDA measurements were performed on 234-5Z primary filter boxes and RMC Line ventilation ducting (References 2 and 3). The results of these analyses, both nondestructive and destructive, indicate a total plutonium accumulation of 11 kilograms (kg). The locations of this plutonium accumulation are schematically presented in Figures 1 and 2.

Figure 1 illustrates the 234-5Z ventilation ducting and exhaust stack manifold system and details a plutonium accumulation of 7 kg. Figure 2 illustrates the 234-5Z active 26-inch process vacuum system and details a plutonium accumulation of 4 kg. Excluding the exhaust stack manifold plutonium accumulation, estimated by laboratory analysis of removed sections to be between 6 and 12 grams plutonium "tightly held" to the interior surfaces (References 4, 5, and 6), all but approximately 30 grams plutonium of the total 11 kg plutonium accumulation is contained within 234-5Z by at least two independent HEPA filters. This approximate 30 grams plutonium is contained in a single portion of ventilation ducting, roughly 140 feet long, which services two inactive gloveboxes in Room 179 of the Plutonium Process Support Laboratory. This ducting exhausts directly into an E-4 filter room and is thus one HEPA filter away from the environment.

Based on the quantity, physical form, and location of plutonium accumulation, an evaluation (Ref. 1) for remedial action was made. This evaluation utilized four factors to select ventilation ducting and service piping for remedial action. The factors (Ref. 1) on which this evaluation is based are: (a) prevention of criticality and prevention of unacceptable environmental release; (b) reduction to radiation exposure, as-low-as-reasonably-achievable (ALARA); (c) interference with ongoing work, such as impact to plant operations if a significant loss of contamination control resulted from a remedial action, cost of remedial action and risk of injury to the worker(s) performing the remedial action; and, (d) dollar value of plutonium material recovered and technical value of information gained, such as validation of portable NDA measurements, by implementing the remedial action.

The results of this evaluation concluded:

a. No piping segments are identified that warrant immediate removal because of safety considerations; and,

b. Five piping segments are identified which warrant additional attention and orderly removal. These five piping segments are shown in Figures 3 through 5. A physical description of each piping segment, listed in chronological order of planned removal along with the estimated plutonium accumulation, is provided in Appendix A.

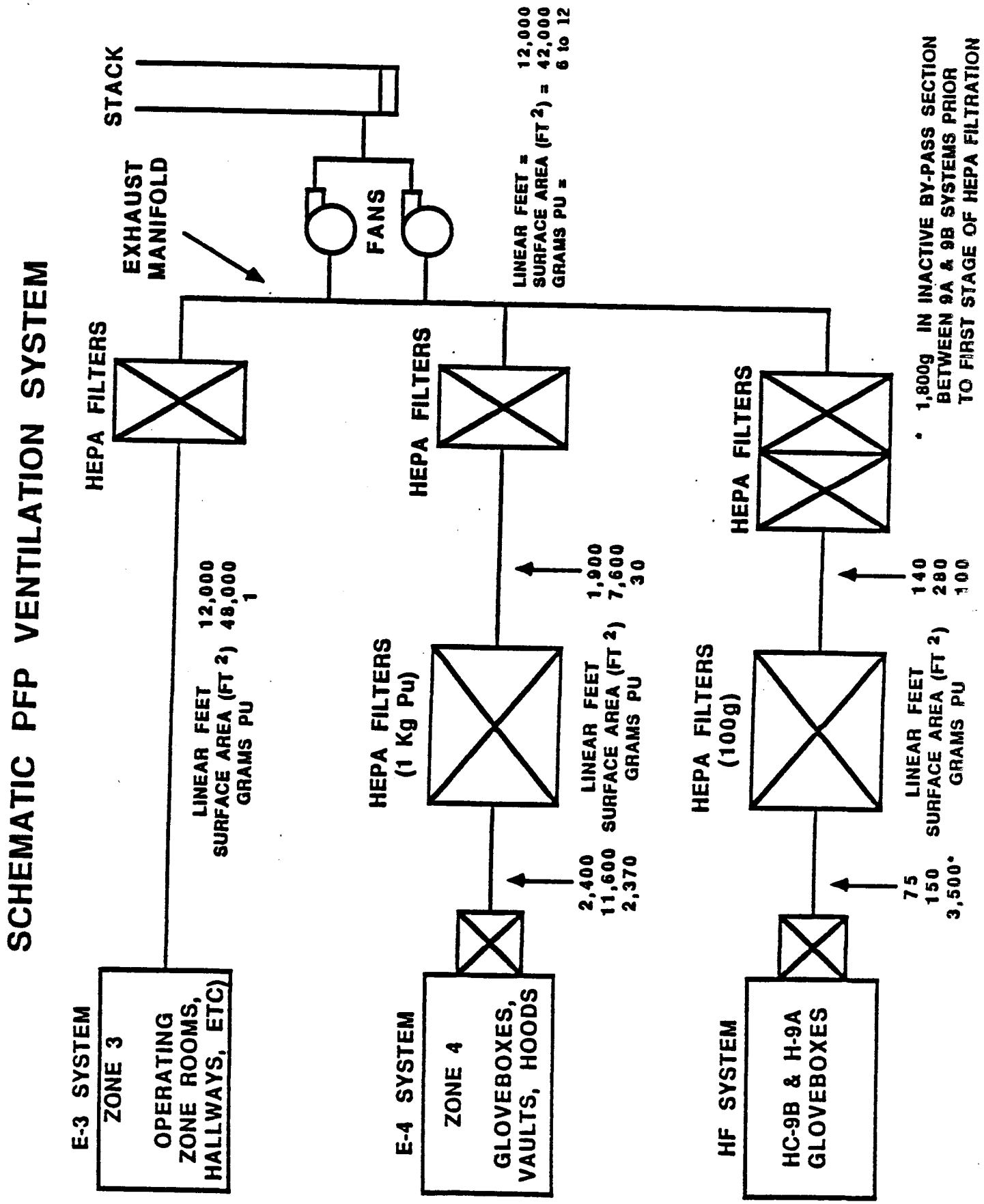
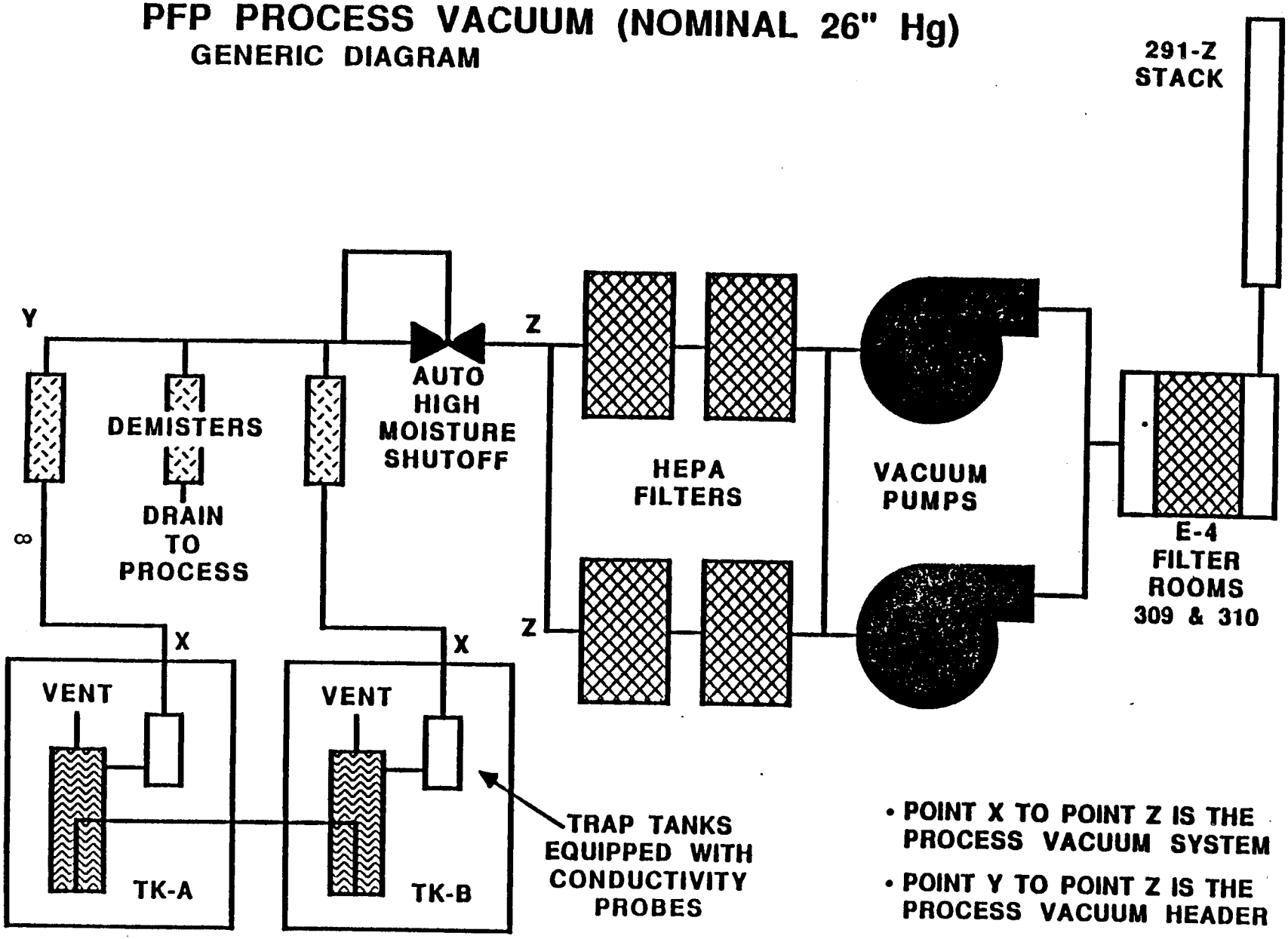

SCHEMATIC PFP VENTILATION SYSTEM
STACK
EXHAUST MANIFOLD
FANS
LINEAR FEET = 12,000
SURFACE AREA (FT 2) = 42,000
GRAMS PU = 6 to 12
HEPA FILTERS
HEPA FILTERS
HEPA FILTERS
* 1,800g IN INACTIVE BY-PASS SECTION BETWEEN 9A & 9B SYSTEMS PRIOR TO FIRST STAGE OF HEPA FILTRATION
LINEAR FEET 12,000
SURFACE AREA (FT 2) 48,000
GRAMS PU 1
HEPA FILTERS (1 Kg Pu)
LINEAR FEET 1,900
SURFACE AREA (FT 2) 7,600
GRAMS PU 30
HEPA FILTERS (100g)
LINEAR FEET 140
SURFACE AREA (FT 2) 280
GRAMS PU 100
2,400
11,600
2,370
75
150
3,500*
E-3 SYSTEM
ZONE 3
OPERATING ZONE ROOMS, HALLWAYS, ETC)
E-4 SYSTEM
ZONE 4
GLOVEBOXES, VAULTS, HOODS
HF SYSTEM
HC-9B & H-9A GLOVEBOXES

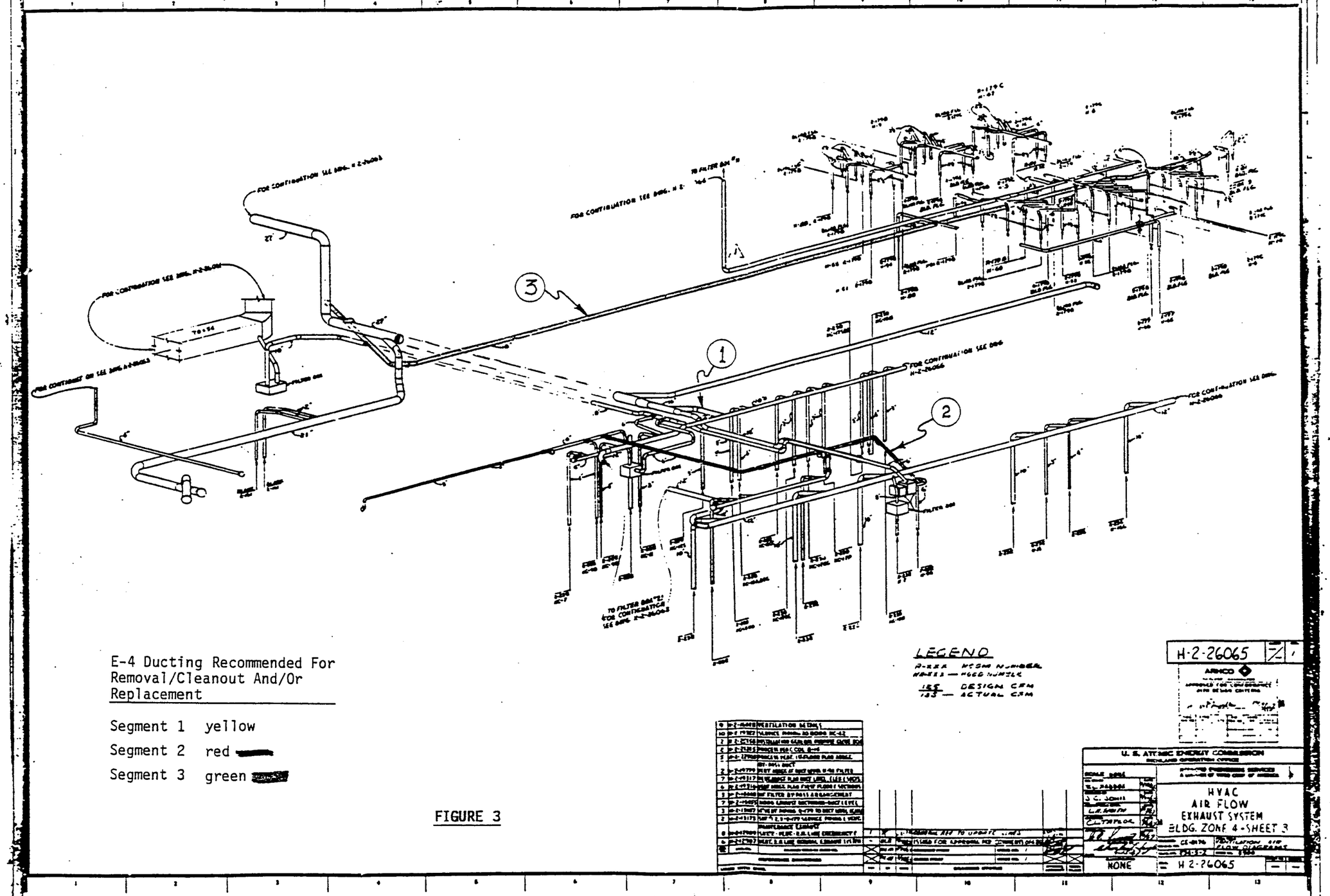
Figure 1

PFP PROCESS VACUUM (NOMINAL 26" Hg)
GENERIC DIAGRAM



- POINT X TO POINT Z IS THE PROCESS VACUUM SYSTEM
- POINT Y TO POINT Z IS THE PROCESS VACUUM HEADER
- POINT X TO POINT Z SOURCE TERM HOLDUP IS 4.3 Kg

Figure 2



E-4 Ducting Recommended For Removal/Cleanout And/Or Replacement

Segment 1 yellow

Segment 2 red [redacted]

Segment 3 green [redacted]

FIGURE 3

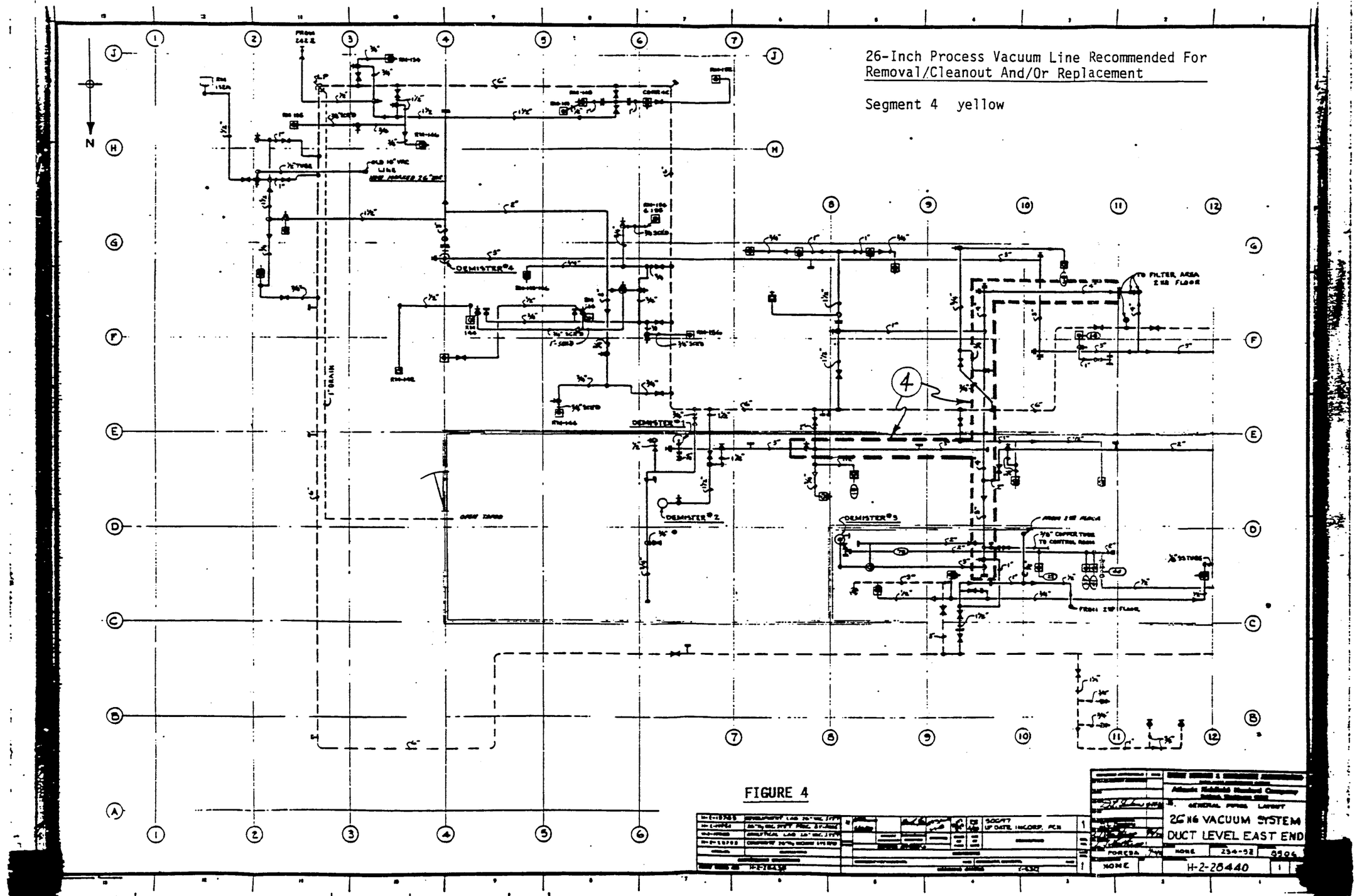

26-Inch Process Vacuum Line Recommended For Removal/Cleanout And/Or Replacement
Segment 4 yellow
N
DEMISTER #4
DEMISTER #1
DEMISTER #2
DEMISTER #5
TO FILTER AREA 2ND FLOOR
4
26 X 6 VACUUM SYSTEM
DUCT LEVEL EAST END
H-2-28440

FIGURE 4

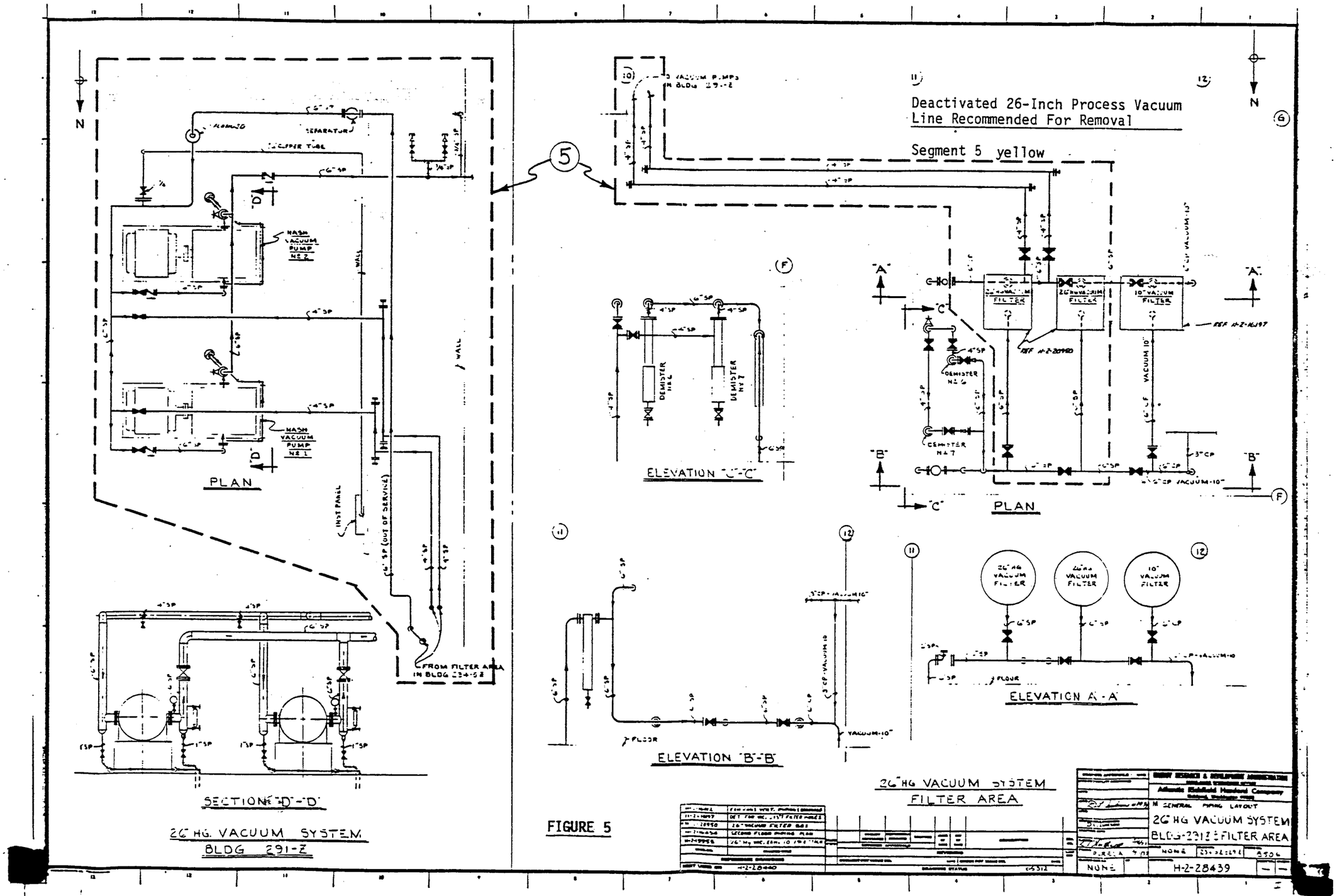

Deactivated 26-Inch Process Vacuum
Line Recommended For Removal
Segment 5 yellow
5
PLAN
ELEVATION "C"-"C"
PLAN
ELEVATION "B"-"B"
ELEVATION A-A
SECTION "D"-"D"
26" HG. VACUUM SYSTEM
BLDG 291-Z
26" HG VACUUM SYSTEM
FILTER AREA
FROM FILTER AREA
IN BLDG 234-5Z
NASH VACUUM PUMP NO 2
NASH VACUUM PUMP NO 1
DEMISTER NO 6
DEMISTER NO 7
26" HG VACUUM FILTER
10" VACUUM FILTER
INST PANEL
FLOOR
WALL
N
GENERAL PIPING LAYOUT
26" HG VACUUM SYSTEM
BLDG-291Z & FILTER AREA
NONE
H-2-28439

FIGURE 5

The chronological order for removing the identified piping segments is determined on a best engineering judgement basis utilizing the same four factors presented above to select piping segments for remedial action. Based on these factors, the order of remedial action is: (a) remove 10′ by-pass section of E-4 ventilation ducting in Room 263; (b) remove 57′ by-pass section of E-4 ventilation ducting between filter boxes 9A, in Room 264, and 9B, in Room 263; and, replace 140′ of E-4 ventilation ducting in Room 262 servicing the two inactive glove boxes in Room 179; (c) replace 150′ of active 26" process vacuum piping in Rooms 262 and 263; and, (d) remove the remnants of the older 26" process vacuum system in the 234-5Z and 291-Z Buildings.

The chronological order for remedial action is justified for the following reasons: (1) remedial action to ventilation ducting precedes remedial action to process vacuum piping because of the differences in material stability (i.e., potential for airborne dispersibility), piping geometry (i.e., criticality design) and the number of HEPA filters separating material holdup from the environment; and, (2) remedial action to the 10′ by-pass section of E-4 ventilation ducting precedes remedial action to other identified E-4 ventilation ducting because it is a small, manageable task that can be used to refine removal techniques with minimal risk to worker(s) and presents the least operational impact to the facility.

Proposed time-line schedules for the removal, in chronological order, of each of these piping segments is provided in Section 4. Due primarily to manpower constraints, piping removal activities will not begin until September 1989. Completion is anticipated by April 1992, indicating a project duration of roughly four years.

3.2 Monitoring Activities in 234-5Z

A variety of additional monitoring activities on 234-5Z ventilation ducting and service piping are to be initiated on a regularly scheduled basis. These monitoring activities are required primarily to provide baseline plutonium accumulation and characterization data on the following piping systems:

1. E4, and E-3, ventilation ducting and filter boxes;

2. Active 26-inch process vacuum piping; and

3. Exhaust stack manifold ducting.

Each of these piping systems contains plutonium holdup quantities at significantly different levels, ranging from 30 - 50 grams plutonium per foot for process vacuum piping down to 0.2 milligrams per square foot for exhaust stack manifold ducting. The baseline information required for each piping system is also significantly different, ranging from quantity and

location data for process vacuum piping to particle size and chemical fixation data for exhaust stack manifold ducting. For this reason, a variety of monitoring techniques will be utilized. These monitoring techniques can best be further explained by dividing them into two distinct categories: (a) destructive monitoring; and, (b) in-line/nondestructive monitoring. For the purposes of this Section, destructive monitoring will include any measurements which require a significant physical penetration, or entry, to gather data. In-line/nondestructive monitoring will include any measurements which can be performed externally to ventilation ducting/service piping with only minor, or no physical penetration/entry required. Therefore, destructive monitoring will include analyses performed on physical samples of ducting components, photographic inspection of interior surfaces and some Nondestructive Evaluation (NDE) testing of metal ducting pieces for stress corrosion and related information. In-line/nondestructive monitoring will include portable gamma/neutron interrogation activities, NDE testing on insitu piping segements, in-line constant air monitoring and retrievable sample probe data.

3.2.1 Destructive Monitoring

A variety of destructive monitoring activities will be performed during this project. These destructive monitoring activities will focus primarily on exhaust stack manifold ducting. It is recognized that the PFP has a long history of safe operation with respect to radioactive material release (Ref. 1). The fact that radioactive material is controlled closely, and maintained well within established limits, is also supported by an extensive sampling and evaluation effort conducted by the Pacific Northwest Laboratories (PNL) in 1971 and 1973 (References 8 and 9). Since only a limited amount of current plutonium accumulation data on exhaust stack manifold ducting is available (Reference 4); and, since no recent technical studies have been performed, additional destructive monitoring activities are justified to verify existing plutonium accumulation data and identify possible changes in the distribution of aerodynamic sizes of plutonium-containing particles measured during studies conducted in the early 1970's. It is recognized that processing activities conducted in the PFP are different today than in the 1970's (i.e., 232-Z incinerator no longer operational, changes to the HF system made, et cetera).

The following destructive monitoring will be implemented to track, characterize and identify plutonium accumulation in exhaust stack manifold ducting:

a. Multiple sampling of filter rooms 309 (outlet), 313 (inlet) and 314 (outlet);

b. Removal and analysis of inspection plates from the discharge side of filter rooms 312 and 315;

c. Removal and analysis of one lower inspection plate from the discharge plenum exterior to the 234-5Z Building;

d. Removal and analysis of one middle plug from the 232-Z plenum in the 291-Z Building; and,

e. Multiple sampling of exhaust fan Number 7 (EM-7) housing port cover and fan blade and exhaust turbine Number 9 (ET-9) outlet damper inspection port.

f. Institute a program for sampling and measurement during maintenance activities involving ductwork and service piping. This can be accomplished by implementing a Job Control procedure to the Work Authorization and Tracking System.

The above destructive monitoring activities are consistent with the enhanced monitoring recommendations presented in Reference 1 and followup inspection by PFP Process Engineering (Reference 10). Baseline analytical data to be obtained from thief samples, such as scrapings, dust and paint chips, will include plutonium and americium-241 content by weight, particle size and chemical makeup. Baseline analytical data to be obtained from ducting components, such as inspection plates and fan port covers, will include plutonium and americium-241 content by surface area, chemical fixation/removability, moisture content and NDE testing as appropriate. Photographs of interior surfaces of exhaust stack manifold ducting will be taken, where practical. Replicate sampling will be employed to facilitate statistical evaluation of data. A proposed time-line schedule of these destructive monitoring activities is presented in Figure 6.

While not specifically defined at this time, a variety of destructive analyses will be performed on each removed piping segment. Accumulations of material found in exhaust stack manifold ducting may be sampled and analyzed. The removal of an inspection plate from the exhaust stack manifold in the 291-Z Building near the base of the stack is also being considered. This task could determine, by visual inspection and destructive sample analyses, the type, quantity and physical form of radioactive material at the base of the stack. These tasks can be performed in fiscal year 1989 without impact to identified budget and manpower resources.

In addition to the above destructive monitoring activities, an independent technical study by the PNL will be performed. This study will focus on the characterization of radioactive particles, such as particle size distribution and total concentration, in exhaust stack manifold ducting. Obtaining particle size distribution data, in terms of aerodynamic characteristics, will generate information directly usable in existing dispersion/deposition models that can forecast spatial distribution and

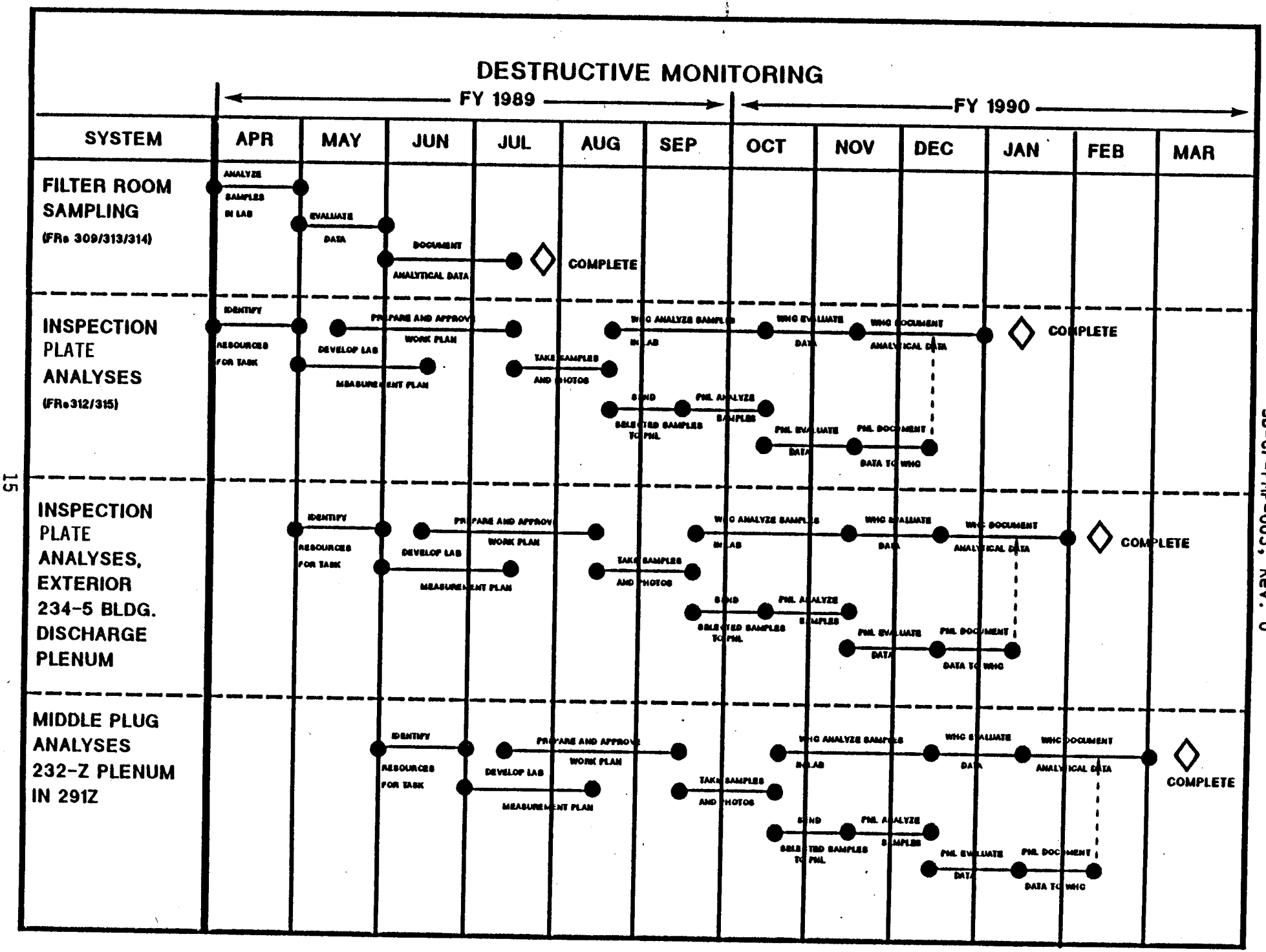

DESTRUCTIVE MONITORING
FY 1989
FY 1990
SYSTEM
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
FILTER ROOM SAMPLING
(FRs 309/313/314)
ANALYZE SAMPLES IN LAB
EVALUATE DATA
DOCUMENT ANALYTICAL DATA
COMPLETE
INSPECTION PLATE ANALYSES
(FRs 312/315)
IDENTIFY RESOURCES FOR TASK
PREPARE AND APPROVE WORK PLAN
DEVELOP LAB MEASUREMENT PLAN
TAKE SAMPLES AND PHOTOS
SEND SELECTED SAMPLES TO PNL
PNL ANALYZE SAMPLES
PNL EVALUATE DATA
PNL DOCUMENT DATA TO WHC
WHC ANALYZE SAMPLES IN LAB
WHC EVALUATE DATA
WHC DOCUMENT ANALYTICAL DATA
COMPLETE
INSPECTION PLATE ANALYSES, EXTERIOR 234-5 BLDG. DISCHARGE PLENUM
IDENTIFY RESOURCES FOR TASK
PREPARE AND APPROVE WORK PLAN
DEVELOP LAB MEASUREMENT PLAN
TAKE SAMPLES AND PHOTOS
SEND SELECTED SAMPLES TO PNL
PNL ANALYZE SAMPLES
PNL EVALUATE DATA
PNL DOCUMENT DATA TO WHC
WHC ANALYZE SAMPLES IN LAB
WHC EVALUATE DATA
WHC DOCUMENT ANALYTICAL DATA
COMPLETE
MIDDLE PLUG ANALYSES 232-Z PLENUM IN 291Z
IDENTIFY RESOURCES FOR TASK
PREPARE AND APPROVE WORK PLAN
DEVELOP LAB MEASUREMENT PLAN
TAKE SAMPLES AND PHOTOS
SEND SELECTED SAMPLES TO PNL
PNL ANALYZE SAMPLES
PNL EVALUATE DATA
PNL DOCUMENT DATA TO WHC
WHC ANALYZE SAMPLES IN LAB
WHC EVALUATE DATA
WHC DOCUMENT ANALYTICAL DATA
COMPLETE

Figure 6

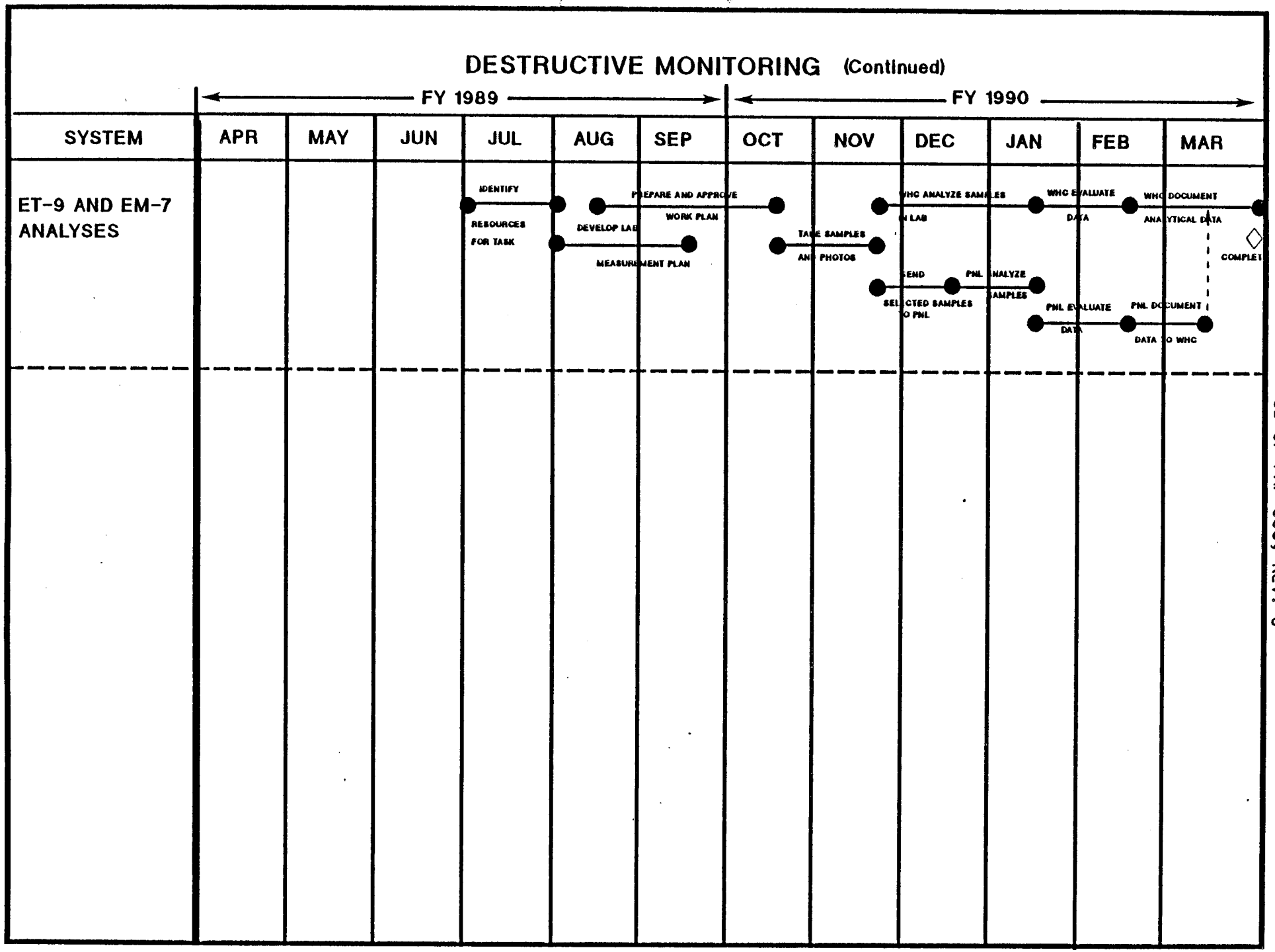


Figure 6

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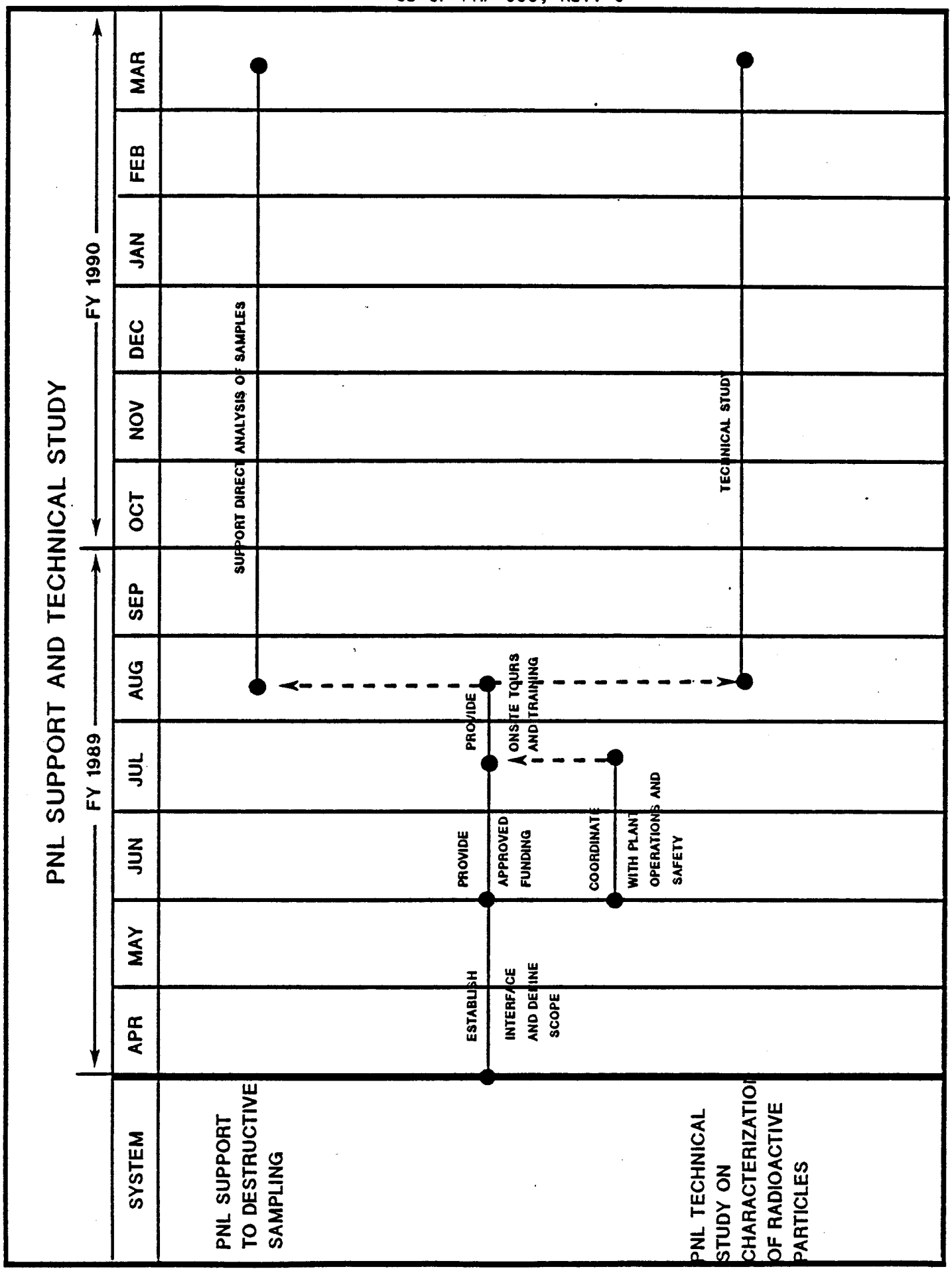
PNL SUPPORT AND TECHNICAL STUDY
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PNL TECHNICAL STUDY ON CHARACTERIZATION OF RADIOACTIVE PARTICLES
ESTABLISH
INTERFACE AND DEFINE SCOPE
PROVIDE
PROVIDE
APPROVED FUNDING
ONSITE TOURS AND TRAINING
COORDINATE
WITH PLANT OPERATIONS AND SAFETY
SUPPORT DIRECT ANALYSIS OF SAMPLES
TECHNICAL STUDY

Figure 7

predict build-up on ducting (Reference 8). PNL laboratory support will also be utilized to provide independent laboratory analysis of selected samples obtained during the above destructive monitoring activities. A proposed time-line schedule for this independent PNL technical study and laboratory support is presented in Figure 7.

As shown in Figures 6 and 7 direct sampling of filter rooms 309, 313, and 314 is currently in progress with anticipated completion in late July 1989. To complete preparation activities and coordinate PNL involvement, the taking of physical samples to support the remaining destructive monitoring activities will not commence until mid July 1989 with anticipated completion in January 1990 through late March 1990.

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3.2.2 In-Line/Nondestructive Monitoring

The following in-line/nondestructive monitoring systems, some of which are not currently available (i.e., new), will be utilized to track, characterize and identify plutonium accumulation in ventilation ducting, service piping and exhaust stack manifold ducting:

a. portable NaI(TI) detector assay systems;

b. portable JOMAR survey assay systems (new);

c. portable germanium detector assay systems (new);

d. constant air monitors (CAMs);

e. passive neutron/gamma activation systems (new);

f. retrievable sample rods/probes (new); and,

g. shielded cutie pie detector system.

Since approximately 60 percent of these monitoring systems are not currently available or require further evaluation before use, procurement of special materials, specific in-line calibration and/or installation activities will be required prior to their routine application in the plant. A proposed time-line schedule is presented in Figure 8 detailing the necessary activities that must be completed before these new monitoring systems can be implemented. The remaining monitoring systems are readily available, or are currently on-line, and routine monitoring activities can be initiated or continued. Figure 9 presents a proposed time-line schedule for the implementation of available monitoring systems, including the identification of piping segments to be monitored and the installation of additional CAMs.

As shown in Figure 8 the JOMAR Survey system, a portable, shielded Geiger-Mueller counter with direct interface to a ratemeter, will replace the shielded Cutie Pie assay system for gross source term identification throughout the plant in October 1989. However, the routine use of portable germanium detector assay systems will not be available until late in the third quarter of calendar year 1990. Since this nondestructive assay system will significantly improve measurement resolution (better accuracy/precision), while decreasing the detection efficiency (higher detection limit), a comparison between NaI(TI) and germanium detector assay data must be made and evaluated prior to routine application. This comparison study is anticipated to take between three and six months. Due primarily to the need to obtain better destructive chemical fixation data on exhaust stack manifold ducting prior to physical penetration, data from sample rods and/or probes will not be available until mid October 1989.

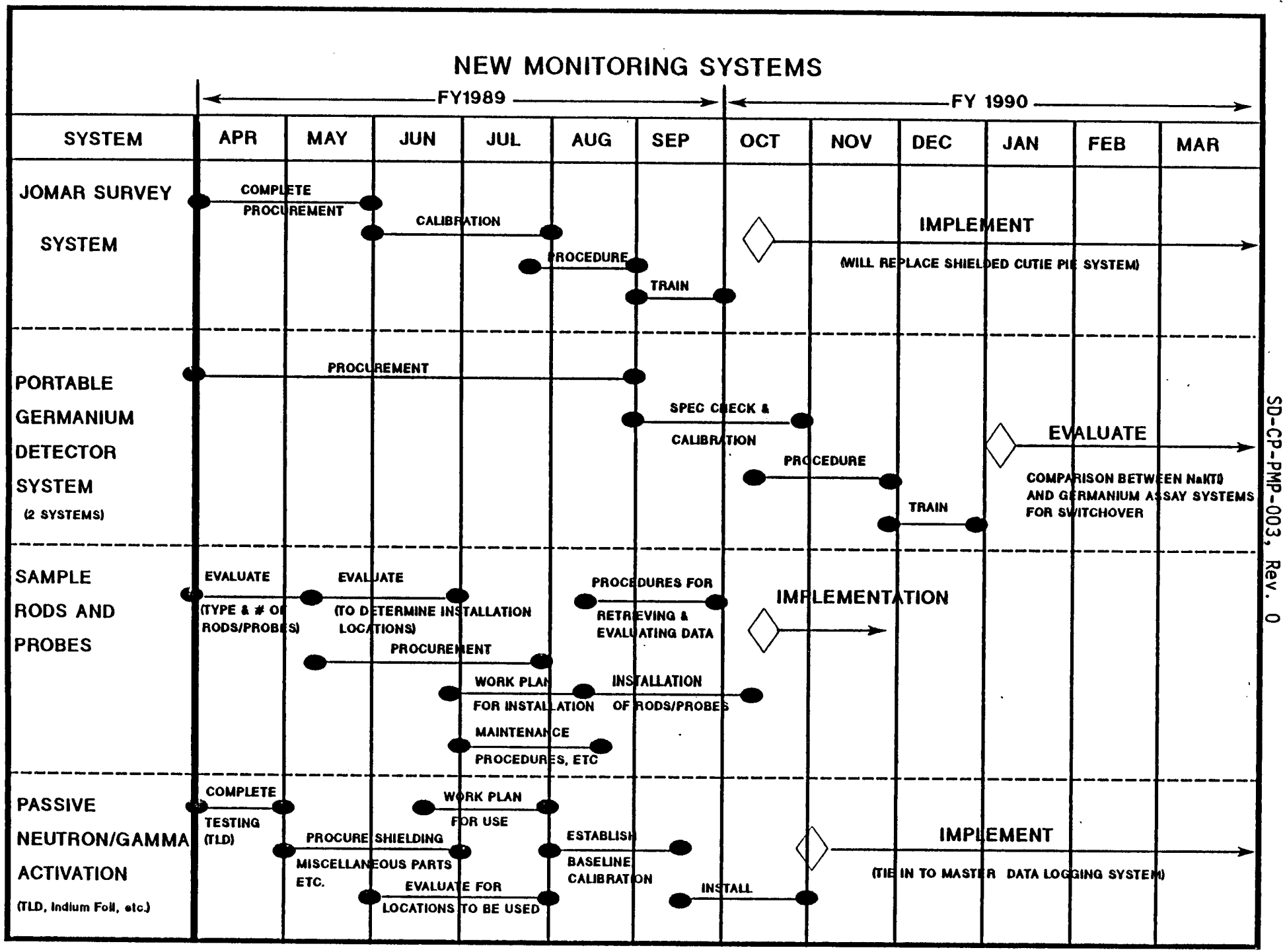

NEW MONITORING SYSTEMS
FY1989
FY 1990
SYSTEM
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
JOMAR SURVEY SYSTEM
COMPLETE PROCUREMENT
CALIBRATION
PROCEDURE
TRAIN
IMPLEMENT
(WILL REPLACE SHIELDED CUTIE PIE SYSTEM)
PORTABLE GERMANIUM DETECTOR SYSTEM
(2 SYSTEMS)
PROCUREMENT
SPEC CHECK & CALIBRATION
PROCEDURE
TRAIN
EVALUATE
COMPARISON BETWEEN NaI(Tl) AND GERMANIUM ASSAY SYSTEMS FOR SWITCHOVER
SAMPLE RODS AND PROBES
EVALUATE (TYPE & # OF RODS/PROBES)
EVALUATE (TO DETERMINE INSTALLATION LOCATIONS)
PROCUREMENT
WORK PLAN FOR INSTALLATION
INSTALLATION OF RODS/PROBES
MAINTENANCE PROCEDURES, ETC
PROCEDURES FOR RETREVING & EVALUATING DATA
IMPLEMENTATION
PASSIVE NEUTRON/GAMMA ACTIVATION
(TLD, Indium Foil, etc.)
COMPLETE TESTING (TLD)
PROCURE SHIELDING MISCELLANEOUS PARTS ETC.
WORK PLAN FOR USE
EVALUATE FOR LOCATIONS TO BE USED
ESTABLISH BASELINE CALIBRATION
INSTALL
IMPLEMENT
(TIE IN TO MASTER DATA LOGGING SYSTEM)

Figure 8

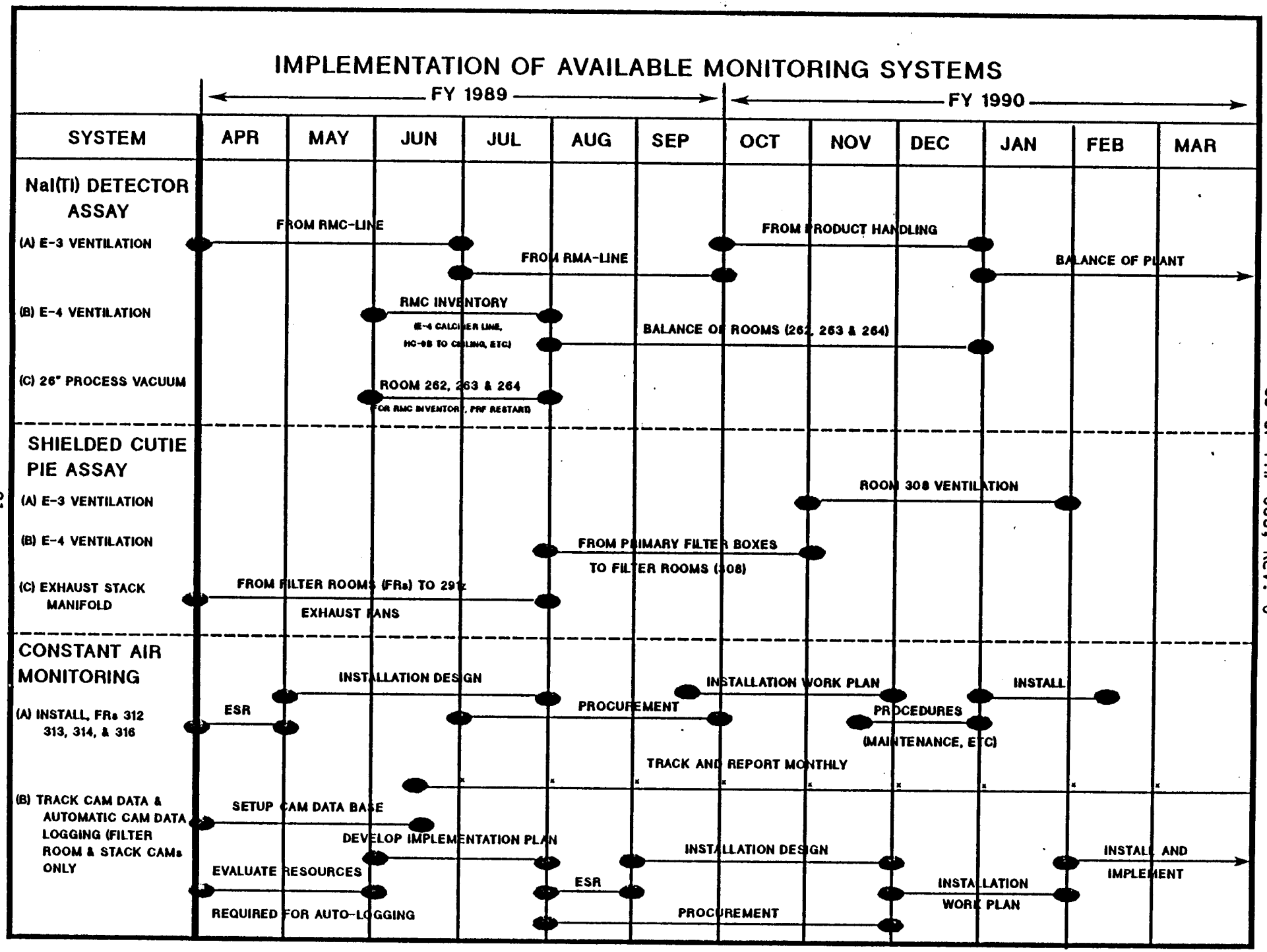

IMPLEMENTATION OF AVAILABLE MONITORING SYSTEMS
FY 1989
FY 1990
SYSTEM
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
NaI(Tl) DETECTOR ASSAY
(A) E-3 VENTILATION
FROM RMC-LINE
FROM PRODUCT HANDLING
FROM RMA-LINE
BALANCE OF PLANT
(B) E-4 VENTILATION
RMC INVENTORY
BALANCE OF ROOMS (262, 263 & 264)
(C) 26" PROCESS VACUUM
ROOM 262, 263 & 264
SHIELDED CUTIE PIE ASSAY
(A) E-3 VENTILATION
ROOM 308 VENTILATION
(B) E-4 VENTILATION
FROM PRIMARY FILTER BOXES
TO FILTER ROOMS (308)
(C) EXHAUST STACK MANIFOLD
FROM FILTER ROOMS (FRs) TO 291Z
EXHAUST FANS
CONSTANT AIR MONITORING
(A) INSTALL, FRs 312 313, 314, & 316
INSTALLATION DESIGN
ESR
INSTALLATION WORK PLAN
INSTALL
PROCUREMENT
PROCEDURES
(MAINTENANCE, ETC)
TRACK AND REPORT MONTHLY
(B) TRACK CAM DATA & AUTOMATIC CAM DATA LOGGING (FILTER ROOM & STACK CAMs ONLY
SETUP CAM DATA BASE
DEVELOP IMPLEMENTATION PLAN
INSTALLATION DESIGN
INSTALL AND IMPLEMENT
EVALUATE RESOURCES
ESR
INSTALLATION WORK PLAN
REQUIRED FOR AUTO-LOGGING
PROCUREMENT

Figure 9

However, pending favorable results from in-progress passive neutron activation testing, such as thermoluminescent dosimetry (TLD), this type of monitoring system could be available for installation at selected ventilation and exhaust stack manifold ducting in mid-September 1989, with implementation in November 1989. It is evident that the majority of in-line/nondestructive monitoring systems available for use in early calendar year 1989 are those which have already been used to measure plutonium accumulation in ventilation ducting and service piping. For this reason, Figure 9 provides the best summary of proposed in-line/nondestructive monitoring activities that will be routinely used throughout calendar year 1989.

An evaluation of existing HEPA filter failure rates for 236-Z and 234-5Z primary filter boxes will be made by August 1989. This evaluation, using primarily historical data, will document the real-time HEPA filter life at specific filter boxes. If needed, additional dioctylphthalate aerosol testing will be performed on primary filter boxes. A tabulation of plutonium holdup in ventilation ducting leading to specific primary filter boxes will then be made. This tabulation will require additional portable NDA plutonium measurements and will be completed by December 1989. A formal report will then be prepared recommending a frequency of HEPA filter change, by filter box, so that failure of HEPA filters in active filter boxes can be avoided. In this manner, the risk of exposing downstream ventilation ducting to further plutonium holdup due to undetected HEPA filter failures can be significantly reduced. This formal report will be issued in March 1990.

3.3 Near-Term Isolation of 232-Z

The 232-Z Building, which formerly contained a plutonium waste incineration capability, is no longer in service. The main process room is currently in an "On Mask" status. The glove boxes for sorting, chopping and leaching have been removed; however, the furnace glove box, scrubber cell and related equipment are still in place. Two of the E-3 pre-filters were recently replaced to improve room negative. The Number 1 E-4 filter box does not pass DOP test; efforts to replace the HEPA filters in this box were thwarted by failure of a mechanical holddown device in the box.

At this time, an engineering study is needed to better identify the best isolation and subsequent D&D approach to this building. Without such information, the correct alternative for near-term isolation, such as installation of a new double pass HEPA filter box or reroute of primary exhaust ducting (i.e., where E-3 and E-4 ducting combine to enter the 291-Z Building) to a portable HEPA filtered exhauster, cannot be determined. Such alternatives need to be evaluated with respect to personnel risk, the potential for environmental release during isolation activities and the no action option.

An engineering study, to identify the best alternative options to (1) near-term isolation of this building from the 291-Z Building; and, (2) subsequent D&D, will be performed in fiscal year 1989. The anticipated completion for this engineering study is August 1, 1989.

3.4 Documentation and Control

This project is composed of a series of activities, such as monitoring activities, physical measurement activities, removal of ventilation ducting/service piping and the accountability and criticality control of nuclear materials removed during cleanout activities. To ensure that adequate planning, control and documentation are maintained throughout this project, the following formal systems will be used:

a. Work Authorization and Tracking System (WATS) in accordance with the Operations-General Administration Manual, WHC-CM-5-5, Vol. 2;

b. General document control, such as operating procedures, change authorizations, and operating specifications, in accordance with the Operations-General Administration Manual, WHC-CM-5-5, Vol. 1;

c. Nuclear material control, accountability and documentation in accordance with the Nuclear Materials Control and Accountability Manual, WHC-CM-4-34;

d. Criticality specification and criticality safety evaluation reports in accordance with the Nuclear Criticality Safety Manual, WHC-CM-4-29;

e. Radiation control and documentation in accordance with the Radiation Work Requirements and Permits Manual, WHC-CM-4-15;

f. Design and engineering control and documentation in accordance with the Standard Engineering Practices Manual, WHC-CM-6-1;

g. Quality Assurance control and documentation in accordance with the Quality Assurance Manual, WHC-CM-4-2; and,

h. Work practices and plant administration controls and documentation, such as lock and tag, safety reviews, and training, in accordance with the Plutonium Finishing Plant Administration Manual, WHC-CM-5-8.

The above formal manuals define the mandatory responsibilities, requirements and controls, training, applicable emergency and recovery responses, testing criteria, applicable inspection, audit and documentation necessary to perform functional work. For this reason, the operation, design, quality assurance and safety controls, training and documentation requirements defined in the above manuals are key to the successful completion of this project in a safe, timely and quality manner.

In addition to the above control and documentation requirements, a formal plutonium accumulation tracking and monitoring system is needed. This system will be utilized during and after completion of this project. A dedicated minicomputer system is required for this task. Such information as plutonium accumulation and location in ventilation ducting/service piping will be tracked and monitored, including input from selected constant air monitors and probes for environment release purposes. A proposed description, estimated cost and time-line implementation schedule for this system is provided in Appendix B. The primary purpose of this system is to provide plutonium holdup information on ventilation ducting and service piping for nuclear materials control and accountability. The secondary purpose is to provide long-term data for trending, and future reference, on in-plant environmental monitoring of exhaust stack manifold ducting. The official environmental monitoring function will still reside with Westinghouse's 200/600 Area Environmental Protection Section.

To ensure that all plutonium holdup data on ventilation ducting and service piping is properly documented for audit and traceability purposes, the following additional requirements are necessary:

a. Numbered Internal Memo documentation on all WHC laboratory measurements performed by the Chemical Processing Systems Engineering and PFP Engineering Departments; and,

b. Portable NDA data sheets, per procedures LA-948-349 and LA-948-384, will be retained for each portable plutonium assay.

c. A Quality Assurance program shall be developed to assure proper calibration, operation, records retention, performance of surveillances, and organizational responsibilities are properly implemented and controlled.

3.5 Integration of Activities

The proper integration of activities is also a key element to the successful completion of this project. This project will require support from many different Westinghouse functional organizations; however, only Plutonium Operations, Chemical Processing Systems Engineering, PFP Engineering, Nuclear Facility Safety, Operational Health Physics, and PFP Maintenance play significant roles. It is also recognized that physical removal of selected ventilation ducting and service piping will require formal integration with respect to monitoring, portable plutonium NDA and physical testing of removed ducting and piping segments. A logic sequence is required to ensure that the performance of these activities occurs in unison rather than at cross purposes to one another. A logic diagram is presented in Figure 10 to demonstrate the integration of activities. This logic diagram is for ventilation ducting/service piping removal activities and similar logic diagrams can be developed for enhanced monitoring activities and the PNL technical study. Review of this logic diagram for ventilation ducting/service piping removal activities indicates that key decision points must be evaluated early in planning stages well before the actual removal of piping segments can begin. These decisions involve the use of future in-line monitoring systems on parallel or replaced piping, adequacy of existing portable NDA data, and an engineered approach to the removal activity via engineering study to identify best removal option.

A Plant Forces Work Review of remedial actions identified on ventilation ducting and service piping is now in progress. For planning purposes, this project management plan has defined this work as plant forces work. However, it is recognized that the actual determination of work force, construction or plant, does <u>not</u> alter work flow, scheduling or primary manpower resources. The only manpower resource impacted by the Plant Forces Work Review is Maintenance support, the crafts that perform the actual cutting, rigging and removal of piping segments. Nuclear operators, radiation protection technicians and related manpower resources are still required, in the numbers defined in this project management plan. This manpower is required to setup greenhouses, transport removed piping segments to the disposition glovebox, remove the plutonium holdup, stabilize the recovered plutonium for safe storage and complete material assay, packaging/labeling and storage activities for plutonium recovery and future reprocessing through the Plutonium Reclamation Facility.

PLUTONIUM REMOVAL ACTIVITY

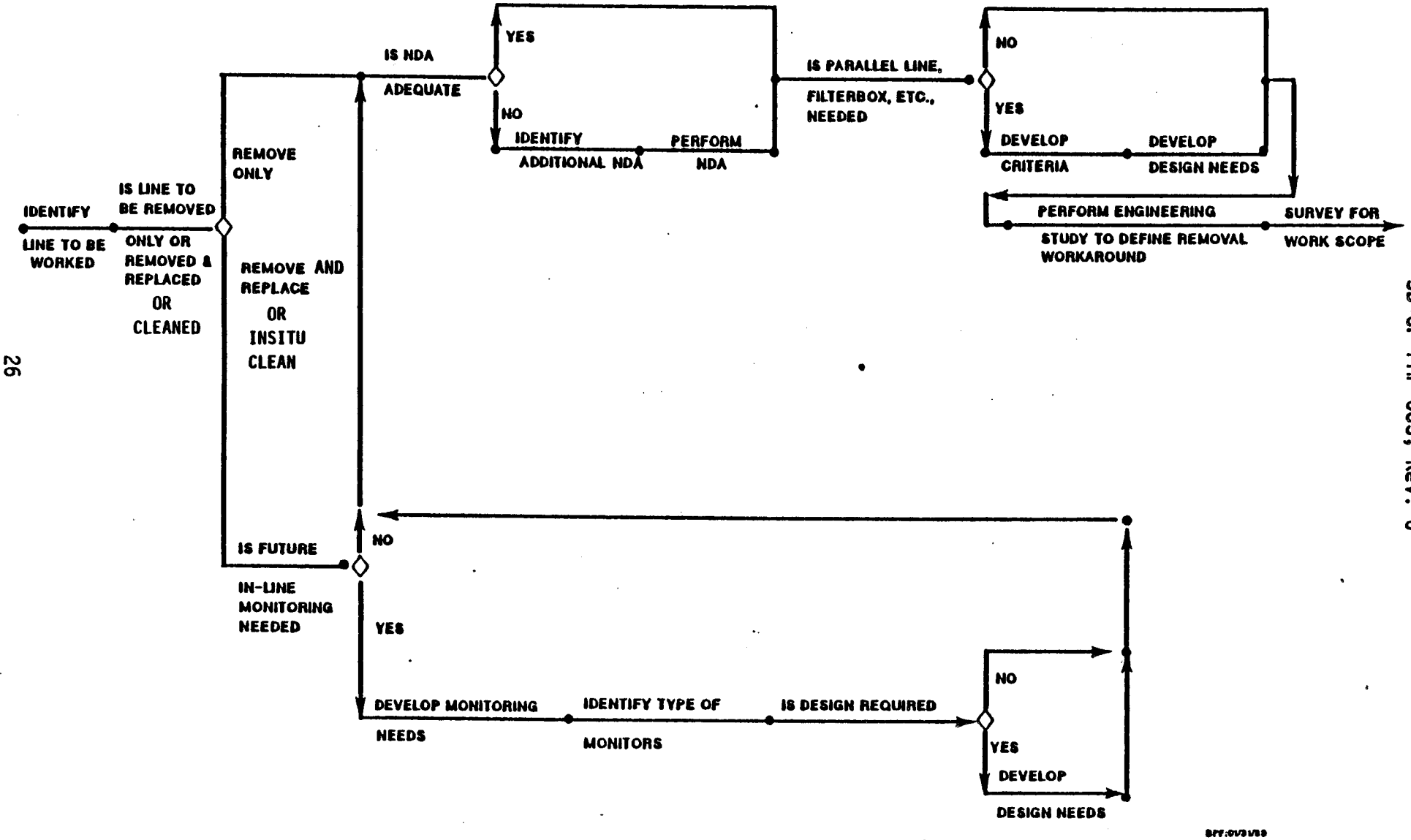


Figure 10

PLUTONIUM REMOVAL ACTIVITY

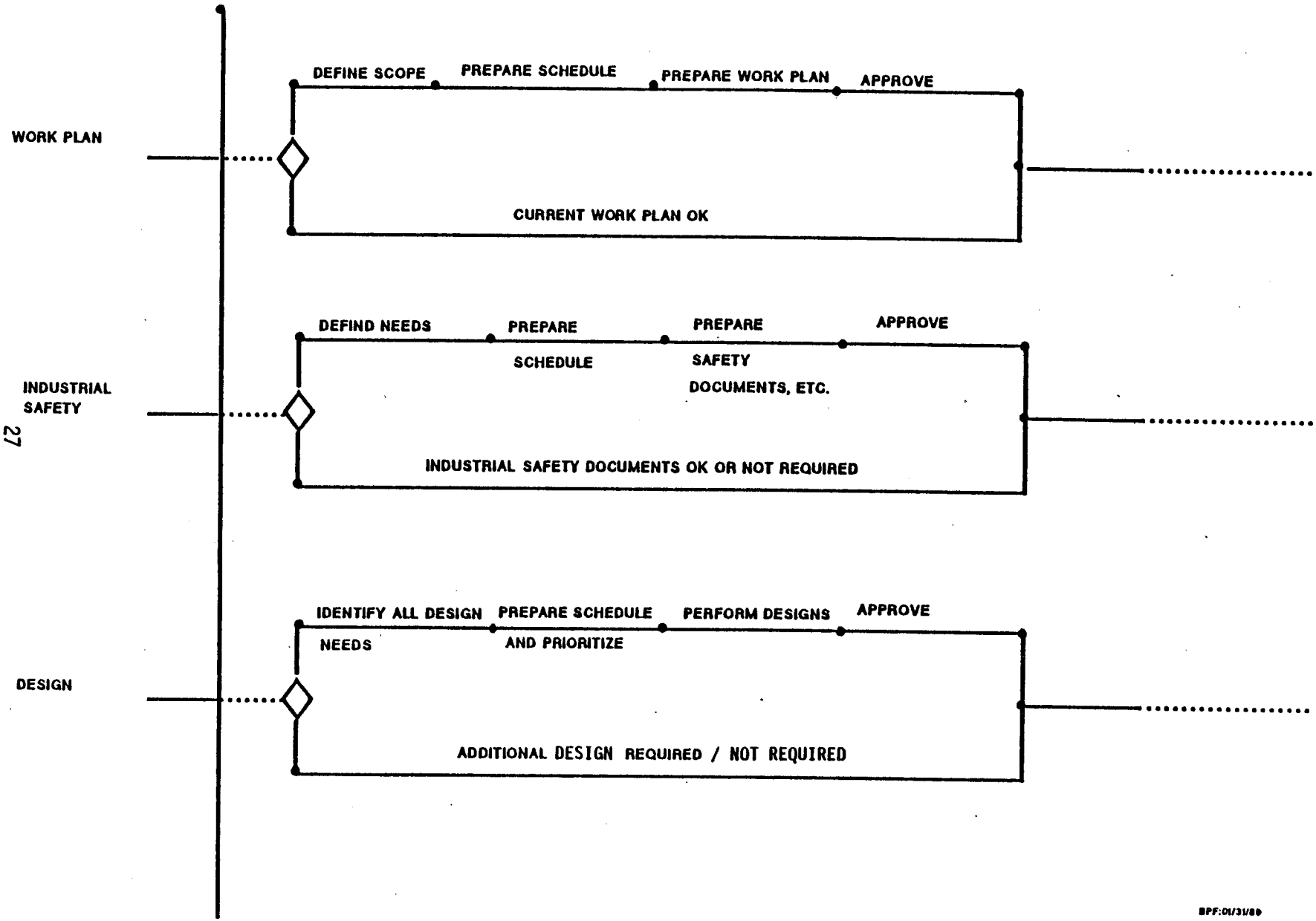


Figure 10

PLUTONIUM REMOVAL ACTIVITY

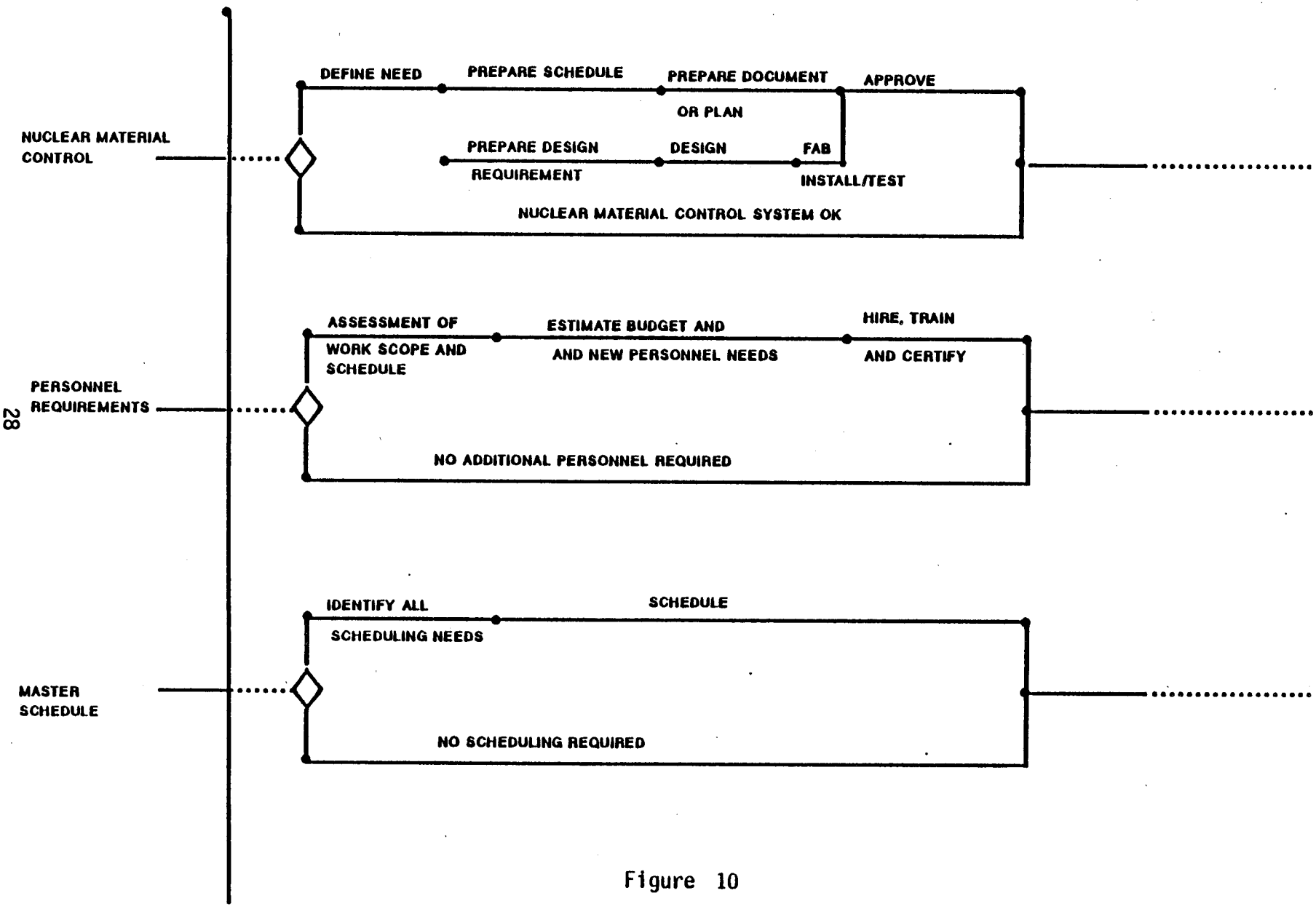


Figure 10

PLUTONIUM REMOVAL ACTIVITY

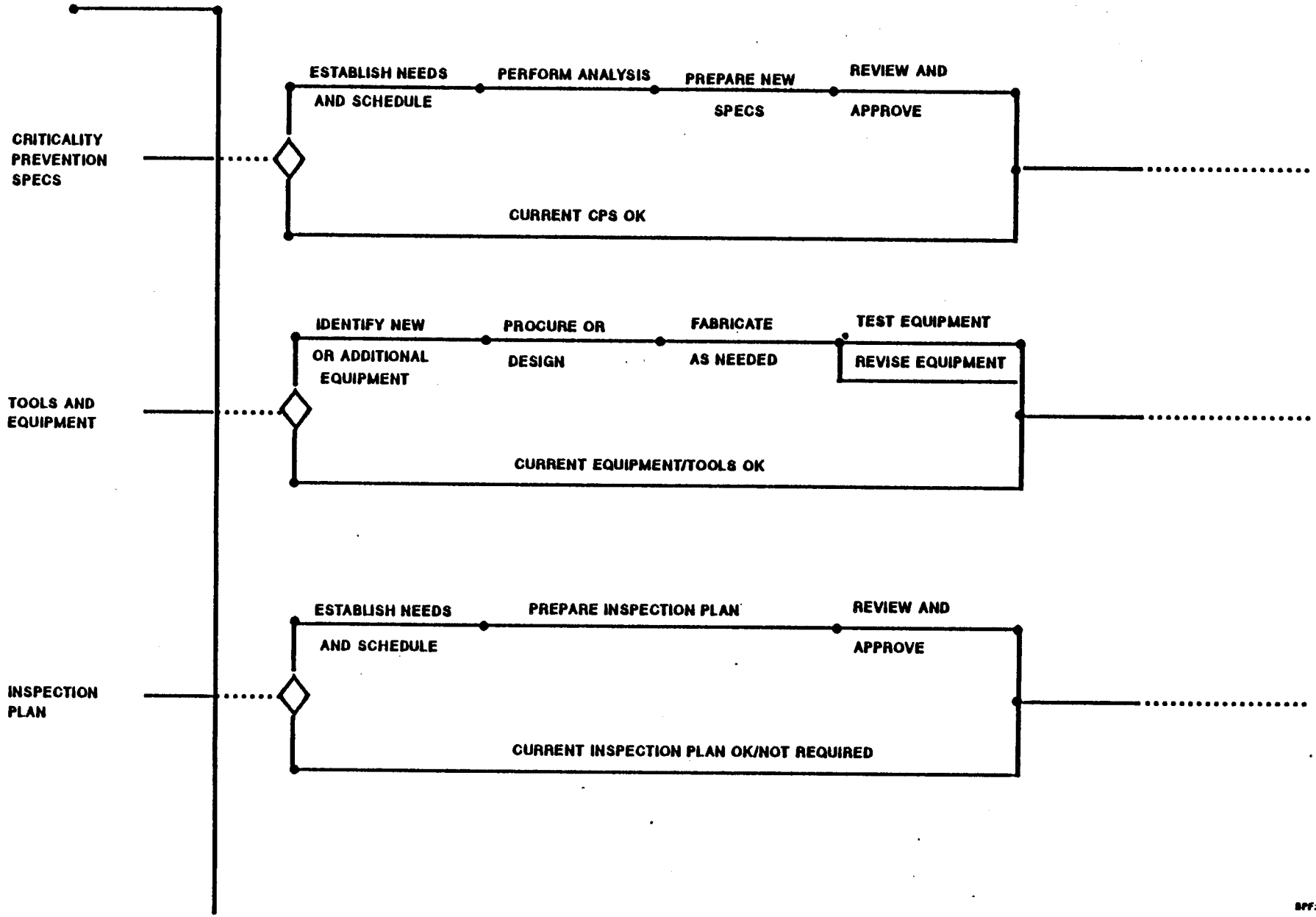


Figure 10

PLUTONIUM REMOVAL ACTIVITY

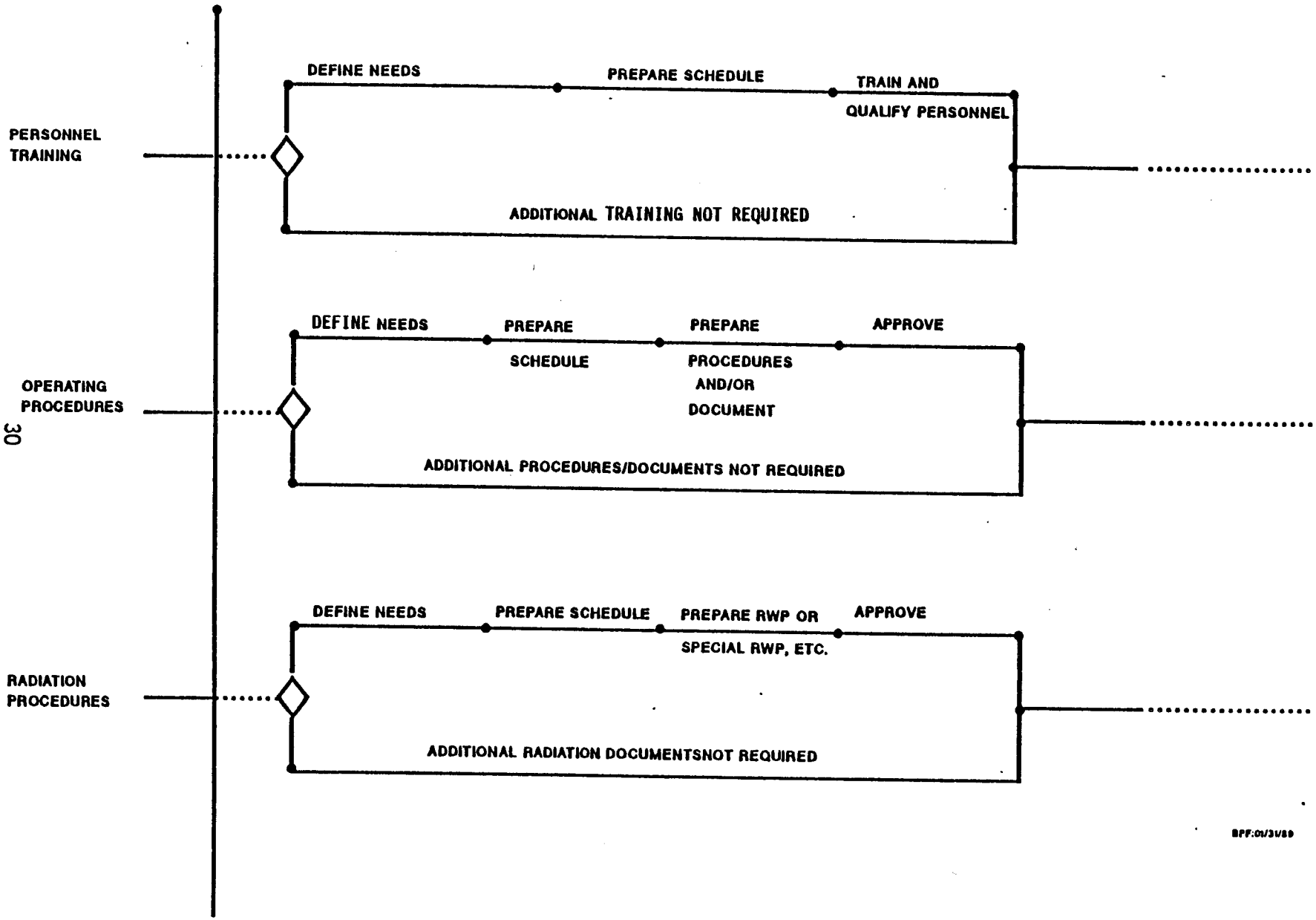


Figure 10

PLUTONIUM REMOVAL ACTIVITY

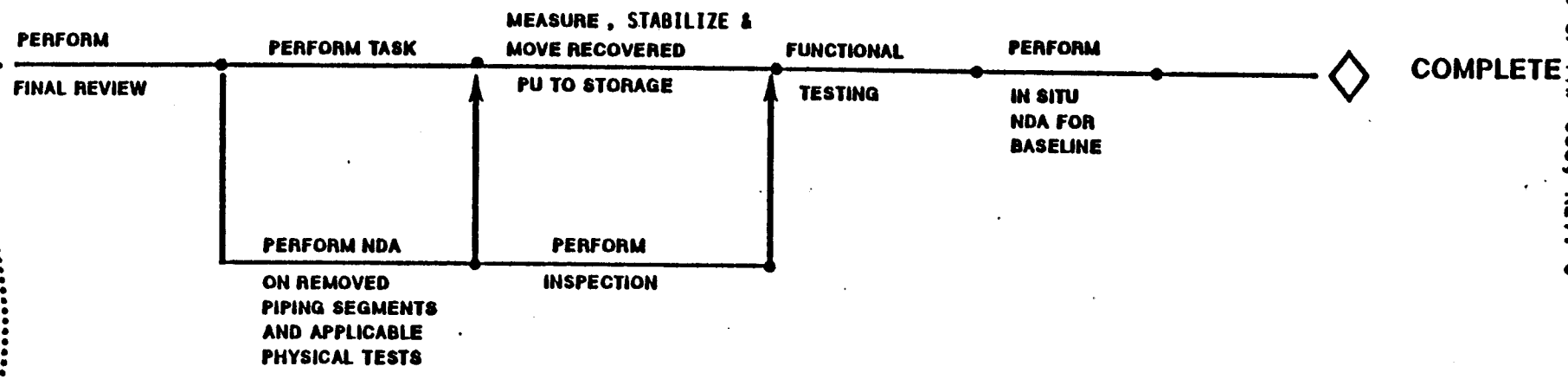


Figure 10

BPF:01/31/89

3.6 Required Resources

A dedicated, permanently assigned, crew of nuclear operators, radiation protection technicians, maintenance and engineering personnel is required to perform the ventilation ducting and service piping removal activities identified in this project. Dedicated support personnel, also permanently assigned, from other Westinghouse departments, such as PFP Nuclear Facility Safety, Production Control and Laboratories will also be required. Where necessary, services of other Hanford contractors will be obtained by this project to support the direct removal of piping segments and/or monitoring activities.

The estimated manpower resources, reporting directly to PFP Remediation Project management, are presented in Table I. Similarly, the estimated manpower resources for supporting personnel, from other Westinghouse departments, are presented in Table II. Again, these manpower resources, some of which are matrixed from other Westinghouse departments, must be permanently assigned to support this project through completion.

The manpower resources identified in Tables I and II <u>for fiscal year 1989 must come from existing staff</u>. For this reason, plant management, maintenance management, operational health physics management and engineering management must support this manpower commitment if remedial actions are to commence in fiscal year 1989. Specifically, one dedicated mechanical/HVAC engineer must be available in mid March 1989, and at least four dedicated nuclear operators must be available by mid July 1989. Dedicated support personnel from other Westinghouse departments include one, half-time, PFP Nuclear Facility Safety person, one full time design engineer, one full time plutonium operations manager between early May and mid June 1989 and one, half-time, laboratory technician from each of the PFP Analytical and Plutonium Process Support Laboratories in April 1989.

The schedules for remedial actions on selected piping segments presented in Section 4 do provide sufficient lead time to hire <u>all</u> dedicated manpower for continuation of remedial actions in future fiscal years.

Personnel training requirements, defined in the Plutonium Finishing Plant Administration Manual, WHC-CM-5-8, are considered to be baseline for training of project and support personnel. Specialized On-the-Job training for nuclear operators supporting piping segment removals will be provided by the Day Shift manager, PFP Remediation Project. This specialized training will include use of portable glove bags and related equipment/tools unique to this project.

Table I
Manpower Requirements Reporting to
PFP Remediation Project Management

Discipline	Number of Equivalent Persons			
	1989	1990	1991	1992
Nuclear Operators(1)	1.1	10	10	5
Mechanical Engineers(2)	1.1	2	2	1
Project Manager	-	1	1	.5
HVAC Engineering Expert(3)	.25	1	1	.5
Principal Scientist	.7	1	1	.5
Nuclear Operator Manager(1)	.6	1	1	.5
TOTAL	3.8	16	16	8

(1) Four full time operators and one manager must be available by June 30, 1989, to complete the removal of Segment 1 piping. Ten "new hire" operators must be available by December 31, 1989.

(2) One full time mechanical engineer must be available in early March 1989; a second full time mechanical engineer must be available by mid April 1989. This engineering support to be obtained by Purchase Contract.

(3) A full time HVAC expert is not required until mid April 1989. This engineering support to be obtained by Purchase Contract.

Table II
Manpower Requirements
from Supporting Organizations

Discipline	Number of Equivalent Persons			
	1989	1990	1991	1992
Operational Health Physics (3)	.5	3	3	1.5
Production Control Manager(1)	.25	.5	.5	.25
Planner/Scheduler(1)	.25	.5	.5	.25
PFP Laboratory (Portable NDA)	.3	1	1	.5
Proc. Chem. & Eng. Lab. (Destructive Anal.)	.3	1	1	.5
PFP Nuclear Facility Safety(1)	.26	1	1	.5
PFP Maintenance(3)	1.1	6	6	3
Construction Project Manager	-	1	-	-
Quality Assurance	.12	.2	.2	.12
PFP Engineering(2)	.5	2	2	1
TOTAL	3.6	16.2	15.2	7.6

(1) An additional Production Control Outage Manager, Planner/Scheduler, and Nuclear Facility Safety representative can be jointly supported between this project and PFP Facility Services. These people must be available by mid April 1989 to complete removal of Segment 1 piping. One full time Nuclear Safety Representative is needed by September 31, 1989.

(2) Cognizant engineering (CE) support on HVAC and process vacuum systems and plant design support will be required thoughout this project. Quarter-time CE support is needed by mid April 1989, one full time person as a design engineer/CE support is needed by mid April 1989. One full time design engineer and one full time CE is needed throughout fiscal year 1992.

(3) Discussions with Operational Health Physics and PFP Maintenance management indicate that three (3) dedicated radiation protection technicians and six (6) dedicated maintenance persons (i.e., riggers, sheetmetal workers, etc.) are required to support remedial actions identified in this project plan.

4. Schedule

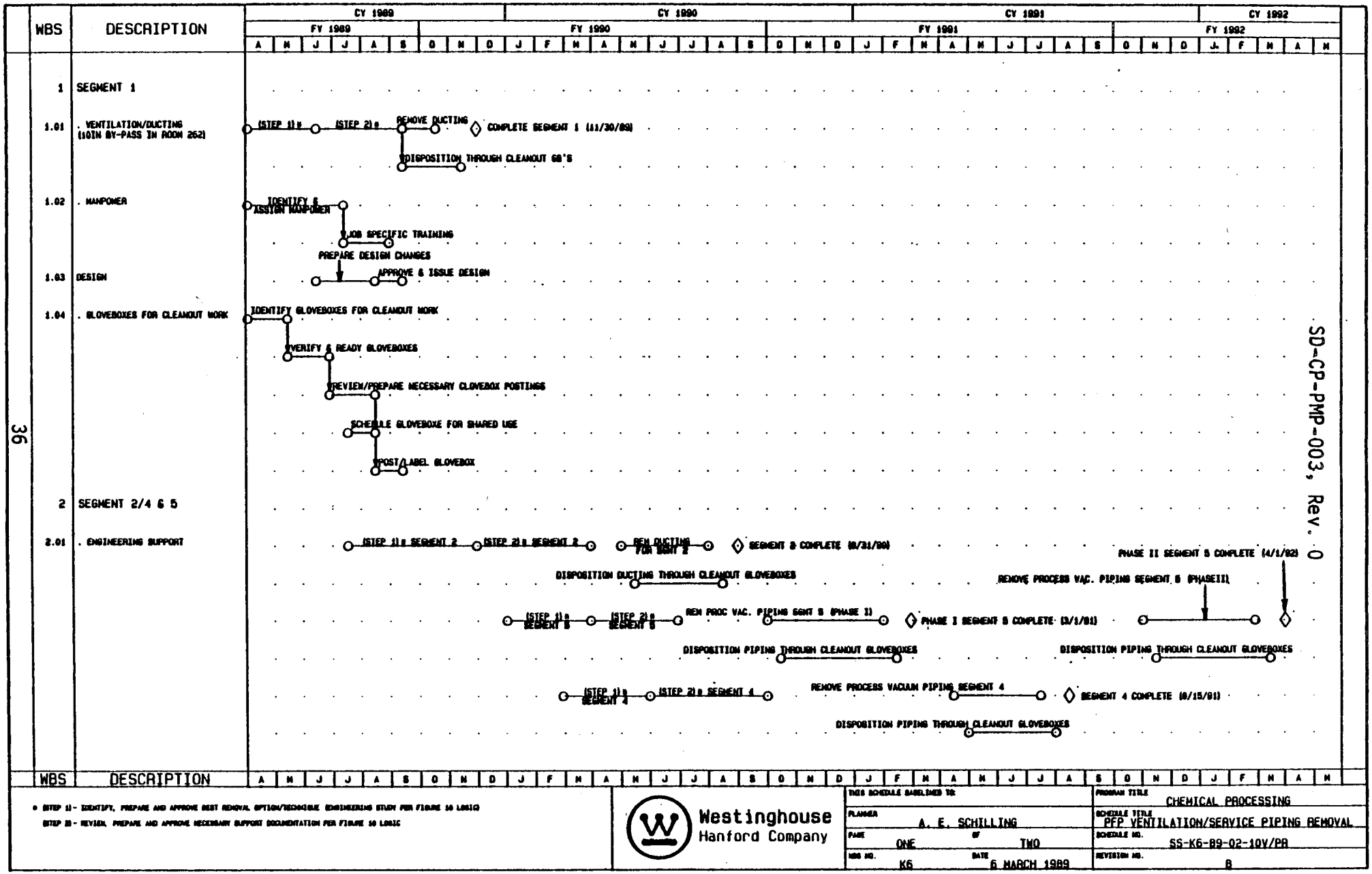
Proposed baseline schedules for the removal of selected 234-5Z ventilation ducting and service piping segments are presented in this Section. The plutonium material removed from these piping segments will be assayed, stabilized, packaged, labeled and stored for future reprocessing through the Plutonium Reclamation Facility. Glove box 235-B-2, located in Room 235-C of the 234-5Z Building, will be used to recover plutonium holdup from removed piping segments. Glove box HC-21-I, located in Room 235-B of the 234-5Z Building, will be used to stabilize recovered plutonium material for safe storage. Samples of plutonium material recovered will be obtained, where applicable, for destructive assay to verify labeled values and provide additional information, such as trace metal content, plutonium isotopic abundance and americium-241 content, useful during future reprocessing.

Proposed Schedules 1 and 2 are directly correlated to the piping segments in Appendix A. Removal of Segment 5, piping remnants of the older unused 26-inch process vacuum system, will occur in two phases. Phase 1 includes piping remnants in the 234-5Z Building; phase 2 includes piping remnants external to 234-5Z and those in 291-Z. During the preparation of these Schedules, certain assumptions and/or interactive constraints, were either required or made to maintain continuity of removal work. These assumptions, and/or interactive constraints, are:

1. To maintain operator continuity during piping removal, <u>existing</u> operators must be used to remove Segment 1 piping. This occurs for two reasons: (a) the lead time to hire new operators, estimated at 10 months, would delay Segment 1 removal an equivalent length of time; and, (b) the front-end engineering necessary to identify best removal option and technique will result in a 7 month inactive period between Segment 1 and Segment 2 removals if the same operators do both segments;

2. Overlapping front-end engineering (i.e., best removal option and technique) is required for the removal of Segments 2, 4 and 5. Furthermore, overlapping design engineering efforts are required for the removal of Segments 4 and 5;

3. Significant procurement, fabrication and installation efforts by WHC personnel were only assumed for the removal of Segment 4 piping, a 150-foot section of active 26-inch process vacuum piping;

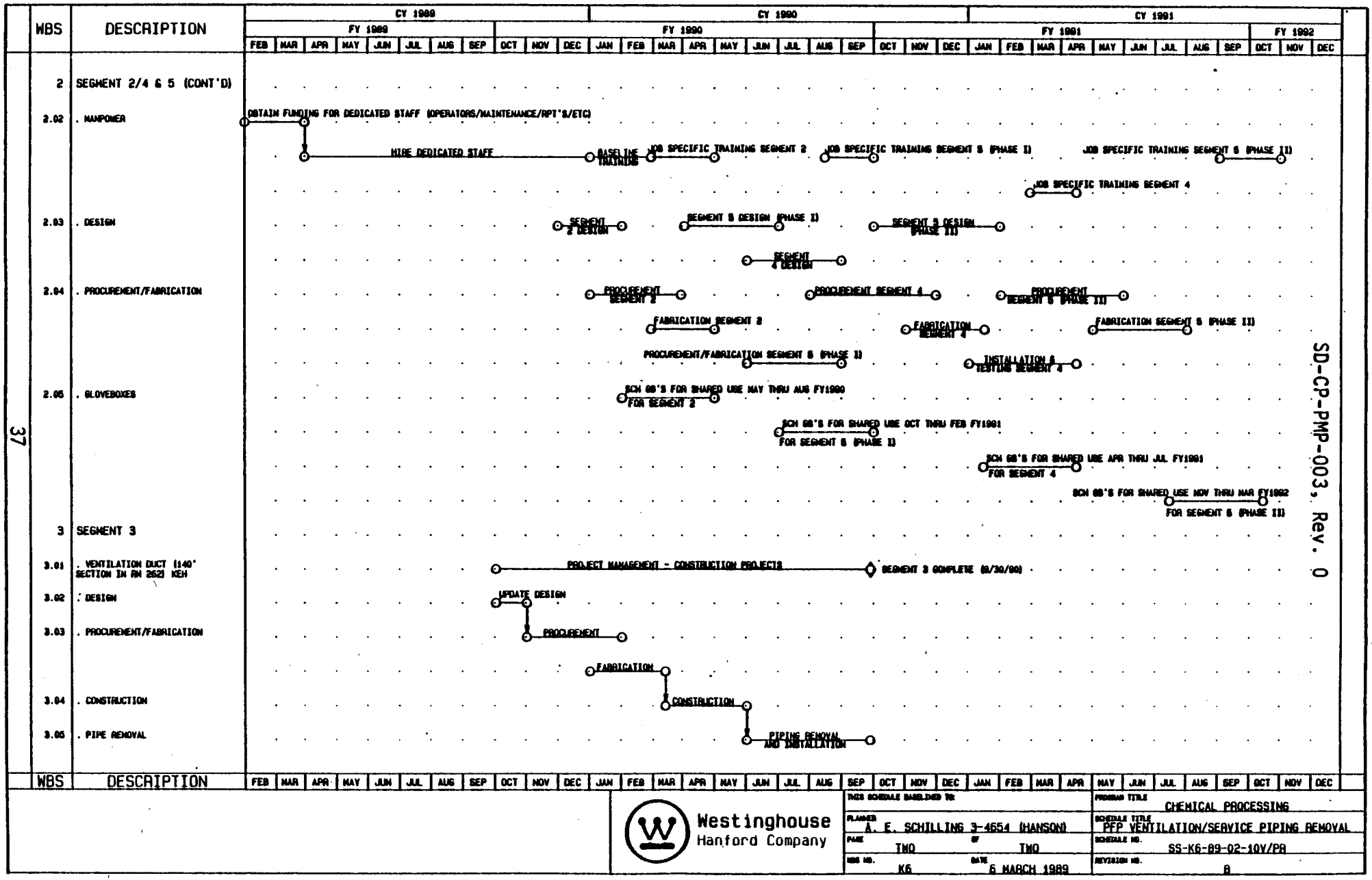


* STEP 1) - IDENTIFY, PREPARE AND APPROVE BEST REMOVAL OPTION/TECHNIQUE ENGINEERING STUDY PER FIGURE 10 LOGIC
STEP 2) - REVIEW, PREPARE AND APPROVE NECESSARY SUPPORT DOCUMENTATION PER FIGURE 10 LOGIC

Westinghouse
Hanford Company

THIS SCHEDULE BASELINED TO:	
PLANNER: A. E. SCHILLING	PROGRAM TITLE: CHEMICAL PROCESSING
PAGE: ONE OF TWO	SCHEDULE TITLE: PFP VENTILATION/SERVICE PIPING REMOVAL
WBS NO.: K6 DATE: 6 MARCH 1989	SCHEDULE NO.: SS-K6-89-02-10V/PR
	REVISION NO.: B

Schedule 1


WBS
DESCRIPTION
CY 1989
CY 1990
CY 1991
FY 1989
FY 1990
FY 1991
FY 1992
FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
2 SEGMENT 2/4 & 5 (CONT'D)
2.02 . MANPOWER
OBTAIN FUNDING FOR DEDICATED STAFF (OPERATORS/MAINTENANCE/RPT'S/ETC)
HIRE DEDICATED STAFF
BASELINE TRAINING
JOB SPECIFIC TRAINING SEGMENT 2
JOB SPECIFIC TRAINING SEGMENT 5 (PHASE I)
JOB SPECIFIC TRAINING SEGMENT 5 (PHASE II)
JOB SPECIFIC TRAINING SEGMENT 4
2.03 . DESIGN
SEGMENT 2 DESIGN
SEGMENT 5 DESIGN (PHASE I)
SEGMENT 5 DESIGN (PHASE II)
SEGMENT 4 DESIGN
2.04 . PROCUREMENT/FABRICATION
PROCUREMENT SEGMENT 2
PROCUREMENT SEGMENT 4
PROCUREMENT SEGMENT 5 (PHASE II)
FABRICATION SEGMENT 2
FABRICATION SEGMENT 4
FABRICATION SEGMENT 5 (PHASE II)
PROCUREMENT/FABRICATION SEGMENT 5 (PHASE I)
INSTALLATION & TESTING SEGMENT 4
2.05 . GLOVEBOXES
SCH GB'S FOR SHARED USE MAY THRU AUG FY1990 FOR SEGMENT 2
SCH GB'S FOR SHARED USE OCT THRU FEB FY1991 FOR SEGMENT 5 (PHASE I)
SCH GB'S FOR SHARED USE APR THRU JUL FY1991 FOR SEGMENT 4
SCH GB'S FOR SHARED USE NOV THRU MAR FY1992 FOR SEGMENT 5 (PHASE II)
3 SEGMENT 3
3.01 . VENTILATION DUCT (140' SECTION IN RM 252) KEH
PROJECT MANAGEMENT - CONSTRUCTION PROJECTS
SEGMENT 3 COMPLETE (9/30/90)
3.02 . DESIGN
UPDATE DESIGN
3.03 . PROCUREMENT/FABRICATION
PROCUREMENT
FABRICATION
3.04 . CONSTRUCTION
CONSTRUCTION
3.05 . PIPE REMOVAL
PIPING REMOVAL AND INSTALLATION
Westinghouse
Hanford Company
THIS SCHEDULE BASELINED TO:
PLANNER A. E. SCHILLING 3-4654 (HANSON)
PAGE TWO OF TWO
WBS NO. K6
DATE 6 MARCH 1989
PROGRAM TITLE CHEMICAL PROCESSING
SCHEDULE TITLE PFP VENTILATION/SERVICE PIPING REMOVAL
SCHEDULE NO. SS-K6-89-02-10V/PR
REVISION NO. 0

Schedule 2

4. KEH will be used for the removal of Segment 3 piping. This piping segment removal effort has already been designed and a new filter box purchased (Reference 11). The fiscal year 1988 cost estimate for this activity, prepared by KEH, is $320,000 (WHC independently estimated at $375,000). Reference 11 indicates this removal activity, and installation of a new filter box and corresponding ventilation ducting, can be accomplished by KEH for $400,000 in fiscal year 1989 dollars. Also, the amount of plutonium accumulation in this segment, 30 grams plutonium or 0.2 grams plutonium per linear foot, does not justify recovery; therefore, removal of plutonium through the disposition glove box will <u>not</u> be required.

Review of these proposed Schedules indicates that Segments 1 through 5 can be removed, and/or replaced, and the plutonium accumulation recovered by the following dates:

Segment 1 - November 30, 1989;

Segment 2 - August 31, 1990;

Segment 3 - August 31, 1990;

Segment 4 - August 15, 1991; and,

Segment 5 - Phase 1, March 31, 1991; Phase 2, April 1, 1992.

An alternative schedule for the removal of these identified piping segments was reviewed using only WHC personnel. These schedules indicated that an additional year would be required to complete this project. The cost estimate was also higher, by approximately $1,000,000 fiscal year 1989 dollars. The primary reason for the extended project length is the limit on manpower resources. Specifically, KEH personnel represent an additional manpower resource enabling the removal of multiple piping segments during fiscal year 1990. The magnitude of front-end engineering performed by WHC personnel is also reduced by using KEH personnel.

5. Estimated Cost

The estimated cost for this project from fiscal year 1989 through fiscal year 1992 is estimated at 5.8 million in fiscal year 1989 dollars. The cost breakdown per fiscal year is provided in Table III. The major cost for this project is labor. Kaiser Engineering Hanford cost for the removal of Segment 3 piping during calendar year 1990 is estimated at $400,000 in fiscal year 1989 dollars.

The final cost and manpower resources for this project will not be firmly established until an engineering study on the 232-Z Building has been performed to identify the best isolation and subsequent D&D approach.

Table III
Estimated Cost

Item	Dollars ($000's) FY 1989	FY 1990	FY 1991	FY 1992
Labor	595	1,910	1,840	920
KEH	-	400	-	-
PNL Study	25	-	-	-
Material	20	50	20	20
Computer	20	-	-	-
TOTAL	660	2,360	1,860	940

6. Future Remedial Actions

In late fiscal year 1991 an engineering study to determine future remedial actions is needed. This engineering study is required primarily to ascertain the need for retaining dedicated manpower resources past fiscal year 1992. This engineering study will identify, evaluate and justify continued work on such items as: (1) remedial actions on additional piping segments; (2) development and implementation of insitu cleanout technologies on piping segments (i.e., develop techniques on E-3/E-4 ventilation ducting preceding HEPA filtration for use during maintenance on service piping between first and final HEPA filters and then on downstream exhaust stack manifold ducting); (3) a threshold limit, other than the current criticality specification limit, for plutonium holdup in ventilation ducting/service piping; (4) near-term isolation, or decontamination & decommissioning, of the 232-Z Building as a future remedial action or separate line item project; and, (5) any other remedial actions or concerns identified during this project.

This engineering study will be prepared by PFP Remediation Project engineering staff and will require five months to develop and release. The scheduled release date is March 1992.

7. References

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7. Engineer Data Transmittal 100843, R. M. Marusich, "Details Concerning the Development, Use and Impact of the Quantity of Material in the E-4 Ducts", June 22, 1988.

8. Characterization of Radioactive Particles in the 234-5Z Building Ventilation Systems - Interim Report, BNWL-B-105, Battelle Pacific Northwest Laboratories, Richland, Washington, June 1971.

9. Characterization of Radioactive Particles in the 234-5Z Building Gaseous Effluent, BNWL-B-309, Battelle Pacific Northwest Laboratories, Richland, Washington, December 1973.

10. Letter, J. A. Teal to A. D. Danko, "Plutonium Finishing Plant Ventilation Exhaust System," December 7, 1988.

11. Letter, M. J. Schliebe to G. J. Miskho, "Funding For Room 179 HVAC Up-grades", September 28, 1988.

8. Appendices

Appendix A

Description and Estimated Material Accumulation in Piping Segments Identified for Near-Term Remedial Action

The five pipe segments identified for removal are discussed below in chronological order of planned removal. All ventilation ducting segments are made from schedule 5, or schedule 10, 304-L stainless steel. Most 26-inch process vacuum piping segments are made from schedule 10, or schedule 40, 304-L stainless steel of intermediate diameter, 4 to 6 inches.

Segment 1

This segment is an approximate ten-foot length of by-pass ventilation ducting, which is now unused and blanked, located in Room 263 near filter box 9B. Failure or inadvertent removal of the blank would leave one HEPA filter between the plutonium in this line and the environment. This segment was selected as our first chronological removal choice for the following reasons: (a) it presents a small, manageable task of short duration; (b) it provides an excellent "test" to refine removal techniques on a system which is relatively easy to remove; and, (c) it has little operational impact on the facility. The plutonium accumulation in this segment is estimated at 7 grams.

Segment 2

This segment is an approximate 57-foot length of ventilation ducting located in Rooms 263 and 264 containing a relatively large amount of plutonium in intermediate diameter duct. This ventilation ducting is a by-pass line between filter boxes 9A and 9B and is blanked by a closed damper near the 9A filter box. Removal of this E-4 ventilation segment will result in an approximate 30 percent reduction of plutonium material currently accumulated in E-4 ventilation ducting. The plutonium accumulation in this segment is estimated at 1.8 kg.

Segment 3

This segment is an approximate 140-foot length of ventilation ducting servicing two inactive gloveboxes in Room 179 of the Plutonium Process Support Laboratory. This ventilation ducting is located in Room 262 and exhausts directly into an E-4 filter room. This segment has only one HEPA filter between the plutonium accumulation in the line and the environment. Some overall risk reduction will be achieved by removal of this segment. The plutonium accumulation in this line is estimated at 30 grams.

Segment 4

This segment is an approxiate 150-foot length of small diameter 26-inch process vacuum piping located in Rooms 262 and 263 near filter boxes 9AB and 9B. This segment is part of the active 26-inch process vacuum system in 234-5Z. Removal of this segment will significantly reduce the amount of plutonium holdup in the 26-inch process vacuum system. This pipe has a safe geometry from a criticality safety viewpoint and the material is in non-dispersible form with little potential for release. The plutonium accumulation estimated in this segment is 4.3 kg.

Segment 5

This segment includes remnants of an unused 26-inch process vacuum system of intermediate diameter piping and filter boxes. Major portions of this line were removed in 1983 and 1984. The present system configuration poses no undue risk from the point of view of potential criticality or respirable plutonium suspension in the event of a seismic event. Removal will effect some reduction in the potential for personnel exposure. Since these remnants of the older 26-inch process vacuum system have not been nondestructively assayed, physical measurement data is not available. However, based on the amount of plutonium removed from this system in 1983/1984, these remnants are anticipated to contain an approximate 1 kg plutonium.

Appendix B

Plutonium Accumulation Tracking and Monitoring System

Costs

Computer hardware cost	$11,795.00
Computer software cost	4,354.00
Hanford Computer Store adder	2,589.35
Total system cost	**$18,738.35**

Implementation Schedule for Accumulation Tracking Database

	ECD
Computer procurement and installation	05-01-89
Database design, implementation and documentation	08-31-89
Application on line	09-15-89