

PERRY NUCLEAR POWER PLANT - UNIT #1

OFF-GAS SYSTEM

CHARCOAL ADSORBER COMBUSTION EVENTS

FINAL REPORT

July 28, 1986

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INTRODUCTION

This report provides a compilation and discussion of the data associated with the Off-Gas System combustion events that occurred at Perry on June 20, 1986 and July 6, 1986. Condition Reports 86-595, 86-596 and 86-656 will capture all the detailed data associated with the events. This report includes the Confirmatory Action Letter, dated June 23, 1986, our written recovery plan which addresses each item in the Confirmatory Action Letter and the details of our investigative analyses and results associated with the recovery plan.

The items addressed in this report under the corresponding tabs are:

1. Confirmatory Action Letter, dated June 23, 1986
2. Written "Plan for Recovery From Charcoal Adsorber Bed Combustion Event", dated July 11, 1986
3. General description and background of the Off-Gas Vault Refrigeration and Processing Systems
4. Analysis of the physical and chemical properties of the original and replacement activated carbon
 - a. In situ carbon samples following the first combustion event

- b. Samples of unused Barneby-Cheney Co. carbon, lot 1605, obtained from the on-site warehouse.
 - c. Nuclear Consulting Services, Inc. (NUCON) supplied carbon samples from the carbon intended for refill of the adsorbers
5. Analysis and determination of the mode of ignition for both combustion events
 6. Analysis and determination of combustion and temperature effects on adsorber bed vessel and piping metallurgy for both events
 7. Description of the adsorber thermocouple testing results
 8. Description of carbon removal, system drying and replacement carbon installation activities
 9. Description of the system testing activities to demonstrate the adequacy of the Off-Gas Vault Refrigeration and Off-Gas Processing Systems
 10. Photographs showing Off-Gas System equipment and recovery activities



CONFIRMATORY ACTION LETTER
UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

June 23, 1986

Docket No. 50-440
Docket No. 50-441

The Cleveland Electric Illuminating
Company

ATTN: Mr. Murray R. Edelman
Vice President
Nuclear Group

Post Office Box 5000
Cleveland, OH 44101

Gentlemen:

This letter confirms the telephone conversation between Mr. E. G. Greenman of this office and Mr. Lyster of your staff on June 23, 1986, related to the recovery program for the off gas charcoal fire identified at Perry on June 20, 1986. With regard to this event we understand that you will :

1. Preserve all data and equipment associated with this event until the NRC has an opportunity to review and assess the information.
2. Maintain the charcoal adsorber beds in a sealed condition until the NRC concurs that adequate precautions have been taken to preclude additional combustion.
3. Provide a written recovery plan that will be implemented after NRC concurrence that will address as a minimum, the following:
 - a. A determination of the ignition source and documentation of the activities leading up to the reporting of the fire.
 - b. The effects of the fire on the adsorber bed tanks and associated piping for the off gas treatment system.
 - c. The effect of the fire on the charcoal. This should address the method of sampling and analysis including the adsorber beds to be sampled.
 - d. If the charcoal is to be reused, an analysis demonstrating its adequacy shall be provided.
 - e. A description of any testing to demonstrate the adequacy of the charcoal beds and the associated equipment.

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CONFIRMATORY ACTION LETTER

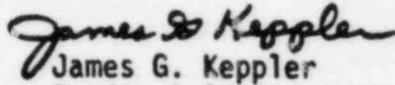
CONFIRMATORY ACTION LETTER

The Cleveland Electric Illuminating 2
Company

June 23, 1986

We also understand that startup of the reactor will not occur without concurrence of the Regional Administrator or his designee. Please let us know immediately if your understanding differs from that set out above.

Sincerely,


James G. Kepler
Regional Administrator

cc: J. J. Waldron, Manager, Perry
Plant Technical Department
M. D. Lyster, Manager, Perry Plant
Operations Department
L. O. Beck, General Supervising
Engineer, Nuclear Licensing and
Fuel Management Section
DCS/RSB (RIDS)
Licensing Fee Management Branch
Resident Inspector, RIII
Harold W. Kohn, Ohio EPA
Terry J. Lodge, Esq.
James W. Harris, State of Ohio
Robert H. Quillin, Ohio
Department of Health

CONFIRMATORY ACTION LETTER

PERRY NUCLEAR POWER PLANT

UNIT #1

PLAN FOR RECOVERY FROM

CHARCOAL ADSORBER BED

COMBUSTION EVENT

July 11, 1986
Revision 5

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VIII.

FULL RECOVERY FROM THE CHARCOAL ADSORBER BED COMBUSTION EVENTS

I. RECOVERY PLAN INTRODUCTION

This Recovery Plan was first issued on June 26, 1986 to address recovery actions from the Unusual Event declared on June 20, 1986 as a result of combustion activity in some of the Off-Gas System charcoal adsorber beds. The Unusual Event declared on June 20, 1986 was terminated on June 23, 1986 when the last temperature element reading fell below 250°F with a dramatic rate of decline exhibited. Nitrogen (N₂) purge activities continued until adsorber bed vessel entry on June 27, 1986. After the charcoal sampling activities were completed, a nitrogen (N₂) blanket was established and remained on both A and B trains of adsorber beds. On July 3, 1986 a plan was formalized and concurrence was obtained from the U.S.N.R.C. for the reperformance of the Off-Gas Vault Refrigeration System (GEN-M-021) temperature pull-down test in parallel with ongoing charcoal and metallurgical analyses. However, entry into the Off-Gas preoperational test (Section 6.12) would not occur without NRC concurrence.

During the normal establishment of prerequisites, on July 6, 1986 a dry instrument air purge at 60 scfm was started through both A and B trains. Approximately one (1) hour after the initiation of the instrument air purge, the center thermocouples on adsorber beds 14A and 14B indicated temperatures greater than 250°F. At 2037 on July 6, 1986 an Unusual Event was declared based upon an indicated recurrence of the adsorber bed combustion event.

This Recovery Plan will be updated to reflect revised portions of the original Plan as appropriate. Appendix A has been added to the Plan to address the recurrence of the adsorber bed combustion event.

II. RECOVERY PLAN PURPOSE

This recovery plan is intended to provide a logical, orderly and controlled approach for full recovery from the two (2) Unusual Events declared due to apparent combustion activity in the 14A and 14B Off-Gas System adsorber beds. This Plan provides a summary description of the activity that was in progress immediately preceding both events and a brief description of the activities and actions taken during the events. Further, this plan will be implemented in full cooperation with the U.S.N.R.C. This Recovery Plan delineates the technical intent of recovery actions. The detailed approved Instructions and Work Orders will control actual work in the field. Should minor deviations from this Plan be deemed necessary, the on-site NRC representative will be informed. This Plan delineates the methodologies and sequences for:

1. Documentation gathering and assembly
2. Operation of Off-Gas System Equipment
3. Determination of Mode of Ignition and Combustion Propagation

4. Determination of combustion and temperature effects on Adsorber Bed Vessel and Piping Metallurgy
5. Entry and Inspection of Adsorber Bed Vessels
6. Physical Sampling and Analysis of Adsorber Bed Charcoal Material
7. Determination of Adsorber Bed Efficiency Degradation due to Partial Combustion
8. Testing Methods to verify adequacy of the Off-Gas Vault Refrigeration and Off-Gas Processing Systems

III. RECOVERY TEAM ORGANIZATION

An organization has been formulated to execute the Recovery Plan in an orderly, controlled and efficient manner. The Recovery Team consists of:

- A. Recovery Manager and Operations Representative - M. D. Lyster
- B. Assistant to the Recovery Manager - R. D. Bowers
- C. Fire Protection, Health Physics and Chemistry Representative - S. J. Wojton

- D. PPTD Technical Section Representative - S. F. Kensicki
- E. PPOD Maintenance Representative - D. J. Takacs
- F. Nuclear Test Section Representative - G. R. Leidich
- G. Nuclear Engineering Department Representatives - C. M. Shuster
and/or K. R. Pech
- H. Nuclear Quality Assurance Department Representatives - E. Riley
and/or V. Higaki
- I. PPOD I & C Representative - R. P. Jadgchew and/or
G. R. Anderson

This organization will meet daily in SB320 at 8:00 a.m., Monday through Friday, (or as required), until termination of the meeting is deemed appropriate by the Recovery Manager.

IV. OFF-GAS CHARCOAL ADSORBERS [D012A(B), D013A(B), D014A(B), and D015A(B)]

The eight (8) charcoal adsorbers are part of the N64 Off-Gas System, which is a non-safety, augmented quality system. As such, the equipment was designed and procured to applicable criteria and codes which required no Equipment Qualification Program application. The

adsorbers are arranged in two (2) trains of four (4) vessels each. Each adsorber vessel contains approximately three (3) tons of activated coconut shell charcoal.

Three (3) temperature elements are installed in each adsorber vessel near the top, center, and bottom elevations of the vessel. Refer to attached Figure 1 for specific locations and elevations of the temperature elements.

The adsorbers are located in the Off-Gas System charcoal vaults of the Off-Gas Building. The first adsorber of each train is located in a separate vault. The remaining three (3) charcoal adsorbers in each train are located in a separate vault along with two (2) process gas coolers. A basic schematic diagram of the system is included as Figure N64-1 for reference purposes.

V. SUMMARY DESCRIPTION OF CHARCOAL ADSORBER BED COMBUSTION EVENT

This section of the Plan delineates those activities in progress at the time of the initial event and those activities and actions which took place during the initial event through termination of the initial Unusual Event at 1125 on June 23, 1986.

A. Activities In Progress

Performance of GEN-M-021, generic mechanical testing, was in progress under Work Order #86-7034 in response to Field Change Request (FCR) #775 for testing of the temperature pull-down capability of the Off-Gas Vault Refrigeration System in support of Off-Gas Processing System Preoperational Test (1N64C-P001).

The initial conditions for the 1N64C-P001 Preoperational Test required the Adsorber Bed Vaults, Adsorber Bed Vessels and internal equipment to be at 150°F, prior to beginning the temperature pull-down test.

B. Description Of The Event

Radiant-type space heaters were being used to raise vault and equipment temperatures to 150°F. Vessel charcoal temperatures were being monitored using permanently installed instrumentation consisting of internal thermocouples (3 per adsorber vessel, located at top, middle and bottom regions in the vessel) with readout in the control room using a 24-point pen recorder with a range of -50°F to 250°F. Vault air temperature was also being monitored using permanently installed instrumentation with a single-point readout in the Control Room, with a range of -50°F to 200°F.

Initial heatup commenced at approximately 1100 on Wednesday, June 18, 1986. At 0600 on Thursday, June 19, dry instrument air flow at 60 scfm total flow was initiated through the vessels to simulate process flow. At 1200 on Thursday, June 19, dry instrument air flow was increased to 100 scfm. Heating and temperature monitoring continued until 1815 on June 19, at which time point 17 (bottom of vessel D14A) was observed to be indicating a temperature of 230°F. The heaters in the "A" train vault were immediately de-energized. Point 17 indicated a temperature of 206°F one hour later.

At 2041, after approximately 33 hours of heating, point 16 (center of vessel D14B) indicated "off-scale high" on the recorder. All remaining heaters were then de-energized. At 2120, two (2) additional points (center of vessel D14A and bottom of vessel D14B) were also indicating "off-scale high". Instrumentation and Control personnel were then dispatched to verify instrumentation readings. Instrument air flow of 100 scfm through the charcoal beds continued.

Visual inspections of the vaults were made at 0020 on June 20, 1986. Smoldering paint and tape were observed. At 0100, June 20th, the off-gas vault refrigeration system was

started in the pull-down mode to cool the vault air and external surfaces of the adsorber vessels. This cooling continued as did the 100 scfm instrument air purge internal to the vessels, until 1000 the following morning.

As the vault refrigeration system cooled the vessels externally, internal charcoal temperatures generally lowered also. However, by this time, a total of seven permanently installed thermocouples had reached the upper readable limit of 250°F on the Control Room recorder. It was decided at this time to secure the instrument air purge in consideration of possible combustion of the charcoal. At 1145, the initial Unusual Event was declared by the Shift Supervisor.

A 5 to 10 scfm nitrogen purge was established through the vessels at 1219. Following establishment of the N₂ purge, charcoal adsorber bed temperatures continued to be monitored. Temperatures in the charcoal adsorber beds were trending downward. N₂ purge and vault refrigeration were maintained throughout June 20, 21, and 22. By 0900 on June 22, all but one adsorber vessel temperature element reading fell below 250°F. At 1100 on June 23, the last temperature element reading dropped below 250°F and at 1125 the initial Unusual Event was terminated by the Shift Supervisor. The N₂ purge was maintained until adsorber bed vessel entry.

VI.

RECOVERY PLAN

A. Plant Status During Recovery Plan Execution

The plant will not enter Operational Condition 2 until the questions surrounding the adsorber bed combustion events have been satisfactorily answered. Activities connected with normal plant operations and maintenance will continue. Further, the Non-Nuclear Heatup evolution will proceed as currently planned.

B. Documentation Gathering and Assembly

The initial adsorber bed combustion event will be documented by condition reports (C.R.) #595 and #596. All relevant data such as temperature element reading data sheets, temperature plots, adsorber bed vessel surface contact temperature versus time plots, strip chart recordings, calculation sheets, vault temperature versus time plots, detailed chronological logs of the event, a chronological description of activities from the time of space heater placement through declaration of the initial Unusual Event and a written evaluation of the adequacy of plant staff actions prior to and during the initial event will be captured by C.R.'s #595 and #596. Refer to Appendix A for discussion of documentation assembly related to the July 6, 1986 adsorber bed combustion event.

C. Operation of Off-Gas System Equipment

The nitrogen (N₂) purge of both A and B trains of adsorber beds will continue until the adsorber bed vessel flanges are ready to be removed. Upon NRC concurrence, the Off-Gas Vault Refrigeration System will be shut down to allow the vaults and adsorber beds to warm to ambient conditions and adsorber bed vessel skin temperatures to rise to a minimum of 60°F to allow metallurgical testing to proceed. Temporary lighting, scaffolding, temperature and humidity control enclosures will be erected in preparation for opening of the adsorber beds. Every reasonable precaution will be taken to minimize the possibility of adsorber bed contamination.

D. Methodology For Determination of Mode of Ignition and Combustion Propagation

To determine how ignition of the charcoal occurred, an engineering review and analysis will be conducted of all known data concerning the event. This data will include:

1. Temperature recordings of adsorber bed thermocouples, adsorber bed contact temperatures, and vault room temperatures.

2. Operating conditions of the system at the time of the event and during subsequent response actions, including monitored stack effluent flow.
3. Results of inspections of the adsorber beds and associated equipment.
4. Test data on charcoal combustion characteristics.

The above data will be compared with all credible scenarios for ignition and propagation of combustion to determine which are supported and which can be rejected, and ultimately to reach a conclusion as to which was the most probable. The scenarios currently under evaluation include:

1. The charcoal reaching its certified minimum ignition temperature.
2. The charcoal igniting at a temperature less than its certified minimum ignition temperature due to the presence of hydrocarbons.
3. The charcoal igniting at a temperature less than its certified minimum ignition temperature due to the presence of moisture.

4. The charcoal igniting at a temperature less than its certified minimum ignition temperature due to the presence of excessive charcoal fines.
5. The effects of flow on ignition temperatures.
6. Consideration of the presence of glycol.

Charcoal receipt documents, charcoal storage requirements, charcoal installation procedures and adsorber bed layup requirements (post-charcoal installation) will be collected, reviewed, evaluated and captured by C.R.'s #595 and #596 in support of the scenario evaluations.

E. Methodology For Determination of Combustion and Temperature Effects on Adsorber Bed Vessel and Piping Metallurgy

Visual inspections will be made of all equipment, piping, and components located within the charcoal vault in which the event took place. Equipment which is found to have undergone any changes due to temperature effects will be evaluated. A.S.M.E. code stamp considerations will be addressed as a result of this heat excursion and qualifications demonstrated or re-established as appropriate.

A detailed walkdown of the vault on June 21, 1986 found no indication of thermal growth in piping and conduit lines, such as scratched paint or galvanizing at support locations. In addition, no abnormalities were found in adsorber vessel supports, adsorber connectors, rubber jacketing or flex conduit, vault sheet metal liners, or concrete floor slabs. The one abnormality noted was the discoloration/oxidation of the coating on two adsorber vessels, 1N64D014A&B. The discolorations are circumferential near the upper portions of the adsorber beds and are estimated to be three (3) to five (5) feet in height on adsorber bed 14A and five (5) to seven (7) feet in height on adsorber bed 14B. These discolorations indicate exposure to higher temperatures than elsewhere on the adsorber beds as no other discolorations have been noted.

Selected sites within the areas of discoloration will be examined metallurgically using a replication process which will allow the comparison of metal grain sizes between the heat affected and unaffected areas of the vessels. The replication process is described in detail in Attachment 1. The second method will be to use a scleroscope (hardness tester) to obtain local hardness readings at both the heat affected and unaffected areas for comparison. The use of the scleroscope is described in detail in Attachment 2.

In addition, temperature element readings on adsorber bed 14A bottom are in question. The readings were low in comparison to other temperature elements within portions of the A train and in comparison to its corresponding location on the B train. Contingency plans are in process for replacement of the 14A bottom temperature element if further evaluation determines the need for replacement.

F. Plan For Entry And Inspection Of Adsorber Bed Vessels

Based upon the fact that adsorber bed vessels 14A and 14B were the only beds noted to have coating discoloration bands, the current plan is to initially open and inspect beds 14A and 14B. As previously discussed, the N₂ purge of both A and B trains of adsorber beds will continue until the flanges of adsorber beds 14A and 14B are ready to be removed. Upon NRC concurrence and completion of climate control, safety and fire protection prerequisites, the N₂ purge will be secured and the inlet train piping will be valved closed and the outlet train piping will be valved open for venting requirements. This valve manipulation will retain the N₂ inerting blanket in all adsorber beds to minimize the possibility of reignition of the adsorber bed charcoal material.

Establishment of fire protection measures will include:
Staging of CO₂ fire extinguishers in the area with one right next to the adsorber cover area. Also water fire suppression will be available via the charged hose from the 620' level. Water will be used as a last resort.

To ensure personnel safety, all individuals involved in opening the adsorber bed vessels will be trained in the use of appropriate respiratory protection apparatus prior to opening any adsorber bed flange. Further, a minimum number of personnel will be allowed to participate in the inspection process. The inspection team will consist of the:

1. C.E.I. Metallurgist
2. C.E.I. Chemistry/Health Physics Representative
3. U.S.N.R.C. Representative
4. G.E. Specialist
5. Support personnel as required.

Once the twelve (12) flange bolts on adsorber bed 14B have been detorqued, the flange will be removed and a protective covering placed on the adsorber bed vessel flange surface. A visual inspection of the adsorber bed vessel interior surface will be conducted and any abnormalities noted and photographed or videotaped.

G. Methodology for Physical Sampling and Analysis of Adsorber Bed Charcoal Material

Note: This is a summary of the physical sampling and analysis plan. The development is underway on a detailed physical sampling plan. Once the detailed plan is completed it will be provided to the U.S.N.R.C. (The detailed plan was submitted and concurrence was obtained from the NRC prior to commencement of sampling activities.)

Representative charcoal physical samples will be taken to allow performance of coefficient of adsorption testing and other charcoal performance tests. Upon completion of the visual and photographic/videotape inspection of adsorber bed 14B, the exposed bed surface will be physically sampled. If ash is present, the ash will be sampled. Once physically sampled, the ash will be brushed aside until charcoal is reached. The charcoal will then be sampled.

Upon completion of the physical sampling process, the 14B adsorber flange will be reinstalled. The inspection and sample process elapsed time will be kept to a minimum to avoid O₂ and moisture migration into the adsorber bed charcoal as well as to minimize other contaminants entering the bed. Upon completion of resealing of the 14B adsorber bed, the opening, inspection and sampling process will be repeated on the 14A adsorber bed.

H. Methodology For Determination Of Adsorber Bed Efficiency
Degradation Due To Partial Combustion

Each train of adsorber beds contains approximately 13 tons of activated charcoal. All adsorber beds were initially filled using procedure number GEP-IP-0040 - Filling of Charcoal Adsorbers.

The first adsorber bed vessels (12A and 12B) in each train are required to have sufficient charcoal to cover all three temperature elements. The other three adsorber vessels in each train should have enough charcoal to at least cover the bottom two temperature elements.

The adsorber bed charcoal material samples taken from 14A and 14B will be tested to determine the in situ coefficient of adsorption and other charcoal tests. These tests will be conducted by a qualified contractor to determine if deleterious

effects on the charcoal have taken place due to the event. Preliminary calculations indicate that a) based upon purge air flow, b) absorbed O_2 in the charcoal and c) O_2 in the free air space above the charcoal, the worst case charcoal burnup is 762 pounds. Additional calculations to determine the amount of volumetric degradation will be made.

I. Description Of Testing Methods To Verify Adequacy Of The Off-Gas Vault Refrigeration And Off-Gas Processing Systems

The Off-Gas Vault Refrigeration System performance will be verified by documenting the cooldown rate of the refrigeration system from ambient temperature to $0^{\circ}F$. This cooldown rate will be evaluated by the system designer, General Electric (GE), to determine its acceptability for overall system performance in accordance with the appropriate GE design specification. If the rate is unacceptable, modifications and/or retest will be specified by GE. The acceptability of the vault refrigeration system will be finalized prior to any testing of the Off-Gas Processing System (N64C).

The performance characteristics of the Off-Gas Processing System will be verified by performing Section 6.12 of the Off-Gas System preoperational test (1N64C-P001). The system designer, GE, will approve the test results via representation

on the Test Program Review Committee. These test results will also be approved by the Plant Operations Review Committee prior to entering Operational Condition 2.

VII. APPENDIX A - ADSORBER BED EVENT RECURRENCE

A. Summary Description of July 6, 1986 Charcoal Adsorber Bed Event Recurrence

On July 3, 1986 a plan was developed and concurred with by NRC Region III, outlining the reperformance of the Off-Gas Vault Refrigeration System temperature pull-down test (GEN-M-021). The testing methodology was revised per FCR #3444 to allow pull-down from ambient temperature conditions rather than elevated temperature conditions.

At 1100 on Sunday, July 6, 1986 NTS personnel conducted a walkdown of the Off-Gas System and Vaults to ensure the area had been cleared of all temporary facilities. At 1700 on July 6, 1986 NTS personnel again conducted a walkdown to ensure readiness of the Off-Gas System and Vaults prior to starting the prerequisite activities for performance of the GEN-M-021 test.

As part of the normal establishment of prerequisites, a dry instrument air purge at 60 scfm was initiated at approximately 1800 through both A and B trains via the A desiccant bed. At

1910 NTS personnel noted that thermocouples for adsorber bed vessels 14A and 14B - center indicated greater than 250°F on recorder 1N64-R613. Preparations were made immediately to secure the instrument air purge, enter the vaults and sample the effluent stream for combustion products. At 1942 the instrument air purge was completely secured.

Temperature monitoring and effluent stream monitoring activities continued. By 2032, the adsorber bed 14A center thermocouple read 656°F and the 14B center thermocouple read 578°F using a millivolt meter by Instrumentation and Control (I&C) personnel. At 2037 the Shift Supervisor declared an Unusual Event due to indicated high charcoal bed temperatures.

Thermocouple readings, adsorber bed vessel contact readings and effluent stream samples continued to be monitored. At 2307 on Sunday, July 6, 1986, a nitrogen (N₂) purge was established through both A and B trains. Following establishment of the N₂ purge, charcoal adsorber bed temperatures and effluent stream content continued to be monitored.

At 1645 on July 8, 1986 the Unusual Event was terminated with all temperatures trending downward and effluent stream samples indicating minimal combustion product presence.

B. Documentation Gathering and Assembly for July 6, 1986 Charcoal Adsorber Bed Event Recurrence

The adsorber bed event of July 6, 1986 will be documented by condition report (C.R.) #656. All relevant data such as temperature element reading data sheets, temperature plots, adsorber bed vessel surface contact temperature versus time plots, strip chart recordings, calculation sheets, vault temperature versus time plots and detailed chronological logs of the event will be captured by C.R. #656. All data collected under C.R. #656 will be included with C.R.'s #595 and #596.

C. Operation of Off-Gas System Equipment Following the July 6, 1986 Charcoal Adsorber Bed Event Recurrence

The nitrogen (N_2) purge through both the A and B trains of adsorber beds will continue until the adsorber bed vessel flanges are ready to be removed. Temporary lighting and scaffolding will be erected in preparation for opening of the adsorber beds.

D. Determination of Need for Additional Metallurgical Evaluations

Visual examinations of the external surfaces of the adsorber bed vessels 14A and 14B will be conducted. These visual examinations are intended to identify any additional adsorber bed vessel coating discolorations. Additional photographs of

the external surfaces of the adsorber bed vessels 14A and 14B will be taken to photographically document the condition of the vessel external surfaces after the July 6, 1986 event.

Adsorber bed vessel contact temperatures and thermocouple temperatures taken during the July 6, 1986 event will also be reviewed by CEI and General Electric metallurgists to determine if any additional metallurgical examinations are required based upon this recent event. Preliminary data indicates temperatures much lower than previously experienced.

E. Plan For Charcoal Removal and Installation Of New Charcoal In The N64 Off-Gas Processing System Adsorber Beds

Detailed reviews of temperature data, effluent sample data, charcoal heat transfer characteristics and charcoal adsorption and desorption characteristics have been performed. These additional reviews have confirmed that adsorber beds 14A and 14B experienced combustion during the July 6, 1986 event. These additional detailed reviews have also revealed the possibility of combustion activity in adsorber beds 15A and 15B. Based upon the fact that the 14A and 14B beds had been inerted with N_2 for a period of approximately thirteen (13) days from the previous event and again combusted upon experiencing instrument air flow, the current plan is to

completely empty all adsorber beds to prevent any further combustion activity and to assure suitability of the charcoal material for use during plant operations.

A detailed Maintenance Temporary Instruction (MTI)-0006 - Unloading, Drying and Loading of N64 Charcoal Adsorber Vessels is in development for removal of the charcoal from all adsorber beds. The NRC will be supplied with a copy of MTI-0006 for review and concurrence. The NRC will be given prior notification and will provide concurrence before charcoal removal activities commence.

The current plan is to remove the charcoal from adsorber bed vessels 13A, 13B, 14A, 14B, 15A and 15B in a wetted condition and from adsorber bed vessels 12A and 12B in a dry condition. A vacuum device will be employed to suction the charcoal from the vessels. Integral to the vacuum device will be a water eductor for mixing demineralized water of sufficient flow with the charcoal in the suction stream of the hose to further ensure quenching of potentially hot charcoal. Refer to Figure 3 for the configuration of the "dry" method of charcoal removal and Figure 4 for the configuration of the "wet" method of charcoal removal.

The charcoal in adsorber beds 13A, 13B, 14A, 14B, 15A and 15B will be wetted by a spray device, supplied by demineralized water, attached to the suction hose while the charcoal is being removed from the vessels.

The charcoal in adsorber beds 12A and 12B will be removed by suctioning without a spray device. Charcoal wetting in adsorber beds 12A and 12B has been determined to be both unnecessary and undesirable. The charcoal in adsorber beds 12A and 12B experienced no combustion and has experienced the longest and most efficient N₂ purge. The charcoal from each adsorber bed will be transported from the vacuum device to a receiving truck containing water for additional quenching. The entire removal process is planned to proceed expeditiously to avoid any unnecessary exposure of potentially hot charcoal to the atmosphere so as to minimize any fire hazard. Disposal of the removed charcoal will be at a CEI fossil fueled plant.

The charcoal removal equipment has been thoroughly tested by conducting a "dry run" of the charcoal removal process. The dry run simulated vessel depth and included water injection into the suction stream. Charcoal material, obtained from the on-site warehouse, has been suctioned from a container to demonstrate the lift capability and the quenching capability of the equipment. The personnel to be involved with the removal

process have been thoroughly trained in the operation of the charcoal removal equipment and have participated in the "dry run".

As previously discussed, the N₂ purge of both A and B trains of adsorber beds will continue until removal activities are ready to commence. Upon NRC concurrence and the completion of safety and fire protection prerequisites, the N₂ purge will be secured and both the inlet and outlet train piping will be valved closed. This valve manipulation will retain the N₂ inerting blanket in all the adsorber beds.

To ensure personnel safety, all individuals involved in opening the adsorber bed vessels and charcoal removal activities will be trained in the use of appropriate respiratory protection apparatus prior to opening any adsorber bed flange. Appropriate respiratory protection apparatus will be staged in the immediate area. Atmospheric monitoring of the area will be conducted to ensure a habitable atmosphere exists.

Temporary water hoses will be staged at the adsorber bed vessel loading flange areas of adsorber bed vessels 13A, 13B, 14A, 14B, 15A and 15B with water supplied from the demineralized water system (P21). All work activities hence forth will proceed from the 15A and 15B adsorber beds to the 14A and 14B

adsorber beds to the 13A and 13B adsorber beds and conclude with the 12A and 12B adsorber beds. The current plan is to proceed with charcoal quenching and removal activities in parallel on both trains.

Establishment of fire protection measures will include staging of CO₂ fire extinguishers in the area with one (1) right next to each adsorber cover area. Also water fire suppression will be available via the charged hose from the 620' level.

Upon establishment of the N₂ blanket, the thermocouples will be removed from the adsorber beds and replaced with blank flanges. The hydrostatic test connection flanges at the bottom of adsorber bed vessels 13A, 13B, 14A, 14B, 15A and 15B will be removed to allow excess water drainage. Upon completion of the test connection flange removal, the adsorber bed vessel loading flanges for all adsorber beds will be removed. Using the temporary water hoses, a water spray via the temporary hoses will be initiated into adsorber beds 13A, 13B, 14A, 14B, 15A and 15B such that the entire cross section of the adsorber bed is continually wetted. The water spray will be continued until approximately the first three (3) feet of each adsorber bed 13A, 13B, 14A, 14B, 15A and 15B, (approximately 100 gallons of water), have been wetted. This wetting will quench any remaining "hot spots" within the first three (3) feet of the bed in preparation for charcoal removal.

The charcoal removal process will then commence with the 15A and 15B adsorber beds and proceed through each train to the 12A and 12B adsorber beds. Upon emptying each adsorber bed, a visual boroscope or television camera examination of the adsorber bed vessel internal surface will be performed to ensure all charcoal material has been removed and to examine and document any abnormalities if present.

NOTE: The Maintenance Temporary Instruction (MTI)-0006 - Unloading, Drying and Loading of N64 Charcoal Adsorber Vessel will more fully delineate the mechanics of system drying and charcoal installation.

Once the charcoal removal process is completed for all adsorber beds in the A and B trains, a general area cleanup and demobilization of charcoal removal equipment will proceed. The system will be drained of any excess water and additional drain points established if required. Upon completion of system draining, the adsorber bed vessel loading flanges and the hydrostatic test connection flanges will be reinstalled.

Upon completion of the demobilization and system boundary restoration, a drying process of the adsorber bed vessels and piping will be initiated. The current plan for drying is to establish a warm dry air purge of the system. Moisture content

of the drying air will be sampled regularly. Thermocouple ports may be used to obtain local samples of the vessel atmosphere.

Upon completion of the drying process, the air purge will be secured and the area and adsorber bed vessels will be readied for charcoal installation. Rigid environmental controls will be established to ensure no charcoal contamination occurs. The NRC will be given prior notification and will provide concurrence before charcoal installation activities commence. The adsorber bed vessels will be refilled using the Maintenance Temporary Instruction (MTI)-0006 - Unloading, Drying and Loading of N64 Charcoal Adsorber Vessel.

F. Retest Requirements of the Off-Gas Vault Refrigeration and Off-Gas Processing Systems

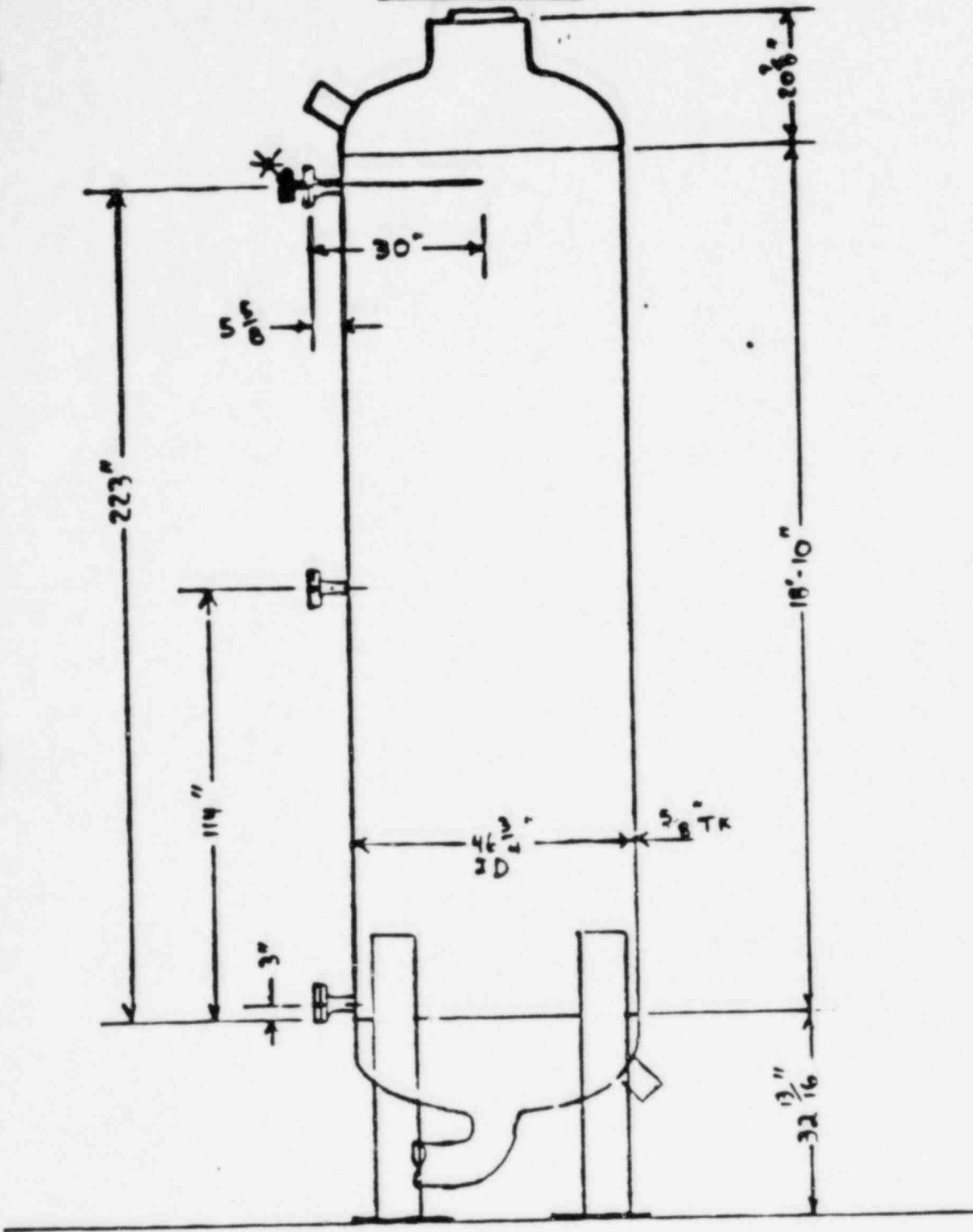
No testing will proceed on either the Off-Gas Vault Refrigeration or Off-Gas Processing Systems without NRC concurrence. The current plan for retesting is discussed in Section VI.I.

VIII.

FULL RECOVERY FROM THE CHARCOAL ADSORBER BED COMBUSTION EVENTS

Figure 2 is the sequence of activities to be executed in support of this Recovery Plan. Upon successful completion of the sequence of activities, the charcoal adsorber bed combustion events will have been completely resolved and Off-Gas System adequacy demonstrated to allow entry into Operational Condition 2.

ADSORBER VESSEL



* Temperature Element (Typ. 3 places)

FIGURE 1

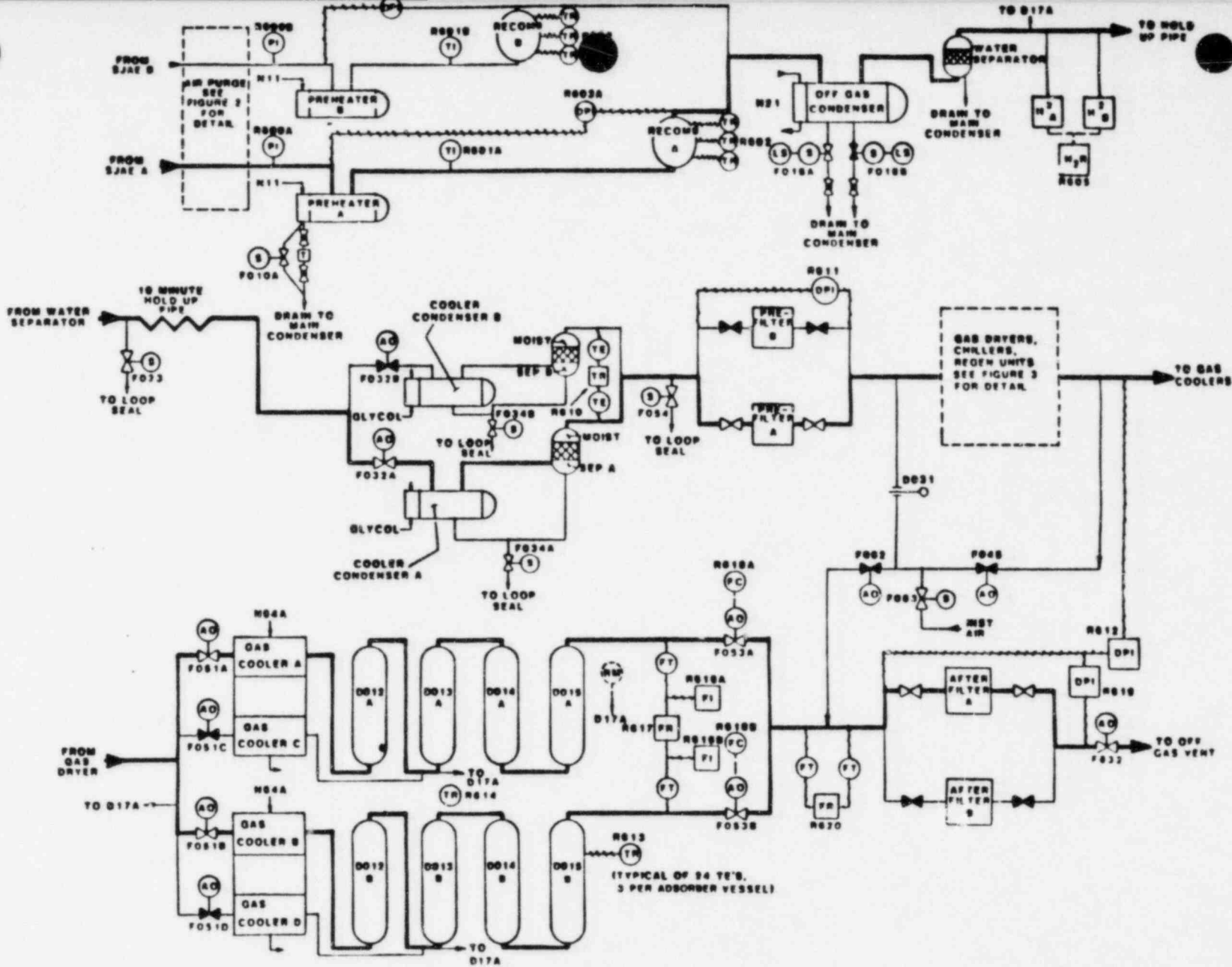
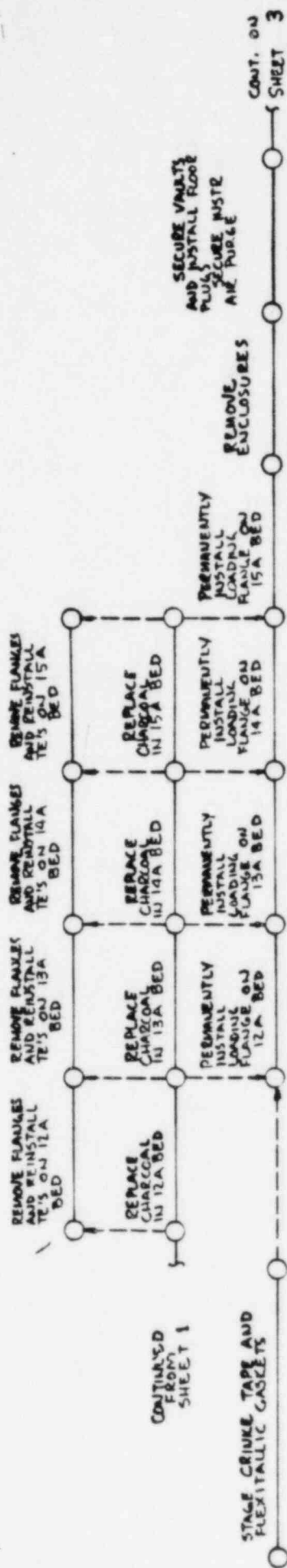


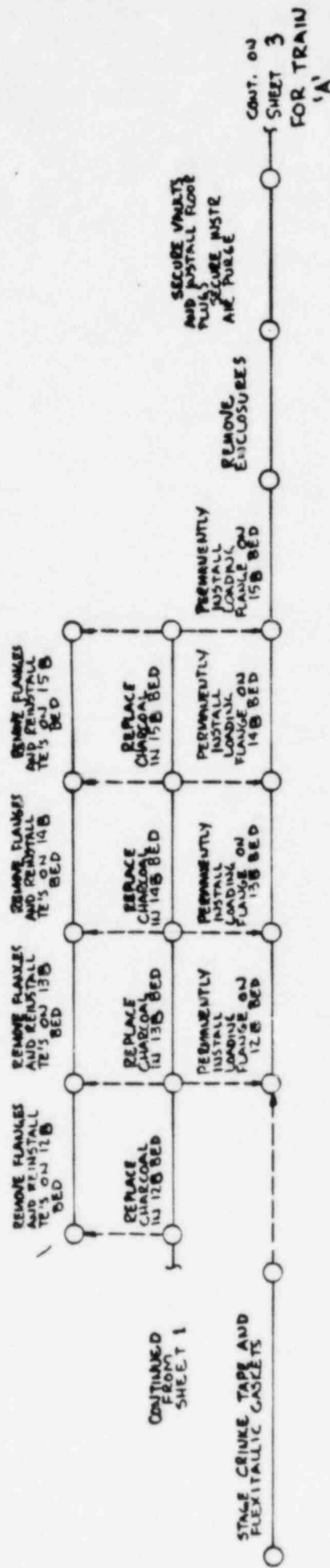
Figure N64-1.
OFF GAS SYSTEM



TRAIN 'A'

**FOR PLANNING
USE ONLY**

NOTES:	REV. NO.	DATE	PURPOSE	PLANNER	CLEVELAND ELECTRIC ILLUMINATING CO. PERRY NUCLEAR POWER PLANT OPERATION PLAN
	6	7/11/66	PRELIMINARY	T. GEORGE LEAD PLANNER	
	1	7/11/66	REVISED LOGIC PER NRC	K. DAVID BOWERS SYSTEM ENGINEER	N64 ADSORBER BED COMBUSTION EVENT RECOVERY PLAN
				PROJECT SCHEDULING:	SHEET 2 OF 3
					REVISION 1

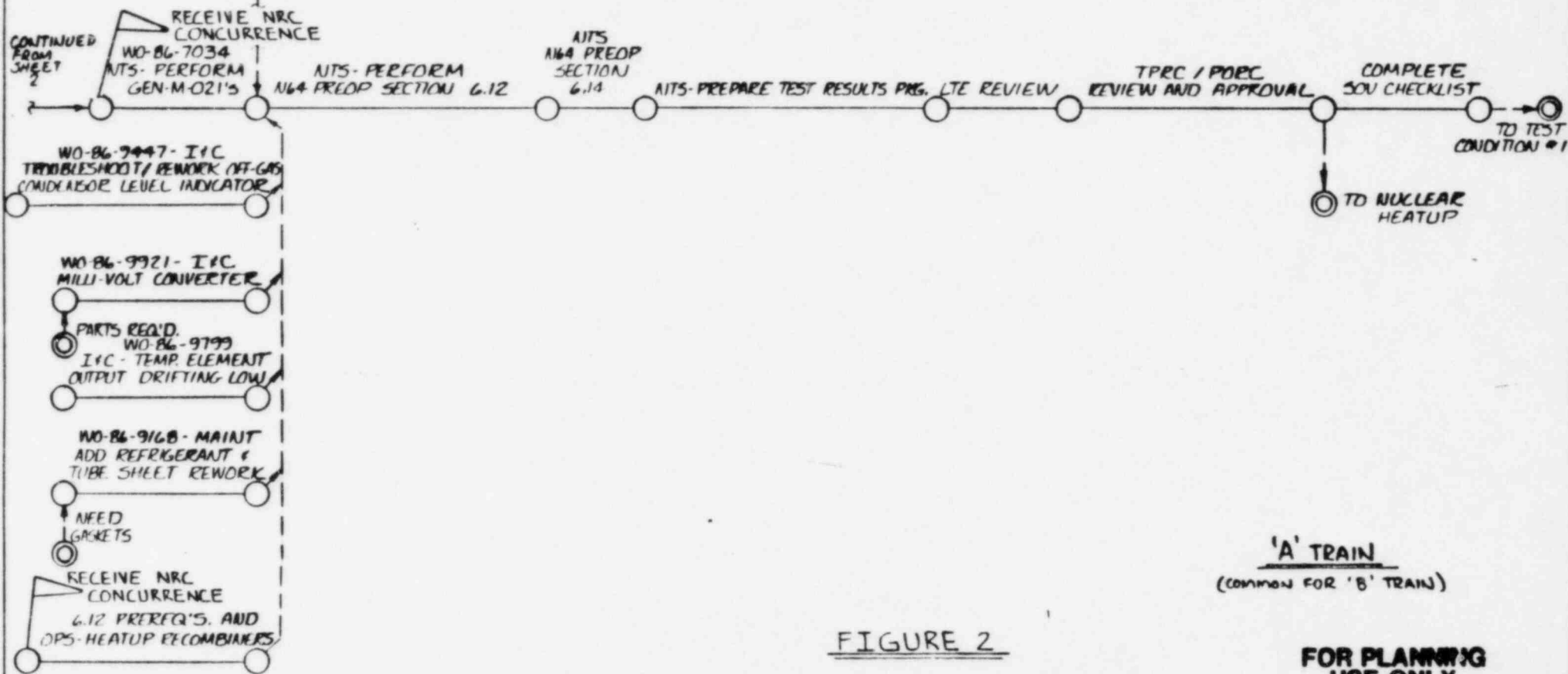


TRAIN 'B'

**FOR PLANNING
USE ONLY**

NOTES:	REV. NO.	DATE	PURPOSE	PLANNER: T. GEORGE	CLEVELAND ELECTRIC ILLUMINATING CO. PERRY NUCLEAR POWER PLANT OPERATION PLAN
	0	7/11/66	PRELIMINARY	LEAD PLANNER: K. DAVID POWERS	N66 ADSORBER BED COMBUSTION EVENT RECOVERY PLAN
	1	7/11/66	REVISED LOGIC PER NRC	SYSTEM ENGINEER:	SHEET 2 OF 2
				PROJECT SCHEDULING:	REVISION 1

- M36- OFF-GAS BLDG EXHAUST OPERATING
- CONDENSER VACUUM AVAILABLE
- CONDENSATE AVAILABLE TO OFF-GAS CONDENSERS

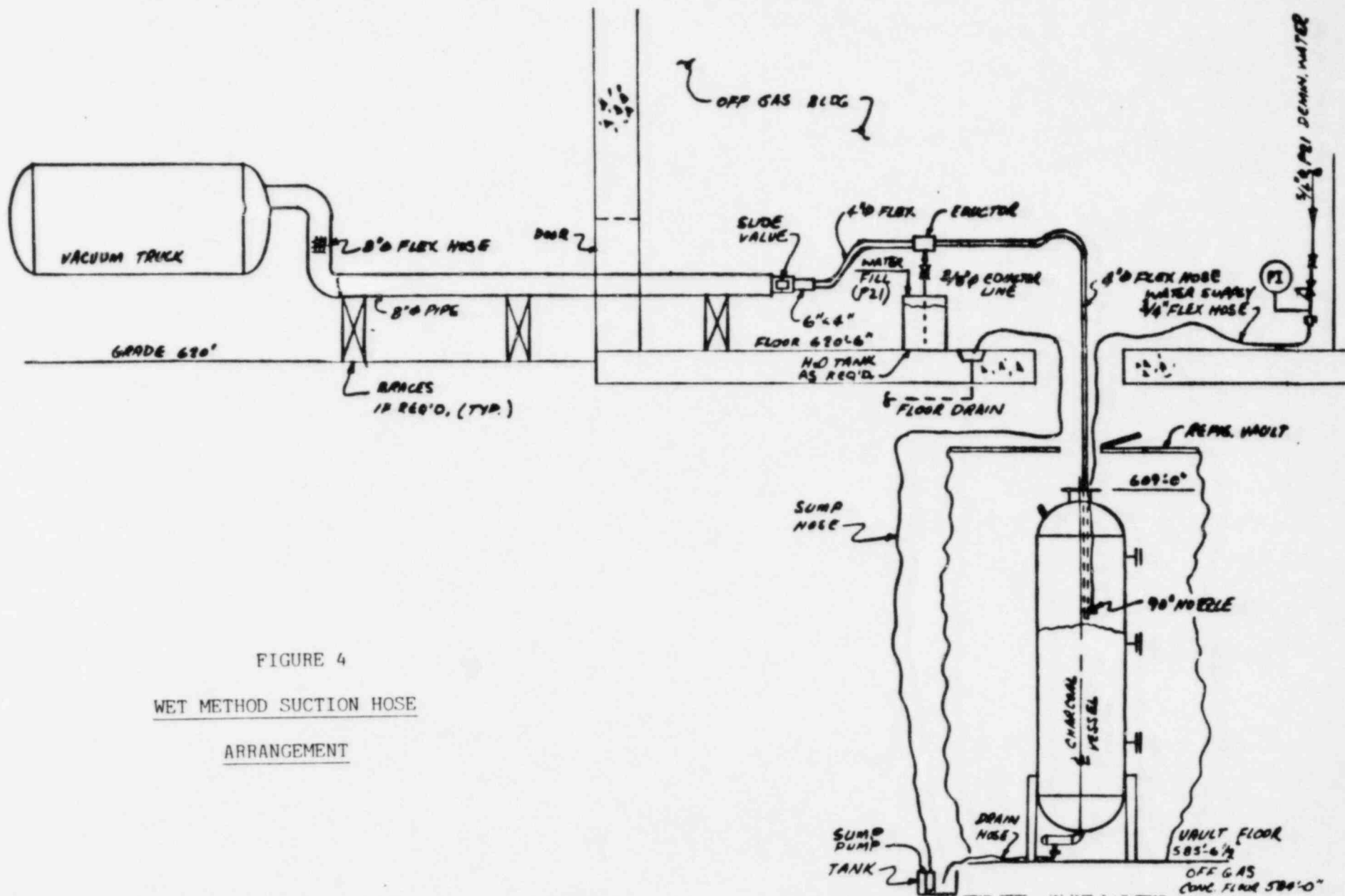


'A' TRAIN
(COMMON FOR 'B' TRAIN)

FIGURE 2

**FOR PLANNING
USE ONLY**

NOTES:	REV. NO.	DATE	PURPOSE	PLANNER: T.C. GEORGE	CLEVELAND ELECTRIC ILLUMINATING CO. PERRY NUCLEAR POWER PLANT OPERATION PLAN
		0	7/11/86	PRELIMINARY	
	1	7/11/86	REVISED LOGIC PER NRC	SYSTEM ENGINEER:	N64 ADSORBABLE BED COMBUSTION INITIAL RECOVERY
				PROJECT SCHEDULING:	SHEET 3 OF 3 REVISION 1



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FIGURE 4
WET METHOD SUCTION HOSE
ARRANGEMENT

Attachment 1

The Replication Process is a method by which the grain structure of a metal surface can be reproduced for laboratory examination without physically removing the sample from the field.

The replication consists of preparing the metal surface using a three step polishing technique. These steps are: (1) Rough grinding the surface with various grits (80-1000) of silicon carbide paper; (2) Intermediate polishing of the surface with 9 micron diamond paste with lapping oil and (3) finally etching the surface with a standard 3% nital etchant.

Once the surface is prepared, blue replica tape (1/2"x1") is applied. This tape will provide a negative of the grain structure being investigated. The tape is then secured to a glass slide. A preliminary evaluation of the replica quality is made with a field microscope. Final analysis and documentation of the structure is deferred until the replica is returned to the laboratory.

Attachment 2

A scleroscope is a portable hardness tester which operates on the principle of measuring the height to which an indenter rebounds from the surface of a test piece. This indenter is spring loaded and then released onto the surface and the rebound is automatically read and assigned a hardness number.

Spring loading allows the scleroscope to be used on a test piece in positions other than flat.

The mark left on the test piece by the indenter is insignificant.

Prior to testing, the surface is ground smooth with medium grit to assure uniform surface preparation in the areas to be tested.