TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT

UNIT 1

ISOLATED PHASE BUS FAILURE REPORT

JANUARY 19, 1982 THROUGH FEBRUARY 8, 1982

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APR 13 1982

ISOLATED PHASE BUS FAILURE REPORT - SEQUOYAH NUCLEAR PLANT

Attached is a copy of the Isolated Phase Bus Failure Report, Sequoyah Nuclear Plant, for your review and dissemination to appropriate personnel.

C. C. Mason

JEG:LLM:JC
Attachment
cc (Attachment):
ARMS, 640 CST2-C (without attachment)
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OFFICE OF PLT SUPT.
[illegible] SEQUOYAH
APR 15 '82

	Info	Action	Reply

ABSTRACT

On January 19, 1982, at approximately 1941 hours, unit 1 at Sequoyah Nuclear Plant tripped from a transformer differential relay operation. The trip was initiated by a ground fault on the 24-kV isolated phase bus. This fault should have been cleared by a neutral overvoltage relay operation. However, the relay failed to operate due to blown input fuses. As a result of the improper clearing of the fault, the damage escalated into the plant and damaged or destroyed several major components. One of the components to be destroyed was the neutral transformer. The violent failure of the transformer spread PCB insulating oil (Interteen) throughout the area under the generator. This hampered the repair operation since personal safety became the main concern with PCBs being involved.

After the failure on unit 1, several checks and tests were performed on the unit 2 neutral overvoltage circuitry, isolated phase bus, and neutral transformer and resistor to minimize the possibility of the same type of incident happening on unit 2. Several corrections have been performed to the unit 1 isolated phase bus to prevent moisture from entering the bus. Improvements will be made to the neutral overvoltage circuitry to improve its reliability, and a backup protection circuit for a ground fault will be implemented.

Mode 4 was established on unit 1 on February 4, 1982, at 1700 hours, and generator synchronization occurred on February 8, 1982 at 2048 hours.

PREFACE

On January 19, 1982, the Sequoyah Nuclear Plant unit 1 generator isolated phase bus failed. A project approach was utilized for the management of recovery activities from the incurred damage. The purpose of this report is to provide factual information related to the failure and describe actions taken to restore the unit to service.

The following is an edited exert from the log of Shift Engineer, Daniel W. Cross, dated January 19, 1982.

> "I would like to thank everyone--all of the maintenance people, Public Safety, especially the assistant unit operators for a job well done during this incident. Everyone at the plant performed in a very cooperative fashion and professional manner. I never had so many phone calls saying I am here if you need me. I sure do appreciate it. There was no arguing or any complaints. Just what can I do!"

The spirit described in the above words was carried on first and foremost in the project team. Casting aside fear of inadverently omitting someone, those who made significant individual contributions to the recovery are herein identified.

Edward Craigge, Victor Taylor, and Mike Dwyer worked tirelessly in the PCB control and cleanup efforts. Their contribution is most appreciated.

Walter Watson displayed the utmost in cooperation in coordinating details of recovery activities with site organizations.

David Wright and his onsite technical team composed of Rickey Sparks, Mark Mullins, Tom Kontovich, and Mike Seay. Rickey Sparks was instrumental in determining the scope of damage, performing inspections, formulating recommendations, coordinating with the Division of Engineering Design, and obtaining replacement parts. Mark Mullins led the investigation into the cause of the failure and was responsible for the determination of the most probable sequence of events. Tom Kontovich performed detailed inspections of the generator and exciter. The results of his inspections were part of the basis for the recommendation for continued operation. Mike Seay assisted in the coordination required to obtain replacement parts and perform inspections.

Steve West directed recovery efforts from the generator terminals through the main transformer bank.

Cleston Jones and his PSO crew worked many long hours in determining the extent of damage and the suitability for service of major electrical equipment.

Wayne Thomas directed the recovery from the generator terminals through the neutral transformer.

Ted Gatewood was responsible for generator disassembly and reassembly.

Landy McCormick provided the planning support and coordination of the preparation of reports.

Jim Kelly was very helpful in interfacing with Westinghouse to obtain replacement equipment. He was also helpful in providing resolution to numerous technical questions that arose.

Jim Hufham, Bob Henson, and Sam Hixson provided the guidance for limiting the release of PCBs.

John Fox provided the lead in determining and evaluating chloride levels produced as the result of the failure.

Sam Hixson and Jim Mantooth who interfaced with the plant and organizations within TVA in defining actions required to mitigate the spread of PCB.

Also no little contribution was made by the craftsmen who performed the cleanup and made the repairs. The effort of the laborers was especially appreciated.

January 30, 1982

pending

C. C. Mason
Sequoyah Nuclear Plant

Subject: REPORT OF FIRE ON JANUARY 19, 1982 - SEQUOYAH NUCLEAR PLANT

Location

Turbine building elevation 706, unit 1 side at unit 1 neutral transformer.

Sequence of Events

At 2040 EST on January 19, 1982, an assistant unit operator walking in the north yard area toward the turbine building saw a flash and smoke in the area of the power transformers in the north end of the 500-kV transformer yard. He tried to call the alarm in on PAX 299; however, this number would not work. He then called the alarm in to the shift engineer at 2041 EST.

The fire brigade responded immediately led by L. T. Carr, assistant shift engineer. In response, heavy smoke was noted on elevations 732 and 706 in the turbine building and a request was made for ventilation lineup. Initial response was to the reported site in the 500-kV switchyard. No fire was found upon arrival in the 500-kV switchyard; however, the high-pressure fire-protection system was operating on B-phase main transformer. A fire brigade member was assigned to secure this water spray system and the rest of the fire brigade redirected their response to the turbine building.

By this time some of the general smoke involvement had cleared from the general area beneath the unit 1 electric generator. Two fire brigade members went to the immediate area, saw that the neutral transformer had blown, and saw some small flames on paper or cardboard spacers within the blown transformer's shell. They promptly extinguished these flames with a 20 pound A:B:C rated portable fire extinguisher and then moved back out of the immediate area. No other flames were noted; however, smoke was still being evolved from transformer oil in the area.

The preaction water spray fire protection system protecting the nearby unit 1 hydrogen seal oil unit had automatically actuated. As soon as it was verified that there was no fire in or exposing this unit, the fire brigade leader directed this water spray system to be shut off.

In the intervening time, self-contained breathing apparatus, hose, and fire nozzles were being brought to the area. A 2½ inch fire hose line was deployed from the standpipe at the preaction water spray fire protection system for the unit 1 hydrogen seal oil unit. A fine water spray from this line was used by fire brigade members in self-contained breathing apparatus to cool the blown transformer's shell and other hot surfaces in the area. It was not needed for fire fighting. After being used for cooling, the 2½ inch nozzle was removed from the hose line and a gated-wye installed and two 100 ft. 1½ inch hose lines deployed as a precaution.

The fire was officially declared extinguished by the fire brigade leader at 2051 EST. The area was then secured to control access to the accident scene, efforts directed at control of the PCB-containing transformer oil, and management and craft personnel called to begin the cleanup and recovery efforts.

Cause

The initiating event appears to have been a phase-to-phase or phase-to-ground fault in the stub buss leading to the B-phase power transformer. This apparently resulted in a phase-to-ground fault beneath the unit 1 generator and an over-heating and over-pressurization of the neutral transformer resulting in the transformer rupturing or exploding.

Damage

There is no evidence of direct fire damage as a result of this incident. A large amount of damage was done by the electrical faults, failures, arcing, and PCB contamination. No form TVA 18002 is being submitted related to fire damage. A 18002 report will be submitted as a result of the actuation of fire protection systems and the damage caused by electrical failures as soon as the investigation into these areas develops sufficient information.

Protection Restored

The preaction water spray fire protection system protecting the B-phase main transformer is being kept out of service at this time under administrative controls due to testing on this transformer. The portable fire extinguishers, fire hose and related equipment, breathing apparatus, and other equipment used by the fire brigade was fully restored or replaced "in-kind" by noon on January 20, 1982. The preaction water spray fire protection system protecting the unit 1 hydrogen seal oil unit was restored to automatic mode sometime during the morning of January 20, 1982. No other fire protection systems were impaired.

Recommendations and Comments

1. It appears that the direction and actions of the fire brigade were well-directed and proper. It also appears that the support they needed from other plant groups was promptly furnished and as needed. Following the

initial control efforts, for a short time, it appears that access to the general scene of the incident should have been restricted more. Also, it appears that a large number of employees responded to the turbine building unnecessarily and were potentially exposed to breathing smoke and toxic gases (the same exposure would exist in the event of substantial smoke involvement from any source). The need to control access to areas similar to this and the need for respiratory protection where smoke and/or toxic gases could be present needs to be re-emphasized. Also, Public Safety, if requested, has the ability and responsibility to control access to these areas.

2. Details, conclusions, and recommendations relative to the electrical failures, damage, restoration, PCB control, and cleanup will be addressed in a later report directed specifically at these aspects of this incident.

Action Taken by Us

Corrective action in those areas addressed in item #1 above and the investigation as mentioned in item #2 above are in progress.

The PAX 299 fire alarm system was repaired the same night as the incident.

L. M. Nobles

L. M. Nobles

Edward A. Craigge

E. A. Craigge

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This was prepared principally by E. A. Craigge.

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I. Detailed Description of the Incident

A. Events Which Occurred

Because of the extent of the failure, the exact sequence of events could not be determined because of the number of unknowns. The following initial conditions were assumed to exist before the fault.

1. At least one of the fuses in the neutral overvoltage circuit was blown before the fault.

2. The covers on the unit 1 spare main transformer low-voltage bushing box were partially removed, and the air baffles were not installed in the spare transformer bus link positions.

Initially, the problem started when there was a flashover to ground in the unit 1 generator 24-kV isolated phase bus on the A phase side of link position 1CA near the normal B phase main transformer (appendix 1, figure 1). The magnitude of this fault current would normally be approximately 440 amperes in the neutral transformer secondary or 4.4 amperes in the primary. However, the value of the neutral resistor was measured after the fault as being 0.141 ohms versus the design value of 0.312 ohms (appendix 1, figure 2). This resistor had apparently been connected incorrectly since its initial installation. This was a low value because a connection bar extended farther than intended and placed an 0.048-ohm resistance in parallel with two 0.4312 resistors (appendix 1, figure 3). With this portion of the bar removed from the resistor, the resistance is 0.3116, which is within acceptable limits of the design value.

The low value of resistance allowed approximately 300 percent of rated current to flow in the transformer. The cable from the transformer to the resistor did not appear to have faulted; therefore, the transformer failure was because of the overcurrent.

After the transformer failed, the fault current in the isolated phase bus fault increased causing the end caps, that are removed for access to link position 1CA, to be blown off. The top cap was blown across the top of the B phase main transformer and landed in the gravel near the road. The bottom cover was blown into the B phase main transformer fire protection piping, then fell to the ground. At this point, the fault flashed to C phase in the isolated phase bus (appendix 1, figure 1), and there was a line-to-line-to-ground fault at this point. Also, the heat from the fault set off the main transformer fire protection. Unit 1 main transformer A and C phase differential relays then operated giving A phase instantaneous and differential targets and C phase instantaneous targets. This tripped the 500-kV power circuit breakers 5034 and 5038 removing the fault from the system. The oscillograph indicated the fault lasted for approximately 4.5 cycles on the system with C phase being involved approximately one-half cycle after A phase. The exciter was tripped approximately eight cycles after the first relay operation (appendix 1, table 1). However, because of the residual flux of the generator field, it took a certain amount of time before the voltage went to zero. This residual flux feeding the fault is what operated the unit 1 generator overcurrent A and C phase relays approximately 54 cycles after the first relay operation (appendix 1, table 1).

During this sequence of events, after the neutral transformer had failed and the generator lost its ground connection, a flash occurred from the neutral bus piece on C phase to the neutral connection housing, burning a hole in the side of the housing and distorting the housing. This flashover and ionized gas, along with the gases from the transformer, were blown into the isolated phase bus where the generator disconnect links are housed via the makeup cooling fans. This, in turn, caused B phase to flash to ground. At this point, all three phases were involved in the fault, but B phase did not get involved in the fault until after the 500-kV breakers were open.

The origin of the ground fault in the isolated phase bus was most likely condensation of moisture on an insulator. If the neutral overvoltage relay had operated properly, the fault consequences would have been minor. The two major problem areas are moisture in the isolated phase bus and some type of backup protection for a ground fault in the generator or the isolated phase bus. Preferably, the detection for this fault should come from another source other than the neutral transformer. The following situation now exists. If the fuses that feed the neutral overvoltage relay are blown, no alarm or other means of detecting the blown fuse is available. The operators take readings from the neutral voltmeter in the control room; however, the voltage that is present is so small it is not always readable. This meter has a scale that reads 0- to 15-kV (reflecting back to the neutral transformer primary).

The isolated phase bus moisture problem has been noticed before. In the summer of 1979, water backed up in one of the dropoffs to a station-service transformer bushing until this bushing failed. Since that time, the plant Electrical Maintenance Section has been draining water from the isolated phase bus on a monthly basis as a part of their preventative maintenance program. The recent failure has indicated future action needs to be taken to remedy this problem.

B. Scope of Damage

1. Generator Winding and Exciter

The main generator and exciter were inspected (rotor in place) for possible damage resulting from a phase-to-ground fault and subsequent double phase-to-ground fault at the main bank transformers. Paul Vaughn and Bob Wilson of Westinghouse assisted in the inspections and made recommendations for repair.

Exciter End Inspection

The backside of the endturns are not accessible on the exciter end and the inspection was limited to the boreside. The overall appearance of the winding was clean but oily. Approximately 10 to 12 ties were found broken, mostly between phase groups indicating relative movement between phases. None of the diamond spacers had been displaced and all appeared captive. There was evidence of vibration dusting appearing at about 10 percent of the spacers. However, it was not severe and this condition has been observed on previous inspections of the unit. Westinghouse stated that most ties are used as an aid in winding and that they are not instrumental in securing the diamond spacers. The spacers are secured by wrapping them in epoxy-soaked dacron and forcing them between the coil halves. The stator slot end wedges were observed to be in their original positions and there was no observable filler strip migration. The rotor retaining ring fit was inspected for arcing and no discrepancies were noted. Of the 12 phase blocks (Z blocks in Westinghouse terminology), 6 were loose enough to be moved by hand. They have been numbered and their positions are as shown on the diagram in appendix II.

Turbine End Inspection

The overall appearance at this end was also clean but oily. Broken ties were again visible on the boreside (top coil halves) and also on the backside (bottom coil halves). Two of the diamond spacers had fallen out and were found in the bottom of the generator. Another spacer had come halfway out but was not loose enough to be pulled out by hand. Only one phase block was noticeably loose. The relative locations of these blocks and spacers are noted on the diagram in appendix II. Vibration dusting was also observed on this end and is known to have existed prior to this inspection. All stator slot end wedges and filler strips were intact. There were no discrepancies noted on the rotor. The taping on one bottom coil had been cracked and came loose. This was superficial damage and does not violate the integrity of the insulation. Three stator water outlet thermocouples were found defective at the header. One had been broken loose at the nipple and the wires for the other two were broken. Their locations are marked on the diagram in appendix II.

Exciter Inspection

There was not evidence of physical damage to the exciter as a result of the fault of January 19, 1982. The failure of the neutral transformer did result in the formation of chlorides which were drawn into the exciter cubicle. Black soot containing chlorides was found on components of the winding, including the armature. There were no blown fuses or evidence of exciter overcurrent. The exciter field current limiting resistors were found mechanically damaged and this resulted in an intermittent ground on one of the resistors.

2. Neutral Transformer, Neutral Bus, Resistor, and Housing

The neutral bus, neutral transformer cubicle, and bus support structures were severely damaged because of the violent failure of the neutral transformer. The right side removable cover and door were blown completely from the cubicle structure. The right side cover was blown approximately 40 feet into the ventilation unit to the right of the cubicle. The force of the explosion tore the supports for the neutral bus and housing from the concrete, breaking and pulling the bolts from the concrete. The internal explosion of the transformer ripped the tank open and blew the transformer from the neutral cubicle to the floor. Once the tank was blown open, the transformer insulating oil (Interteen-100-percent PCB oil), which was extremely hot, was blown onto equipment and structures in the area of the neutral cubicle. Soot from the incineration of the oil was deposited on the generator casing, exciter, and other equipment in the vicinity of the neutral cubicle. The neutral resistor was not physically damaged but was coated with combustion products and PCB fluids.

3. Generator Neutral Connection and B Phase Disconnect Link

As already discussed in section I, part A, of this report, the neutral connection arced to the neutral enclosure and current transformer (ct) conduits. The neutral enclosure was ripped open and a hole approximately two feet in diameter was blown in the enclosure at the C phase end. The arcing in this area splattered aluminum onto the three neutral bushings. The enclosure mounting adapters were also damaged severely. The C phase neutral connection was distorted where the neutral bus connects. This neutral bus connection was blown away when the neutral bus was pulled from its supports.

The B phase generator disconnect link arced to one of the side sheets as discussed in section I, part A, and blew the removable cover assembly to the floor on elevation 706. A hole approximately eight inches in diameter was found in the disconnect link. The support angle and insulator were melted by the arc. The B phase main lead bushing was splattered with melted aluminum as a result of the arc. The disconnect link compartment cooling fans were undamaged although the filters were melted.

4. Isolated Phase Bus

The phase-to-ground faults and the phase-to-phase fault, which occurred at the 1CA disconnect link in the isolated phase bus near the normal B phase main transformer, resulted in extensive damage. The top and bottom covers were blown completely from the housing. The air flow baffle was melted away approximately 60 percent. The link mounting flanges on both A and C phases were partially melted. The support insulators were severely damaged and another on A phase was splattered with aluminum. There was no structural damage to the isolated phase bus support structure.

5. Cable, Conduit, and Miscellaneous Equipment

No physical damage was apparent on the generator ct's and potential transformers (see appendix III for test). The neutral ct cable and conduit were damaged by the arc from the neutral bus. The main lead ct cable required replacement due to its brittle condition. The neutral overvoltage relay circuit cable was also damaged.

II. Recovery from the Incident

A. Emergency Project Preparedness Team

1. Project Organization

On January 21, 1982, approximately two days after the incident occurred, the Emergency Project Preparedness Team was formed. The team's organizational chart was made and approved by the plant superintendent on January 22, 1982. Appendix IV is the organization and the personnel involved. Technical support, planning support, and the project manager (production) were provided to the site from the central office.

2. Work Location

The central office personnel set up their work station in the Field Services Group (FSG) trailers. All other personnel maintained their normal work locations at the site.

3. Team Meetings

The Emergency Project Preparedness Team met each morning at 7:45 a.m. in the plant coordinator's office. The purpose of the meeting was to discuss current status on all of the work relating to the bus failure. Coordination for future work was also determined.

Morning meetings commenced on January 22, 1982, and ceased on February 5, 1982.

B. Repairs, Inspections, and Tests Performed

1. Generator Winding and Exciter

The stator winding was successfully high-potential tested at 32-kV ac which was the value recommended by Westinghouse for a normal maintenance high-potential test. Westinghouse recommended pulling the generator rotor to effect a complete repair; but in consideration of load requirements at that time and the evaluation of the condition of the windings by Westinghouse and TVA, it was decided to accept the risk of continuing operation after making all repairs possible with the rotor in place. These repairs were made by Westinghouse technicians and included removal or securing of all accessible broken ties, replacing and securing the diamond spacers that had been displaced, and securing all loose phase blocks. The phase blocks were not removed and refitted but were cleaned in place and secured with resin. The loose tape in the turbine end was cleaned and resined to prevent further damage from windage.

The two header thermocouples that had broken wire were repaired. It was necessary to splice in a 6-inch section of wire to these thermocouples. The thermocouple that was broken at the nipple was not repaired because of the time required for brazing. The thermocouple terminal board studs were replaced and all terminal board wiring was verified correct at this time. Actually only one stud per thermocouple was replaced as the other stud was correct. The thermocouples are copper-constantan and copper-chromel studs had been originally installed.

The diode wheel diodes and fuses were checked in accordance with SI-502. The exciter armature, diode wheel, and generator field winding were meggered in accordance with SI-503. Both tests were satisfactory. The exciter field was tested by a pole drop test which indicated that pole No. 8 was defective (possible shorted turns). Westinghouse recommended that this pole be replaced during the first refueling outage. This deficiency will not affect continued operation. The broken current limiting resistors for the field were replaced. The chloride level found on the exciter was 2.6 milligrams per square decimeter. Westinghouse did not feel that this was excessive, and to cleanup they recommended that the exciter be vacuum cleaned and wiped down with dry lint-free rags to remove chlorides. This technique was successful in reducing the chloride level on the exciter and additional cleaning was not necessary (see appendix III for all exciter test results).

2. Neutral Transformer, Neutral Bus, Resistor, and Housing

The neutral transformer and cubicle, neutral bus, and housing and resistor were replaced with duplicate parts obtained from WBN.

The defect ve equipment was removed and the new equipment obtained from WBN was installed in its place. All neutral bus bolted connections and terminations were torqued to specified values. The following tests were performed on the neutral transformer and resistor obtained from WBN.

a. Bridge (transformer and resistor)
b. Ratio
c. Doble
d. Polarity
e. Megger
f. DC high-potential test (neutral bus only)

All test results were satisfactory (see appendix III for results).

3. Generator Neutral Connection and B Phase Disconnect Link

The C phase neutral connection as mentioned in section III, part B, No. 3, was distorted. This connection was obtained from WBN unit 2 generator and installed. The neutral enclosure and mounting adapters were also obtained from WBN. All bolted connections were torqued to specified values. The aluminum splatters on the neutral and main lead bushings were cleaned with 3M scotch brite pads. Once the bushings were clean, it was evident that the damage was only superficial. The bushing successfully withstood the ac high-potential test performed on the generator.

The damaged B phase disconnect link was originally sent to Westinghouse in Cincinnati, Ohio, to be repaired. Upon its arrival in Cincinnati, it was determined that because it was potentially PCB contaminated it would be more expedient to fabricate another bus link. The support insulator and removable cover assembly were also furnished by Westinghouse. Other damaged areas in the compartment were repaired with materials obtained locally.

4. Isolated Phase Bus

The damage on the 1CA disconnect link was too severe to perform onsite repairs. The delivery date on a replacement disconnect link and housing prevented the complete repair of the damaged section of bus before unit 1 startup. A temporary fix was agreed on and implemented. Appendix V, figure 1, depicts the temporary fix. The permanent repair will be performed during the unit 1 fall refueling outage as outlined in appendix V, figure 2. The three damaged insulators at the 1CA disconnect link were replaced along with two additional insulators discovered during the support insulator cleanup and inspection. Following the cleanup, the isolated phase bus was meggered and dc high-potential tested (see appendix III for results). All tests proved satisfactory.

5. Cable, Conduit, and Miscellaneous Equipment

All conduits and cables damaged as a result of the failure were replaced and all cable termination was performed in accordance with M&AI-12 (termination instruction). The ct's were meggered and ratio tested. The metering and regulating potential transformers were megger, ratio, and doble tested. The lightening arrestors were doble tested. All test results were satisfactory. (See appendix III for results.)

6. Protective Relaying

See appendix III for relay test results.

7. Main and Unit Station Service Transformers

The following tests were performed on the main and unit station service transformers. (See appendix III.)

a. Bridge
b. Ratio
c. Megger
d. Doble
e. Gas-in-oil analysis

All test results proved satisfactory. Therefore, internal inspections of the transformers were not warranted.

8. Turbine Couplings and Bearings

After the transformer failure and a possible system jolt, the Rotating Equipment Group recommended several turbine generator checks. The checks and their results were as follows.

a. Check runout/eccentricity of exciter coupling--Both results were the same as left after the last inspection.

b. Check runout/eccentricity of No. 4 coupling--Both were found the same as left after the last inspection.

c. Swing check exciter rotor--This was checked because a problem had been found here previously. The swing was slightly higher than was left previously and was very slightly out of tolerance. This was considered normal, whether or not there had been an incident. This has been corrected.

d. Inspect No. 11 bearing--This was done because the bearing had to be removed for the swing check. Bearing clearance was slightly excessive and has been corrected. This was not caused by the incident.

e. Inspect hydrogen seals--This was done because it required so little extra work with the bearing brackets already removed. The seals were in good condition.

See appendix III for clearance readings for 1-5.

These were the areas most likely to be damaged by a system disturbance. Since there was no problem at the No. 4 coupling and this is the point of maximum horsepower transmission, there did not appear to be any reason to inspect any other parts of the machine.

9. Structural Supports and Concrete

An inspection of structural supports and concrete in the area of the transformer failure and isolated phase bus failure was performed by the Mechanical Branch and the findings were as follows.

The concrete and metal surfaces in the area of the transformer were covered with black carbon deposits. Workmen washed all the exposed surfaces, primarily to remove PCB contamination. A piece of the transformer was blown against a space cooling unit in bay 76-T7. The southwest corner of the concrete pad was cracked at the anchor bolt. No damage to the generator foundation concrete or to the structural steel of the turbine building was detected. The workmen stated that they had not noticed any cracked concrete during their cleanup. The neutral isolation bus support hanger was torn down during the explosion because its anchor bolts were burned into two pieces.

The structural steel, which supports the main bus between the turbine building and the main transformers of the switchyard, was blackened by burning paint but not structurally damaged. The concrete supports for this steel did not show any signs of damage.

C. Repair Material Coordination and Vendor Inspection Coordination

1. General Summary

As a result of the failure, several pieces of electrical equipment were required. In order to expedite the earliest return-to-service on unit 1, several sources for obtaining material were utilized.

2. Major Components Acquired From WBN

WBN was the primary source for material due to the fact that the units are the same as Sequoyah's and that the equipment was onsite. Preparations were made and the necessary equipment was transferred to Sequoyah. (See appendix VI, table 1, for a detailed list.)

3. Major Components Acquisitioned from Westinghouse

Westinghouse was also a primary material source. They provided all of the isolated phase bus repair material and a new B phase bus link. (See appendix VI, table 2) for detailed list.) Westinghouse provided two technicians for the inspection of the unit 1 generator and a list of repair material necessary to conform with their recommended repair procedure. Westinghouse provided the high-potential test set necessary to test the stator windings on the generator.

4. Materials Acquired from Power Service Shops

The Power Service Shops were utilized to manufacture the neutral reactor transformer bus connection link and two shunts that were not available from WBN. EN DES will be notified of this so that they will incorporate these two items into the list of material that will be purchased for WBN. The Power Service Shops also provided additional material. (See appendix VI, table 3.)

5. Other Material

Any other material that was required was either obtained through SQN Power Stores or through Sequoyah FSG. (See appendix VI, table 4.)

D. PCB Cleanup

1. Inside the Plant

a. Nature of Problem

The unit 1 neutral grounding transformer which failed on January 19, 1982, contained approximately 58 gallons of Interteen. Interteen is a synthetic insulating oil for transformers supplied by Westinghouse and is composed primarily of PCB. PCB is considered an environmental pollutant and a potentially significant health hazard if ingested or breathed in massive or prolonged exposures. At the time of failure, a portion of the insulating oil vaporized and/or decomposed into the air and was exhausted through the turbine building ventilation system. A significant amount was sprayed or blown out of the transformer and deposited as oily residue and soot on building structures and equipment. The remainder spilled onto the floor in the immediate area of the failed transformer. An undetermined amount of the latter entered floor drains in the immediate area of the failure or spilled through floor grating and floor openings to lower elevations before absorbent and other spill control measures could be initiated. An undetermined quantity of the PCB from the floor drains and spills to the lower elevations reached the floor trench drains on the turbine building's lowest floor and were carried by normal water flow to the turbine building station sump.

b. Contamination Control

One of the first actions initiated by the plant's fire brigade in their emergency response was to direct the lineup of the turbine building ventilation system to exhaust smoke and airborne contaminants. As soon as the immediate emergency was controlled, the Operations Section directed that discharge from the turbine building station sump be aligned to the large unlined holding pond. Due to replacement of turbine building sump piping, Operations was not able to direct the sump discharge to the large unlined pond until Saturday, January 23, 1982. Also, the plant laborers were directed to, and did, put absorbent pillows into the station sump.

Within less than one hour following the transformer failure, the boundaries of the accident and heaviest PCB contamination were flagged off, procedures were being initiated for access control, and personnel contacted and called into the plant for cleanup and recovery operations. The boundaries established on the day of the incident were subsequently found to be essentially adequate for turbine building elevation 706. Closer examination on January 20, 1982, resulted in contamination control zones on elevations 732 and 662 being established and the control zone on elevation 685 being expanded. The interior of the station sump was initially controlled by the plant's confined space entry (appendix VII) procedure. The immediate access area around the access hatch was later zoned off when entrance was required into the sump for cleanup operations.

c. Cleanup Measures

(1) Surface Contamination

The initial cleanup efforts on surface contamination were directed at the accumulation and control of liquid and residues in areas where they could flow or be tracked and either enlarge the area requiring cleanup or might reach drainage systems to other potential discharge points. Rags and absorbent materials were the primary materials used in this effort and the procedures as outlined in Standard Practice SQA126 (appendix VIII) and Hazard Control Instruction HCI-HM10 (appendix IX) were followed.

At noon on January 20, 1982, the central office staff expressed concern that plant procedures being utilized for the cleanup efforts might not be adequate to safeguard the safety of employees and control the contamination. All cleanup operations were immediately halted pending the arrival of technical support from the central office and the review, revision, or preparation of adequate procedures. An interim procedure for the cleanup of PCB spills and control of contaminated materials was drafted and issued as Hazard Control Instruction HCI-HM26 (appendix X) to supplement the existing plant procedures. This was completed at approximately 7 p.m. on January 20, 1982, and cleanup operations were allowed to resume.

Varsol was chosen as a solvent for cleanup and was used almost exclusively for surface cleaning except where subsequent recleaning was done on electrical equipment using Malter XL-99 and 1,1,1 trichloroethane.

Initial cleaning was done without an established cleanliness criteria. Later, based upon the results of the cleaning efforts and the effectiveness of other industry cleanups, it was decided that 10 $\mu g/ft^2$ was generally achievable for smooth surfaces. The same level of cleanup appears achievable for most rough and/or porous surfaces; however, some small and isolated surface areas of this type may not be cleanable to this level. These will require specific evaluation and a level higher than 10 $\mu g/ft^2$ accepted.

On January 21, 1982, results of airborne samples taken in the areas of highest surface contamination on January 20, 1982, were received. These confirmed that the level of airborne PCB was significantly and uniformly below the control level for 8 hours per day, 40 hour per week exposure. The respiratory protective requirements due to PCB contamination were waived on this basis. (Highest airborne PCB results were 0.28 $\mu g/M^3$ in comparison to an acceptable control level of 1.0 $\mu g/M^3$.) Respiratory protection requirements were retained for cleaning operations using solvent in areas with less than adequate ventilation.

Cleanup of surface contamination is being completed based upon the above referenced procedures and criteria. Priorities assigned to specific areas were initially established by other recovery and testing efforts. Zones were established (appendix XI, figures 1 through 4) and marked up on TVA 47W200 series drawings to assure a final programmatic cleanup and to correlate the results of contamination analysis before and after cleanup.

The safety precautions as delineated in Hazard Control Instruction HCI-HM26 were reviewed and selectively relaxed by the safety staffs as the cleanup progressed and the contamination potential lessened.

In order to evaluate any potential effects of personnel exposure to potentially high levels of airborne PCB contamination during the period when it could have been present, a list (appendix XIII) of people in the involved areas of the turbine building during and for two hours following the transformer failure was compiled. Each of the individual's medical records has been "flagged" based upon this list. Any abnormalities that could be related to this incident will be noted by the health station and reported to management. In approximately one year, these medical records will be reviewed and any suspected abnormalities pursued.

(2) Water/Sump Contamination

Only the control and cleanup of PCB contaminated water through the floor and trench drains, within the turbine building station sump, and to the discharge of the sump pumps will be addressed here. Control and cleanup of PCB contaminated water from the station sump to the large unlined pond, the CCW discharge canal, and to the river is addressed in a separate section of this report.

The piped floor drainage system from the area of the failed transformer to its termination at an open trench drain on elevation 662 of the turbine building was highly contaminated with PCB. As soon as the routing of this closed drain could be verified, a blind flange was installed to prevent additional discharge to the trench drains. The floor and cone drains involved were blocked and procedures (appendix XIII) developed to attempt to steam clean the piping. These efforts did not provide satisfactory results and it was decided that due to the small pipe sizes, relatively short length, and accessibility the optimum solution would be to replace the contaminated portion of this drain piping. This has been initiated, but not completed due to material restraints and the availability of manpower. In the interim, all drains associated with this system which are necessary for unit startup and operation have been temporarily rerouted to trench drains.

The trench drains from the affected areas were initially flushed to the point where they go to embedded piping with high-pressure fire hose. To the degree possible, the embedded pipe drains were flushed with a fire hose to the station sump. Subsequently, the open trench drains were steam cleaned.

The levels of contamination within the turbine building station sump varied considerably depending upon the level of flow through the sump. Initial swipe samples from the sump walls showed high levels of contamination. Water samples from the sump resulted in widely fluctuating levels of contamination. Initial efforts at cleanup consisted of flushing the sump with a high-pressure fire hose while raising and lowering the water level in the sump. The results of this effort were marginal. The sump ceiling, walls, floor, and all fixtures within were then cleaned by hydro-lasing a number of times. Following this, the entire sump was steam cleaned and reflushed. This resulted in a drop in contamination on the sump walls from the area of 30,000 to 40,000 $\mu g/ft^2$ to less than 15 $\mu g/ft^2$. Subsequent water samples from the sump proper indicated an improvement but still far above the 0.1 $\mu g/l$ level given by the State of Tennessee as an acceptable level for discharge to the CCW discharge canal. Because of the volume of water being routed through the sump to the large unlined pond, a continuous flush was being performed on the station sump. By February 5, 1982, the level of contamination in the station sump was reduced to 150 $\mu g/l$.

As a result of a meeting among TVA, Federal EPA representatives, and State of Tennessee representatives on February 4, 1982, an agreement was reached on discharge in emergency conditions such as pending overflow of the unlined holding pond.

Following the above, sump pump housings and discharge piping within the station sump were hand wiped with rags and solvent to remove oily residues which had accumulated. After this process, the interior surfaces of the station sump were again hydro-lased with a chemical cleaning agent (Triton X-100) added and again flushed with a high-pressure fire hose.

All flushing and cleaning operations in the station sump were performed in accordance with Hazard Control Instructions HCI-HM10 and HCI-HM26 (on PCB cleanup), HCI-G8 (confined space entries), and a handwritten procedure for Operations on flushing and cleaning the turbine building station sump.

d. Surveys and Sampling

Industrial Hygiene and central office support for surveys, sampling, and evaluation of PCB contamination levels was requested on the morning of January 20, 1982, and support personnel arrived shortly after 3 p.m. EST the same day. Initial airborne samples were taken in the areas of highest suspected contamination and as close to active cleanup operations as possible. Swipe samples were taken throughout the areas of contamination, at the perimeters of the barricaded cleanup areas, in approximately

8-10 feet and 12-15 feet expanded perimeters around the marked-off areas, and in remote areas on the unit 2 side of the turbine building on various elevations (for baseline data).

The results of the above sampling were provided by TVA's laboratory in Chattanooga. The test points were plotted on a marked-up set of TVA drawings 47W200 series for reference and correlation.

Subsequent swipe and airborne samples were taken throughout the cleanup process to provide background data, clarify the extent of cleanup needed, verify the results of cleanup of areas and equipment, and verify the cleanup of tools and equipment in use.

Initial water samples from the turbine building sump were taken on January 20, 1982. Subsequent sampling was conducted on at least a daily basis throughout the cleanup process.

Appendix XIV summarizes the locations of samples taken, dates taken, type of samples, and results. The included marked-up TVA drawings 47W200 series shows locations.

e. Disposal of PCB Wastes

The accumulation, packaging, and shipping of PCB contaminated wastes followed Standard Practice SQA126 based upon DPM-N81E3. This source did not provide sufficient detail or guidance for the specific problems or its magnitude. A supplemental instruction (appendix XV) in this area was developed and implemented at the plant based upon the information available and the lack of functional assistance in this area from offsite support organizations.

Approximately 100 drums and 10 wooden crates total of PCB contaminated wastes will be packaged, loaded, and shipped via TVA truck to power stores in Muscle Shoals for disposal following this procedure.

f. Results and Effectiveness

The cleanup procedures and processes initially developed for the cleanup of surface contamination were highly effective and produced results within the cleanliness criteria established.

The cleanup procedures and processes for cleaning drains also appears to have been highly successful except for the cleaning of the piped drain from the area of the involved neutral transformer to its termination point on turbine building, elevation 662. Steam cleaning, the only procedure tried, was not significantly effective. Because of the obvious expense of trying other procedures, which might also be ineffective, it was deemed economically expedient to remove and replace the piping which would no doubt be effective.

Cleaning of the station sump was hampered by several problems. Procedures were developed and implemented to achieve .1 μg/l, a high degree of cleanliness; however, it appeared obvious that a cleanup level to achieve 0.1 μg/l of PCB contamination for release was not achievable. Cleaning in the sump was also very difficult and time consuming due to difficult access, limited visibility, confining protective clothing and extraordinary precautions taken to assure the safety of the cleanup laborers.

g. Comments and Recommendations

(1) Comments

(a) At least seven onsite groups were directly involved with the cleanup operations. These were the plant laborers, electricians, and safety staff; FSG laborers, electricians, and safety staff; and power stores. Throughout the cleanup process there were problems in coordination of specific job activities, work areas, priorities, and materials procurement and distribution. These problems were addressed as they arose and resolved to allow the work to progress. Coordination problems did, however, result in delays and duplication of effort.

(b) From the start of the cleanup effort there were problems in material availability. Understandably, the plant was not equipped in this area to handle a problem of this type and magnitude. Shortages were experienced in signs, coveralls, plastic gloves, rubber boots, respirator cartridges and prefilters, chemical goggles, and appropriate solvents. Most of these items are on a maximum/minimum at power stores, however, the minimums were not on hand.

(c) Since it was a nonroutine activity, there were problems identifying the requirements for and coordination of shipments of PCB contaminated materials for disposal.

(d) Because of an oversight and lack of effective communication, a bus connector from the contaminated area was shipped by the plant to the Westinghouse, Cincinnati, Ohio, plant. This was discovered before the part was delivered to Westinghouse's facility and both the driver of the delivering TVA truck and Westinghouse were notified. The plant recommended that swipes be taken and analyzed in Cincinnati to determine the level of PCB contamination, Westinghouse be requested to decontaminate the connector as necessary (with our guidance if needed), and package, label, and return any contaminated materials with the repaired part. Instead, it was decided that the bus connector would be shipped back to the plant "as it was" on a TVA truck and that Westinghouse would provide a new replacement part. Swipes taken and analyzed after the damaged bus was returned to the plant showed contamination levels on the outside of the part of between 2.4 and 3.6 $\mu g/ft^2$ and less than 1 $\mu g/ft^2$ inside. These levels are considered insignificant PCB contamination.

(e) Boundaries of contaminated areas were removed on elevations 706, 685, and 662 by onsite personnel before final wipe sample results were received confirming that surface contamination levels were acceptable.

(2) Recommendations

(a) Should a similar incident occur in the future, a specific individual should be assigned to serve as cleanup coordinator. This person should be a manager who can devote the time and efforts necessary to this job. He/she should not have significant other plant duties and responsibilities that would result in detractions from the efforts in coordinating the cleanup. A cleanup coordinator was assigned, but it was later in the cleanup effort.

(b) Plant maximum/minimum inventories of basic cleanup materials should be reviewed. The minimum levels established for cleanup materials should be maintained and available at all times.

(c) Plant inventories of cleanup materials at each plant cannot reasonably be oriented toward a cleanup operation of this magnitude. TVA should consider the provision of a centralized storage facility from which the individual plants can obtain the more basic cleanup materials in a reasonably short period of time.

(d) The laboratory at the 401 Building in Chattanooga was the only facility within the system equipped to provide the required PCB analyses. This lab was inundated with samples to be run on their limited equipment by their limited number of personnel qualified for this analysis. Consideration should be given to either: 1) acquisition additional equipment and train more personnel at the involved laboratory; 2) duplicate this laboratories capabilities in at least one other TVA laboratory, or; 3) enter a reciprocal aid agreement with a non-TVA owned laboratory in the area which has similar capabilities. This is desirable in other potential incidents similar to this and also in the event that this entire laboratory or individual equipment is unavailable due to a fire, equipment breakdown, or other occurrence.

(e) Though a conservative approach was taken in this cleanup, a somewhat more conservative approach could have been taken in two areas. As a minimum, mutual response personnel should utilize respiratory protection equipment and protective clothing. Also, in conjunction with a more timely turnaround in analysis, protective equipment and control boundary requirements should remain in effect pending laboratory verification supporting their relaxation.

(f) A review of the adequacy of existing PCB disposal procedures should be made and revision incorporated as necessary.

2. Outside the Plant

a. Nature of Problem and Action Taken

The National Pollutant Discharge Elimination System (NPDES) Permit No. TN0026450 assigned to SQN states in Part III, Item A, "There shall be no discharge of PCB compounds such as those commonly used for transformer fluid." This permit condition stems from the concern for PCB toxicity to aquatic biota and the possible health hazard to humans if PCB is present. PCB's resistance to degradation in nature is a compounding factor for concern. The NPDES permit places a legal restriction upon TVA to prevent release of PCB to the waters of the U.S.

The turbine building sump received PCB from the accident and its discharge, NPDES Serial No. 010, would normally be routed to the waters of the U.S. This discharge was intercepted following the accident and held in the limited capacity large unlined pond to prevent violation of the NPDES permit. As the pond filled to capacity, there existed three alternatives.

(1) Allow the pond to fill and overtop its banks risking TVA property damage and discharge of PCB.

(2) Remove the turbine building sump flow from the pond returning it to the waters of the U.S., thereby violating the NPDES permit. The water held in the pond could then be treated for PCB removal and discharged or discharged without treatment resulting in a separate violation for that discharge point, Serial Discharge No. 009.

(3) Continue the turbine building sump discharge to the pond while treating and discharging the pond contents.

Alternative No. 3 was the one chosen.

The PCB contaminated waste water was treated by passing it through a granular activated carbon adsorption system consisting of two single stage filters operated in parallel. The PCB was adsorbed onto the surface of the carbon with the treated effluent discharged to the diffuser pond. Various hoses, piping, valves, coupling, flow meters, and pumps supplied by FSG at SQN were used in setting up the adsorption system and conveying waste water to and away from it. Originally one permanent electric pump set in place at the large unlined pond was employed to force water through the filter units. This pump's discharge volume did not equal or exceed the volume of water coming into the pond from the turbine building sump. It was either holding at a relatively constant pond level or loosing capacity. The FSG purchased two large diesel pumps located at Hartsville from the Division of Construction. These pumps provided enough capacity to overcome the incoming flow to the pond thereby decreasing the level of water in the pond.

In the event additional holding capacity was required, the small unlined pond was dedicated to the PCB cleanup activities. This pond was emptied through the use of pumps and hoses supplied by both FSG and CONST at SQN. It was later decided that the small lined pond would also be pumped down and emptied.

b. Surveying and Sampling Program

Oil or liquid containing PCB, released within the turbine building as a result of the (January 19, 1982) transformer accident, entered the building floor drains leading to the turbine building sump. Two grab samples were taken from the sump contents on January 20, 1982 to determine the extent of PCB contamination within the sump. The results of the sample analyses were obtained on the morning of January 21, 1982, and revealed the presence of PCB. If the turbine building sump contents contained PCB, the possibility of PCB in the sump discharge going to the waters of the U.S. existed. The turbine building sump discharge was aligned to the CCW channel instead of its normal discharge path to the yard holding pond due to ongoing replacement of piping between the sump and the yard pond. Therefore, on January 21, 1982, the turbine building sump was resampled along with grab samples being taken from the CCW channel and the diffuser pond effluent. The turbine building sump sample analysis revealed PCB at approximately the same level as on the January 20, 1982, with the CCW and diffuser effluent sample analyses indicating PCB at levels less than the TVA central laboratories minimum detectable limit of 10 μg/l. The minimum detectable limit capability of the central laboratory was reduced to 0.1 μg/l on January 22, 1982, by sensitive adjustment of the laboratories gas chromatograph unit. Grab samples were taken from the turbine building sump and diffuser pond effluent on a daily basis from January 22, 1982 forward. All sampling was performed by representatives of the Emergency Preparedness and Protection Branch (EP&PB).

Samples collected on January 22, 1982, revealed the highest PCB levels encountered in the turbine building sump and diffuser pond effluent. This is believed to be the result of a slug of PCB water being pushed from floor drains in the turbine building into the turbine building sump and out the diffuser discharge as a result of a large regenerative waste discharge through the floor drains on the night of January 21, 1982. Since that time, all samples taken from the diffuser discharge to the Tennessee River have contained less than the minimum detectable limit for PCB by the TVA central laboratory.

The Water Quality Branch (WQB) of the Office of Natural Resources, collected grab samples from the Tennessee River on January 22, 1982, following the diffuser sample results of the same day indicating PCB was discharged to the river.

Samples were taken at the raw water intakes of C. F. Industries, Tennessee American Water Company, and at the scroll case at Chickamauga Dam. These samples indicated the presence of PCB which was later shown to be erroneous when they were reanalyzed and shown to actually contain less than the TVA central laboratories detectable limit for PCB.

The Water Systems Development Branch, of Office of Natural Resources, ran a model on January 22, 1982, to determine the location within the Tennessee River of a slug of PCB water at 9 a.m. on January 23, 1982, had it been discharged from the diffuser pond at 10 p.m. on January 19, 1982, and 8 a.m. on January 22, 1982. The model indicated river mile 435.1 for the January 19, 1982 release and river mile 465.3 for the January 22, 1982 release. River mile 465.3 is the location of the Tennessee American Water Company intake.

Samples were collected by WQB the morning of January 23, 1982, from the Tennessee River at miles 435 and 452 at middepth and midchannel, 483.4, which is the trailing edge of the mixing zone and at 485 upstream of SQN at middepth and midchannel. In addition, samples were collected from the raw and finished water of C. F. Industries, Tennessee American Water Company, South Pittsburg Water Treatment Plants, and the scroll case at Chickamauga Dam. These samples contained less than the central laboratories minimum PCB detectable limit.

The afternoon of January 23, 1982, the WQB and the EPA collected samples from the raw and finished water of C. F. Industry and Tennessee American Water Company water treatment plants. Tennessee American Water Company representatives collected samples of their raw and finished water at the same time. These samples were analyzed by TVA central laboratory; EPA, Athens, Georgia Laboratory; and Stewart Laboratories, Inc., in Knoxville, Tennessee; and all results indicated less than $0.1 \mu g/l$.

On January 31, 1982, representatives of the EP&PB began collecting samples from the influent and unit A and B effluents of the Calgon Corporation granular activated carbon adsorption system. A grab sample was taken at the beginning of system operation followed by an 8-hour composite sample. Beginning on February 1, 1982, a daily grab sample was taken from each point. PCB analyses on these samples were performed by the TVA central laboratory. The PCB removal efficiency of the system has been shown to be very good.

The SQN chemical laboratory began grab sampling the influent and unit A and B effluents of the adsorption system on February 3, 1982, and analyzing for various control parameters such as turbidity, total suspended solids, oils and grease, and ph. This sampling and analytical program was conducted on a five-day-per-week basis, and the results were used to forewarn of plugging and subsequent PCB breakthrough of the carbon filter units. This information also indicates the quality of water being discharged to the environment irrespective of the PCB concentration. In addition, analyses for water hardness and total sulphates were performed twice per week for the same purposes.

Stewart Laboratories, Inc, on February 3, 1982, analyzed portions of six samples taken from the turbine building sump, diffuser pond effluent, the adsorption system, and a reference sample. The TVA central laboratory performed the same PCB analysis on portions of the same samples. A comparison of the results verified the accuracy of the TVA central laboratory at a 90-percent confidence level.

The values of all samples analyzed in relation to the PCB contents of the SQN waste water discharges and in relation to the carbon adsorption system's performance are being maintained by the EP&PB. These values are available through S. W. Hixson at extension 4711 or J. G. Mantooth at extension 4707. A log of these values will be "published" following the completion of the cleanup project.

c. Responsibilities

(1) Calgon Corporation

In relation to the services contracted, the Calgon Corporation's responsibilities include providing the hoses required for transferring the activated carbon from the transport truck into the adsorption vessels. In addition, Calgon would be responsible for all major maintenance of the adsorption system such as vessel rupture, etc. Also see contract section for additional responsibilities.

(2) TVA (Site)

The responsibilities of TVA in relation to the use of the adsorption unit is outlined below.

(a) Transfer trailer truck access to a site prepared for setting up the adsorption system which is 14 feet by 28 feet by 15 feet and weighs 35,000 pounds empty.

(b) Collection, conveyance, and disposal of carbon transfer water and all drainage from the adsorption system site.

(c) Influent and effluent piping to and from the adsorption system and disposal of the treated effluent.

(d) Influent pumping to the system with flow control to limit the water pressure to a maximum of 70 psig.

(e) Provide necessary utilities.

1. Compressed air at 100 psig with a flow rate of 80-100 cfm required for each carbon transfer process.

2. Water at 100-150 gpm flow rate for a total of 4000-5000 gallons required for each carbon transfer process.

(f) Provide manual labor for system installation and dismantling. Machinery required included a 30-ton crane for on- and off-loading the adsorption system and a cherry picker to assist in mounting certain piping pieces.

(g) Operation of the adsorption system including monitoring of the influent and effluent water quality.

(h) Minor maintenance of the system such as valve repair for which Calgon supplied or reimbursed TVA for replacement parts.

(i) Pretreatment of the influent if necessary to ensure PCB removal capabilities of the system are not hindered by total suspended solids, oil and grease, hard water, sulphates, etc. Pretreatment may have included filtration, ph adjustment, or dechlorination.

(j) Installation and maintenance of antisiphon loop at the adsorption systems effluent, if needed.

(k) Subsequent carbon transfers after initial two truckloads.

(l) Arrangement for disposal of spent carbon and any disposal fees.

(m) Damages to the adsorption system due to negligence or operation outside system design limits.

d. Disposal

A definite disposal method for the spent activated carbon has not been decided upon. Alternatives may include disposal with Chemical Waste Management, Inc, or burning to destroy the PCB. These disposal techniques possess their own individual problems which must be addressed. Whatever method is chosen, it must be approved by the necessary regulatory agencies. Further investigation of disposal alternatives will be conducted.

The sludge and soil within the large unlined pond is expected to be contaminated with PCB and future analysis should be made to confirm this expectation. If PCB contamination exists, PCB will continue to show up in discharges from this pond in the future, thereby being a continuing source for violation of the NPDES permit. The contaminated sludge and soil should be removed for disposal or isolated in some manner to prevent a continuing discharge of PCB. This situation may require discussions with the proper regulatory agencies to determine a definite need for disposal of the sludge and soil. Alternatives must again be considered if disposal is required. One possible alternative would be, once again, Chemical Waste Management, Inc.

E. Chloride Contamination

1. Problem and Associated Limits

PCB at high temperature has the chemical characteristic of breaking down to form hydrochloric acid by the following general equation: PCB (at 2700°F) = HCl + CO_2.

Because of the high currents and temperatures which occurred during the isolated phase bus to ground fault and the resultant blowup of the neutral transformer, there was large concern for chlorides causing corrosion and possible future failure of critical electrical generating equipment. No nuclear safety related systems were involved in possible chloride contamination.

The limits for chlorides are 1.0 mg/dm^2 for electrical and mechanical equipment and 0.08 mg/dm^2 on stainless-steel piping.

2. Chloride Cleanup

A general area cleanup of soot, chlorides, and PCB took place during the recovery phase of the incident. Chloride swipe locations and results can be found in appendix XVI. A detailed cleanup was performed in those areas found to have high chloride levels (i.e., generator, thermocouple studs, exciter).

Stainless steel piping samples in all areas would not meet criteria (0.08 mg/dm^2). This is believed to be because of high background chloride contamination from concrete, dust, etc. Stainless steel will be dealt with separately from this report since the contamination measured did not result from transformer failure.

F. Planning and Scheduling

1. Generator, Neutral Bus, Main Transformer Work

a. General

It was decided to divide the repair work between FSG and plant maintenance. FSG was designated as being responsible for repairing the generator and the neutral bus and transformer. Plant maintenance took the responsibility of making repairs to all 24-kV buses and all of the equipment in the switchyard.

b. Original Versus Actual Schedule

(1) General

The original schedule was broken down into three different areas (generator, neutral bus, and plant maintenance). This was done to allow each group to better track their individual schedule and report updates easier. The original schedules were produced on January 22, 1982. These schedules showed all repairs completing by February 2, 1982. This meant a duration for repairs of 14 days and startup on day 15. The original critical path was estimated to be main and unit station service transformer testing. Transformer testing was originally believed to be critical path due to the wet weather which initially existed. It was felt that doble testing would have to be delayed due to the bad weather causing transformer testing to be critical path. Neutral bus work was originally considered near critical path being two days off of critical path. Generator work was also considered near critical path being one day off of critical path.

(2) Plant Maintenance Work

Because of the good weather, the Division of Power System Operations finished main and unit station service transformer testing in 4 days instead of the 11 days originally scheduled. After this testing was completed, no other work which was being performed by plant maintenance was considered critical path or near critical path. (See appendix XVII for original versus actual schedule.)

(3) Neutral Bus Work

Neutral bus work was originally scheduled to take 14 days to complete. The major portion of this work concentrated on cleanup, neutral transformer installation, neutral bus and terminal enclosure installation, and neutral ct testing and repair. This work actually took 14 days to complete. (See appendix XVIII for original versus actual schedule.)

(4) Generator Work

Generator work was not originally critical path but became critical path after an inspection of the generator on January 23, 1982 revealed several broken tie blocks inside the generator. This inspection resulted in dismantling the generator further than originally planned in preparation for rotor removal. It was then decided on January 25, 1982, that the rotor would not be removed and repairs to the generator tie blocks and thermocouples would be performed. (See appendix XIX for the original versus actual schedule.) The original generator schedule showed belly plate removal commencing on January 21, 1982, and completion of the exciter reassembly by January 29, 1982. This was an original duration of nine days. This duration does not include the three days for the generator air test and purge. Generator and exciter work actually commenced on January 21, 1982, and exciter reassembly completed on February 2, 1982. This was a total duration of 14 days. The 5-day duration increase in critical-path time is attributed to having to make repairs to the generator windings (2 days) and a more extensive reassembly of generator parts than was originally intended (4 days). Meggering and high potential on the generator took one day less than originally scheduled.

c. Manpower Support

The following is a breakdown of manpower which was used in support of the bus failure. These are average manpower levels, per day, for the duration of the work.

Field Services

Engineer/Craft	First Shift	Second Shift
Engineers	7	2
Electricians	13	9
Machinists	3	1
Laborers	17	5
Truck Drivers	1	0
Ironworkers	2	1
Carpenters	2	2
Painters	3	1

Plant Maintenance

Engineers/Craft	First Shift	Second Shift	Third Shift
Engineers	3	1	0
Electricians	10	6	0
Laborers	6	6	7

Division of Power System Operations

	First Shift	Second Shift
Engineering Personnel	6	0

Technical Support

	First Shift	Second Shift
Engineers	4	0
Engineering Aides	1	0

The above manpower levels were used for generator, neutral bus, switchyard, and PCB cleanup work inside.

2. PCB Cleanup of the Large Unlined Pond

a. Actual Schedule

Because of the drain lineups at the time of the incident, along with pumping the turbine building sump to the large unlined pond, PCB was found to exist in the unlined pond. EPA stated that this water had to be cleaned up prior to being pumped to waters of the U.S. from the unlined pond. On January 28, 1982, efforts toward obtaining and setting up equipment which would be used to filter the PCB from the water in the large unlined pond began. Appendix XX shows the actual durations for setting up the filtration equipment and cleanup of the unlined pond. It took approximately two days to set up the filtration equipment. Pumping out of the small unlined pond for reserve purposes took three days. Pumping out of the small lined pond took approximately 2.5 days. The total duration for filtering the large unlined pond cannot be determined at the time of this report due to pump mechanical difficulties.

b. Manpower Levels

The average manpower expended in order to set up equipment, filtrate the large unlined pond and pump down the small unlined pond is as follows. These manpower levels are an average for the period of January 29, 1982 through January 31, 1982.

Field Services Branch

Engineers/Craft	First Shift	Second Shift
Engineers	2	1
Engineering Aides	0	1
Carpenters	5	8
Electricians	3	3
Steamfitters	13	6
Laborers	1	3
Painters	0	1
Truck Drivers	2	1

Emergency Prepardness and Protection Branch

	First Shift	Second Shift
Engineers	4	2

3. PCB Cleanup Inside the Turbine Building

a. Actual Schedule

Final cleanup of PCB from the area inside the posted boundaries commenced on January 29, 1982. Elevations 732, 685, and 662 had only a minor amount of PCB contamination as compared to elevation 706. Appendix XX shows the actual schedule for cleaning up the PCB on all four elevations of the turbine building.

b. Manpower

Manpower levels used for cleanup of the PCB consisted primarily of labor personnel. The manpower used for this work is included in the figures in part IV, figure 1, part C, of this report.

G. Startup Testing and Monitoring

The following data should be collected and recorded when unit 1 returns to service.

1. All generator temperatures should be logged at 25-percent load increments from 0- to 100-percent load.

2. The generator load, generator field voltage and current, exciter field voltage and current, and the generator line currents should be read and recorded at 25-percent load increments, as with the thermocouple readings.

3. Turbine, generator, and exciter bearing vibration should be monitored and recorded as the turbine is brought to speed and loaded.

4. The generator neutral voltage should be recorded at 25-percent load increments, using a digital voltmeter reading the voltage across the neutral voltmeter in the control room. Also, monitor the voltage at the 159GN relay. If the neutral voltage is unable to be detected on the analog voltmeter in the unit 1 control room, then the auto ranging digital multimeter should be left connected until a replacement meter can be installed in the circuit and read as part of

AI-5, appendix B2, page 1. If this voltage should be below 0.5-V then the circuit should be checked for blown fuses, loose connections, etc.

5. The Division of Power System Operations should check the ct phasing to the relays to ensure polarities are correct.

(See appendix III for data sheet and concrete reinforcing bar heating test near isolated phase bus, Sequoyah Nuclear Plant, unit 1.)

III. Administrative Action, Recommendations, and Followup Action

A. Recommendations and Followup Action

1. Generator and Exciter

The repairs made to the generator stator during this outage were made so that the unit could be returned to service as soon as possible. The rotor was not pulled as recommended by Westinghouse and repairs were made only to areas accessible with the rotor in place.

At the first refueling outage when the rotor is removed, a complete inspection will be possible and all necessary repairs can be made. The winding end turns should be thoroughly cleaned with solvent to remove oil. The phase blocks should be removed and refitted. Some diamond spacers may also require removal and refitting.

The thermocouple that broke loose from its outlet header nipple should be reattached. The defective exciter field pole should be replaced at this time. The Electrical and Instrument Controls Branch will procure a replacement pole and they will then write a DCR to remove the resistors (3000 ohm) from the diode wheel that are purportedly unnecessary and a potential source of trouble. The refueling outage will allow time for correction of any other discrepancies discovered at this time.

Appendix III contains the report on the inspection and repair of the generator thermocouples. It should be noted that the repairs performed are predominately of a temporary nature. During the upcoming refueling outage, the inspection of the generator will facilitate permanent repairs to these temporary fixes.

In the interim, we are recommending crawl-through inspections of the generator during outages of sufficient duration to monitor the condition of the winding.

2. Isolated Phase Bus

To prevent moisture from entering the isolated phase bus on units 1 and 2, the following repairs and modifications have been implemented or will be implemented at a later date.

a. Change the link access covers where the glass cover is installed at the bottom instead of the top.

b. Install Krayrex wire reinforced windows with built-in drain plugs in place of the glass windows.

c. Replace all glass windows in the main transformer low-voltage bushing housing access covers with Krayrex windows.

d. Replace the glass windows in the generator removable link covers with Krayrex windows.

e. Inspect all gaskets on the external isolated phase bus for deterioration and leaks. These gaskets will be replaced at the first opportunity, but in the interim they have been sealed with RTV sealer on unit 1. Westinghouse is interested in this problem and will work with TVA in determining the cause of the gasket deterioration.

3. Neutral Overvoltage Circuit

It is apparent that some type of backup protection is needed for a ground fault in the generator or isolated phase bus. At this time there is no means of detecting a blown fuse in the neutral overvoltage circuit with the exceptions of physically verifying that there is no voltage on the voltmeter in the control room or on the circuit and physically checking the fuses at the neutral transformer cubicle. The voltage which is present in the neutral is not always detectable on the 0- to 15-kV meter in the control room (reflecting back to the neutral transformer primary).

B. DCRs Submitted and Being Submitted

The following is a list of DCRs which have been submitted to cover work performed. Also listed are DCRs that will be submitted to cover recommended modifications.

1. SQ-DCR-1484 - Replacement of the unit 1 neutral grounding transformer and housing, grounding resistor, grounding connections, and required hardware with duplicate equipment transferred from WBN.

2. SQ-DCR-1485 - Units 1 and 2 - Rearrange the inspection covers on the disconnect links on the isolated phase bus where the covers with inspection windows are at the bottom position. Replace the glass windows at the disconnect links with Krayrex windows manufactured with drain plugs. Replace all other glass inspection windows with Krayrex windows. Unit 1 is complete.

3. DCR to implement a backup protection scheme for ground fault protection.

4. DCR to include generator parameters (voltages and currents) on the delayed traces on the oscillograph.

5. SQ-DCR-P1519 - Replace present neutral voltmeters on unit control boards with round face meters with a 0- to 15-volt input.

6. Investigate the possibility of changing the gasket material on the isolated phase bus cover gaskets.

7. Investigate this incidence applicability to other nuclear plants and follow up with DCRs if necessary.

C. TACFs

TACF 82-45-58 removes the 1CA disconnect link from the isolated phase bus on the low side of the B phase main transformer and temporarily caps the ends off with caps furnished by Westinghouse. Material to return the 1CA disconnect link and housing to normal will be onsite February 8, 1982. The work to restore the 1CA link will not be performed until the upcoming refueling outage which is scheduled for the fall of 1982.

IV. Cost of Repairs

A. Accounts Established

Two expense job account numbers were established as a result of the incident. Job account No. E340 was established to accumulate costs associated with repair/replacement of isolated phase bus, neutral grounding transformer, generator repair, and cleanup of PCB inside the turbine building. Job account No. E342 was established to accumulate the cost associated with insulation, maintenance, operation, and disassembly of the charcoal filters for filtering plant discharges to eliminate PCBs caused from the isolated phase bus and neutral grounding transformer explosion.

B. Availability of Cost Information and Breakdown

Total cost information for both of these accounts will not be available until after March 10, 1982. Cost information, at that time, will be able to be broken down into personnel, material, and equipment cost.

C. Contracts

1. PCB Cleanup (Outside)

Paul Boron with the Calgon Corporation in Pittsburg, Pennsylvania, was contacted verbally on January 26, 1982, by the Radiological and Environmental Protection Section. The services available through the corporation and the associated fees were discussed at that time. The services contracted through TVA Contract No. 82P34-196457 are itemized below.

a. Delivery of a granular activated carbon adsorption system consisting of two single stage units operated in parallel and having a maximum hydraulic capacity of 860,000 gpd. Two truckloads (20,000 pounds each) of activated carbon for the initial loading of the units. Supervision of system setup including initial carbon loading. Training of TVA personnel in operation of the system. Continuing consultation and technical assistance. Rental of the system for the first month.

Inclusive Price: $57,800.

b. Supervision of system disassembly including final carbon removal and return transportation to Pittsburg. Transportation of spent carbon to Livingston, Alabama for disposal. Reconditioning of the system.

   Inclusive Price: $20,600.

c. Delivery of additional truckloads (20,000 pounds each) of activated carbon if and when needed plus transport of spent carbon to Livingston for disposal.

   Inclusive Price: $22,100 (each truckload).

d. Cost for system rental for each extra month beyond the first month: $6,000.

e. Use of the adsorption system for six consecutive months.

V. Westinghouse Summary

See appendix XXI for Westinghouse's synposis of the Isolated Phase Bus Failure.

APPENDIX I

1. Table 1
2. Figure 1
3. Figure 2
4. Figure 3

APPENDIX I
TABLE 1

Sequoyah Nuclear Plant Unit 1
Annunciations Received January 19, 1982

Time	Condition	Alarm
19:41:10.560	A	Generator 1 Turbine Shutdown
19:41:10.584	A	Oscillograph Operation or Failure
19:41:10.599	A	Transformer 1 Differential Relay Operation
19:41:10.603	A	500-kV Power Circuit Breaker 5034 Operation
19:41:10.605	A	500-kV Power Circuit Breaker 5038 Operation
19:41:10.644	A	Generator 1 Exciter Power Supply Abnormal
19:41:10.696	A	Generator 1 Voltage Regulator Trip
19:41:11.068	A	Transformer 1 Unit Station-Service Transformer 1A or 1B Sprinkler System Initiate
19:41:11.473	A	Generator 1 Overcurrent Relay Operation
19:41:11.747	N	Oscillograph Operation or Failure

A - Abnormal

N - Normal

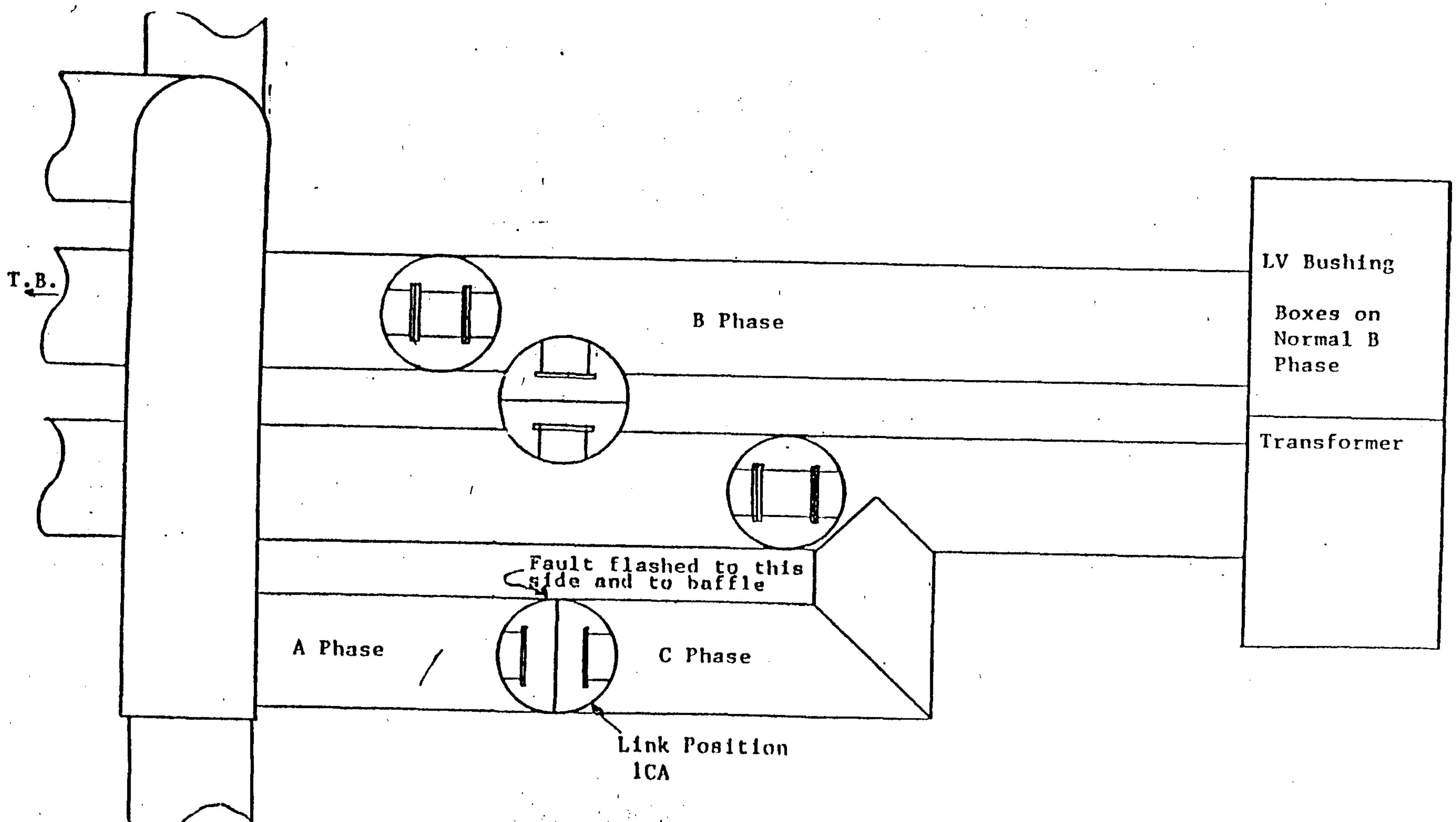


Figure 1. Physical Layout of Isolated-Phase Bus in Fault Area

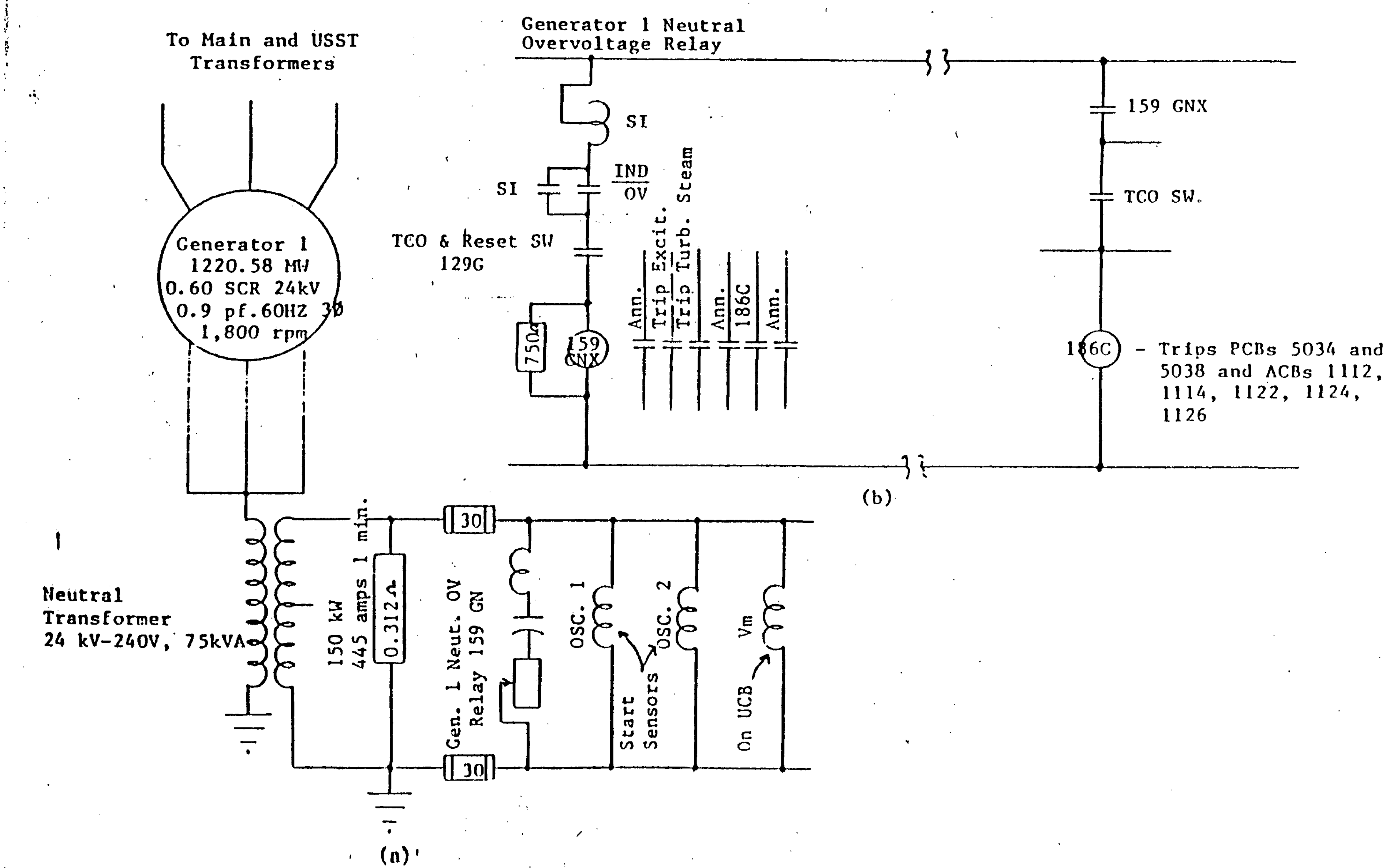
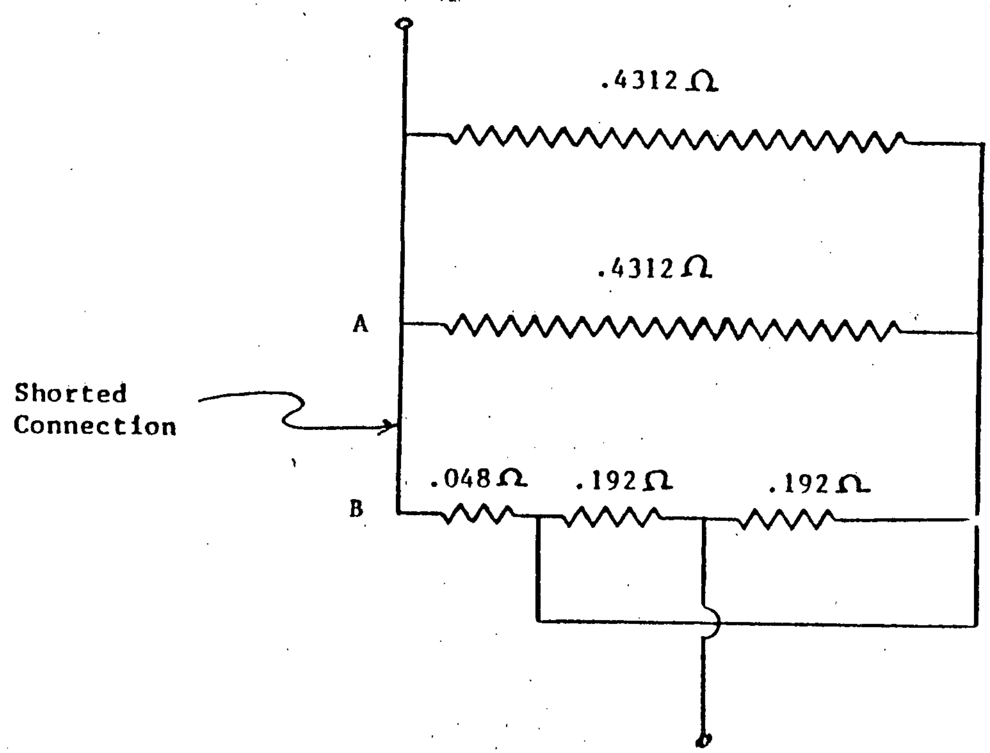


Figure 2. Neutral Overvoltage Relay Protective Circuit (a) ac schematic (b) dc schematic



Value measured with
A to B shorted is 0.141 ohms

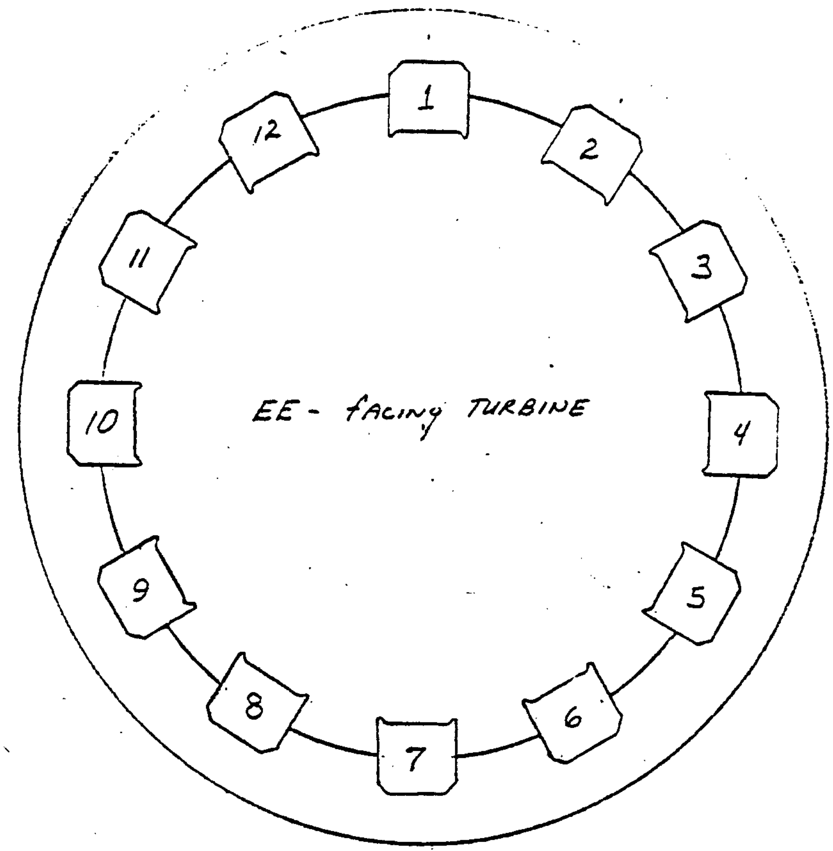
Value calculated with
A to B open is 0.3116

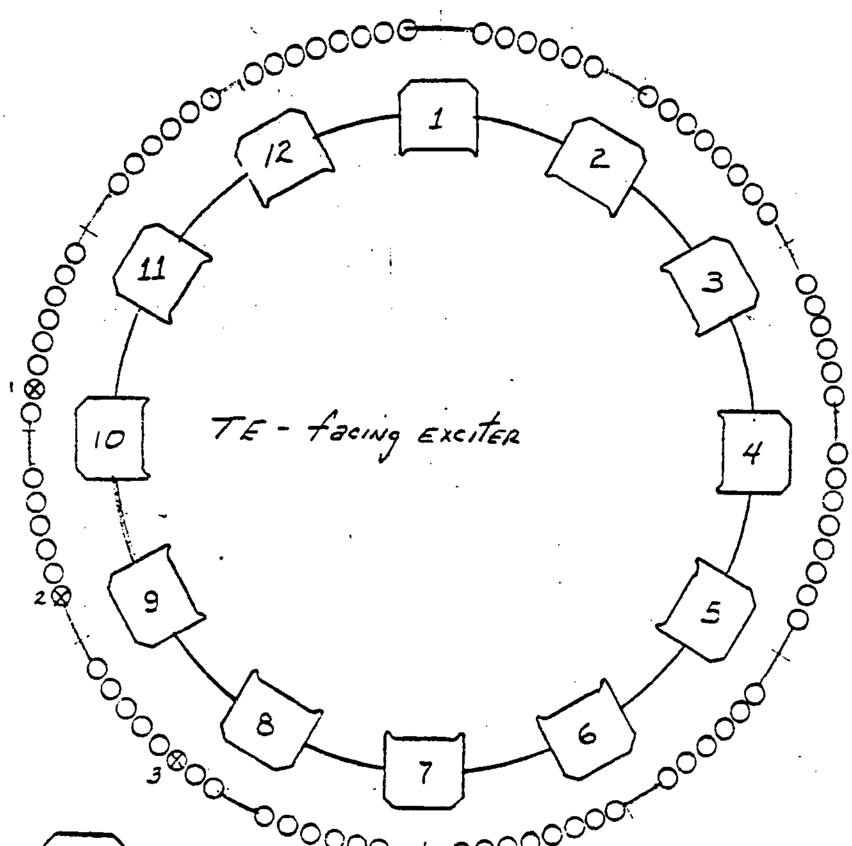
Figure 3. Neutral Resistor

APPENDIX II

Unit 1 Generator Inspection Diagrams

Appendix II





- Loose phase blocks

APPENDIX III

I. Test Reports

Appendix III

I. Test Reports

   A. Units 1 and 2 generator neutral transformer

   B. Units 1 and 2 main and station service transformers

   C. Unit 1 generator/exciter

   D. Relays and meters

   E. Isolated phase bus - unit 1

   F. Potential transformers and current transformers

   G. Gas-in-oil analysis reports

II. Couplings, Bearings, and Seals Readings

   A. Generator hydrogen seals

   B. Exciter bearings

   C. Generator Nos. 9 and 10 bearings

   D. Generator - exciter couplings

III. Inspection and Repair of Generator Thermocouples

IV. Data Sheets for Unit Startup

DOBLE INSULATION TESTS

MISCELLANEOUS EQUIPMENT

(SPARE BUSHINGS, INSTRUMENT TRANSFORMERS, ETC.)

DOBLE ENGINEERING—COMP.
WATERTOWN, MASS.
FORM M—ME178

COMPANY TVA DATE 1/27/82

LOCATION OF TESTS SEQUOYAH AIR TEMP. 70°F OIL TEMP. 70°F

EQUIPMENT TESTED GEN #1 NEUTRAL TRANSFORMER WEATHER INSIDE % HUM. 60

WESTING HOUSE SINGLE PHASE 60 ~ DATE LAST TEST INITIAL

75 KVA 24000V / 240V SN PXC72275 LAST TEST SHEET NO.

COPIES TO

LINE NO.	SERIAL NO	TEST KV	EQUIVALENT 2.5 KV READINGS — MILLIVOLTAMPERES: METER READING	MULTIPLIER	MVA	MILLIWATTS: METER READING	MULTIPLIER	MW	% POWER FACTOR: MEASURED	COR 20°C			INSULATION RATING
1		2.5	35	100	3500	2	20	40	1.14	—	ENG	HIGH GND LOW	G
2		'	23	100	2300	2	20	40	1.74	—	ENG	HIGH GUARD LOW	G
3		↓	32	100	3200	2	20	40	1.25	—	OVERALL	HIGH-GND	G
4													
5													
6													
7													
8													
9			EXCITATION										
10													
11		2.5	70	100	7000							ENG H1 UST H2	
12		2.5	66	100	6600							ENG H2 UST H1	
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

REMARKS

Good to 3% per staff

KEY TO INSULATION RATING

BUSHINGS-INSULATORS-ETC.	WOOD MEMBERS-OIL-ETC.	WINDINGS
G = GOOD	XG = GOOD	WG = GOOD
D = DETERIORATED	XD = DETERIORATED	WD = DETERIORATED
I = INVESTIGATE	XI = INVESTIGATE	WI = INVESTIGATE
B = BAD (REMOVE OR RECONDITION)	XB = BAD (REMOVE OR RECONDITION)	WB = BAD (REMOVE OR RECONDITION)

TEST SET NO. MEU 167 TEST BY JFN CHECKED BY CE SHEET NO.

Appendix III

TEST RECORD -- GENERAL

REPORT NO.: CA-

SHEET NO.: D1 OF D2 SHEET

LOCATION: SEQUOYAH NUCLEAR PLANT

DATE OF TEST: 1/20/82

SUBJECT: GEN #2 NEUTRAL TRANSFORMER

DATE OF REPORT:

GENERAL DATA: WESTING HOUSE, SINGLE PHASE 60 ~ 75 KVA
55°C RISE 24000Y/240 V SN PXC00772

COPIES SENT TO:

TESTED BY: NICHOLS & BELL

CHECKED BY: CES

APPROVED BY: CES

BRIDGE TEST

			READING	MULT.	RESISTANCE
DC RESISTANCE	H1 - H2	40Ω	400	1/10	40Ω
DC RESISTANCE	X1 - X2	.271Ω	271	1/1000	.271Ω

POLARITY DC KICK METHOD SUBTRACTIVE

RATIO PRIMARY INPUT 6900V
SECONDARY OUTPUT 69 V
RATIO = 100/1

MEGGER TEST

HIGH	LOW	500 MΩ
HIGH	GND	500 MΩ
LOW	GND	300 MΩ

NEUTRAL TRANSFORMER SECONDARY LOAD RESISTER
BRIDGE TEST

READING	MULT	OHMS	
1.498	0.2	.2996	WITH OUT SECONDARY CABLES
1.501	0.2	.3002	WITH SECONDARY CABLES

EQUIP	TVA NO.	DATE DUE
WHEATSTONE BRIDGE	166298	10/27/82
TEST P.T.	105557	11/12/82
VOLTMETER	76814	4/28/82
FLUKE	338508	5/23/82
500V MEGGER	148385	6/22/82
ANALIZER	467369	4/28/81

TEST RECORD -- GENERAL

REPORT NO.:	CA-
SHEET NO.:	02 OF 02 SHEETS
DATE OF TEST:	1-26-82
DATE OF REPORT:	

LOCATION: SEQUOYAH NUCLEAR PLANT

SUBJECT: GEN #1 NEUTRAL TRANSFORMER

GENERAL DATA: WESTINGHOUSE SINGLE PHASE 60 ~ 75 KVA
24000 / 240 V. SN PXC78275

COPIES SENT TO:

TESTED BY:	CHECKED BY:	APPROVED BY:
CALLAHAM	CES	CES

BRIDGE TEST

					READING	MULT.	RES
DC RESISTANCE		H_1-H_2	38.69	Ω	3869	1/100	38.69
DC RESISTANCE		X_1-X_2	0.00278	Ω	1390	.002	.00278

POLARITY DC KICK METHOD — SUBTRACTIVE

RATIO PRIMARY INPUT — 240 V.
SECONDARY OUTPUT — 2.40 V.
RATIO = 100/1

MEGGER TEST

HIGH - LOW 500+ MΩ
HIGH - GND 500+ MΩ
LOW - GND 500+ MΩ

NEUTRAL TRANSFORMER SECONDARY LOAD RESISTOR
BRIDGE TEST

READING	MULT	OHMS	WITHOUT SECONDARY CABLES
1572	.2	.3144	

EQUIP	TVA NO	DATE DUE
WHEATSTONE BRIDGE	166205	10/27/82
KELVIN BRIDGE	130697	12/11/81
500V MEGGER	149385	6/22/82
VARIAC	166539	7/6/82
VOLTMETER	76914	4/28/82
FLUKE	33858	5/23/82

DOBLE ENGINEERING CO.
BELMONT, MASS
FORM [illegible]-2017

OIL ☒
ASKAREL ☐
AIR ☐
GAS ☐

TWO-WINDING TRANSFORMERS

COMPANY TVA DIVISION DPSO DATE 1-24-82
LOCATION OF TESTS Sequoyah Nuclear Plant AIR TEMP. 41° F TOP OIL TEMP. 17°C
TRANSFORMER Main Bank #1 A? WEATHER Clear % HUMIDITY 65 %
MFR. ASEA SERIAL NO. 6211-882 AGE TYPE/CLASS FOA KVA 415,000
FREE BREATHING ☐ SEALED ☒ GAS BLANKETED ☐ CONSERVATOR ☐ GALLONS OF OIL

	BUSHINGS MFR.	TYPE	CLASS	DWG. NO.	CAT. NO.	KV	YEAR
HIGH SIDE KV 500/√3 Y☐ △☐	H₁ ASEA	GOB 1800	BIL 1800KV		LF125011P		19[illegible]
LOW SIDE KV 22.5 Y☐ △☐	H₂ ASEA	GOA 650 13.8KV	BIL 650KV				19[illegible]
NEUTRAL							

DATE LAST TEST 9-23-72
COPIES TO WRM (2), WAD, CCM, GES, JDW, ELS, ERA
LAST SHEET NO. CH-9[illegible]

OVER-ALL TESTS

Pico Farads	TEST	WINDING ENERGIZED	WINDING GROUNDED	WINDING GUARDED	TEST KV	mA METER READING	mA MULTIPLIER	MILLIAMPERES	W METER READING	W MULTIPLIER	WATTS	% POWER FACTOR ($CF = 1.07$) MEASURED	COR. 20°C	KEY TO INSULATION RATING	INSULATION RATING
22,210	1	HIGH	LOW		10	83	1	83	11.5	.2	2.3	—	—		
10,110	2	HIGH		LOW		38	1	38	5	.2	1.0	.26	.28	C_H	[illegible]
16,200	3	LOW	HIGH			61.5	1	61.5	12	.2	2.4	—	—		
4,200	4	LOW		HIGH	↓	83.5	.2	16.7	11	.1	1.1	.66	.71	C_L	[illegible]
		CALCULATED RESULTS				—	—	45	—	—	1.3	.29	.31	C_{HL} (TEST 1 MINUS TEST 2)	[illegible]
						—	—	44.8	—	—	1.3	—	—	(TEST 3 MINUS TEST 4)*	—

KEY TO INSULATION RATING: G = GOOD; D = DETERIORATED; I = INVESTIGATE; B = BAD (REMOVE OR RECONDITION)

*CURRENT AND WATTS SHOULD COMPARE WITH THOSE FOR C_{HL}

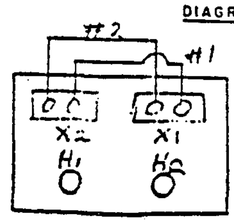
BUSHING TESTS

	LINE NO.	BUSH. NO.	PHASE	BUSHING SERIAL NO.	TEST KV	µA METER READING	µA MULTIPLIER	MICROAMPERES	W METER READING	W MULTIPLIER	WATTS	% POWER FACTOR MEASURED	COR. 20°C	COLLAR TESTS (WATTS/CURRENT) TOP		INSULATION RATING
HIGH SIDE	1	H₁			5	56	1	56	6.0	.2	1.2	.21	.21	.012/[illegible]	ECT	G
	2	H₂			5	37	.1	3.7	7.5	.02	.15	.41	.41	.022/[illegible]	ECT	G
	3	H₁			10	87	.02	1.74	7.5	.01	.075	.43	.43		UST	G
	4	H₂				66	.02	1.32	7.0	.01	.07	.53	.53			G
LOW SIDE	5	X₁		111378		96	.02	1.92	10.5	.01	.105	.55	.55	.047/[illegible]		G
	6	X₁		111380		96.5	.02	1.93	11.0	.01	.11	.57	.57	.050/[illegible]		G
	7	X₂		111375		94	.02	1.88	10.5	.01	.105	.56	.56	.036/[illegible]		G
	8	X₂		111377	↓	95	.02	1.90	11.0	.01	.11	.58	.58	.035/[illegible]	↓	G
	9															
	10															
	11			Excitation	Test		Top H.									
	12				10	62	1	62								
	13				10	62	1	62						Exc H₁ – UST H₂		
	14													Exc H₂ – UST H₁		
	15															
	16															
	17															
	18															
	19	OIL SAMPLE			10	91	[illegible]	910	2.5	.002	.007	.08	.12	OIL TEMP °C 41°F		X[illegible]

$CF = 1.4$

N - NEUTRAL

DIAGRAM



REMARKS:

TEST SET NO. M2H-77 TEST BY MWL [illegible] CHECKED BY CFH

B

Page 2 of 10

Appendix III

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.:

______ OF ______ SHEETS

LOCATION: Sequoyah Nuclear Plant	DATE OF TEST. 1-23-82
SUBJECT: Main Bank #1 Transformer A Ø	DATE OF REPORT:
GENERAL DATA: ASEA Single Phase, 60 ~, 500 KV/22.5 KV Type TFEY 1245-D FOA 420000 KVA GRDY SN 6211 842	
COPIES SENT TO: WBM, WAD, CCM, GGS, JDW, ELE, FBA	

TESTED BY:	CHECKED BY:	APPROVED BY:
Cox & Nichols	CEL	CEL

Bridge Test

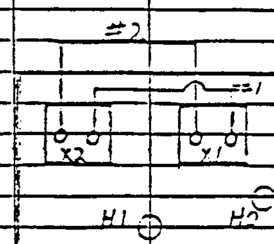
H1-H2	Reading	K	Ω	Temp.	C.F	Ω @ 75°
Tap 1	1.5066	.1	.15066	20°C	1.216	.18313
2	1.4740		.1474			.17924
3	1.4450		.1445			.17571
4	1.4165		.14165			.17225
5	1.3290		.1329			.16890
#1 X1-X2	1.6708	.001	.001671	20°C	1.216	.002032
#2 X1-X2	1.5907	.001	.001591	20°C	1.216	.001935

Ratio Test (TTR)

Tap	#1	#2
1	13.770	13.770
2	13.446	13.447
3	13.122	13.122
4	12.798	12.797
5	12.474	12.474

Megger

H-G	1000+	MΩ
#1 X-G	1000+	MΩ
#2 X-G	1000+	MΩ
H-X#1	1000+	MΩ
H-X#2	1000+	MΩ



CT Megger Test

X Sec - Gnd	1000+	MΩ
Y Sec - Gnd	1000+	MΩ
X - Y	1000+	MΩ

Equipment	No	Due Date
Kelvin Bridge	130697	12-1-82
Regulator	239683	10-20-82
Megger	166258	6-22-82
TTR	338514	

DOBLE INSULATION TESTS

DOBLE ENGINEERING CO. BELMONT, MASS FORM -2 #178

TWO-WINDING TRANSFORMERS

OIL ☒ ASKAREL ☐ AIR ☐ GAS ☐

COMPANY TVA DIVISION DPSO DATE 1-25-72

LOCATION OF TESTS Sequoyah Nuclear Plant AIR TEMP. 41°F TOP OIL TEMP. 10°

TRANSFORMER Main Bank #1 B¢ WEATHER [illegible] % HUMIDITY [illegible]

MFR. ASEA SERIAL NO. 6211 891 AGE TYPE/CLASS FOA KVA 315 000

FREE BREATHING ☐ SEALED ☑ GAS BLANKETED ☐ CONSERVATOR ☐ GALLONS OF OIL

	BUSHINGS MFR.	TYPE	CLASS	DWG. NO.	CAT. NO.	KV	YEAR
HIGH SIDE KV [illegible] Y☐ △☐	4 ASEA	[illegible]	[illegible] KV	[illegible]			[illegible]
LOW SIDE KV 22.5 Y☐ △☐	4 ASEA	[illegible]	[illegible] KV			132 KV	19[illegible]
NEUTRAL							

DATE LAST TEST 9-22-7[illegible]

COPIES TO WRM (2), WAD, CCM, GGS, [illegible], FLT, FBA LAST SHEET NO. [illegible] 954 [illegible]

OVER-ALL TESTS

TEST	WINDING ENERGIZED	WINDING GROUNDED	WINDING GUARDED	TEST KV	MILLIAMPERES METER READING	MULTIPLIER	MILLIAMPERES	WATTS METER READING	MULTIPLIER	WATTS	% POWER FACTOR MEASURED	COR 20°C	KEY TO INSULATION RATING: G = GOOD, D = DETERIORATED, I = INVESTIGATE, B = BAD (REMOVE OR RECONDITION)	INS. RATING
1	HIGH	LOW		10	84.5	1	84.5	12.0	.2	2.4	——	——		
2	HIGH		LOW		39.5	1	39.5	5.5	.2	1.1	.27	.39	C_H	
3	LOW	HIGH			61.5	1	61.5	11.5	.2	2.3	——	——		
4	LOW		HIGH	↓	82.5	.2	16.5	10.5	.1	1.05	.24	[illegible]	C_L	
CALCULATED RESULTS					——	——	45.0	——	——	1.3	.29	[illegible]	C_{HL} (TEST 1 MINUS TEST 2)	
					——	——	45.0	——	——	1.25	——	——	(TEST 3 MINUS TEST 4)*	—

CF 1.[illegible]

A. Fisade
22,240
10,340
16,400
[illegible]

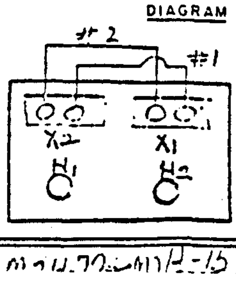
BUSHING TESTS

*CURRENT AND WATTS SHOULD COMPARE WITH THOSE FOR C_{HL}

	LINE NO.	BUSH NO.	PHASE	BUSHING SERIAL NO.	TEST KV	MICROAMPERES METER READING	MULTIPLIER	MICROAMPERES	WATTS METER READING	MULTIPLIER	WATTS	% POWER FACTOR MEASURED	COR 20°C	COLLAR TESTS (WATTS/CURRENT) TOP		INS. RATING
HIGH SIDE	1	H_1			5	57.5	1	57.5	11.5	.2	2.3	.40	.40	.035/[illegible]	ECT	
	2	H_2			5	35.5	.1	3.55	9	.02	.16	.45	.45	.030/[illegible]	ECT	
	3	H_1			10	95	.02	1.9	10	.01	.10	.53	.53		UST	
	4	H_2				64.5	.02	1.29	6.5	.01	.065	.50	.50			
LOW SIDE	5	X_1		111376		92	.02	1.84	7	.01	.07	.38	.38	.040/[illegible]		
	6	X_1		102330		95	.02	1.9	10.5	.01	.105	.55	.55	.036/[illegible]		
	7	X_2		111356		95	.02	1.9	10	.01	.10	.53	.53	.030/[illegible]		
	8	X_2		111355	↓	95.5	.02	1.91	11	.01	.11	.58	.58	.030/[illegible]	↓	
	9															
	10															
	11			Excitation	Test			Tap H								
	12				10	64.5	1	64.5						ENG. H_1 - UST H_2		
	13				10	64.5	1	64.5						ENG. H_2 - UST H_1		
	14															
	15															
	16															
	17															
	18												CF = 1.46			
	19	OIL SAMPLE			10	90	[illegible]	[illegible]	11	.005	.055	.09	.13	OIL TEMP °C 41°F		

N = NEUTRAL

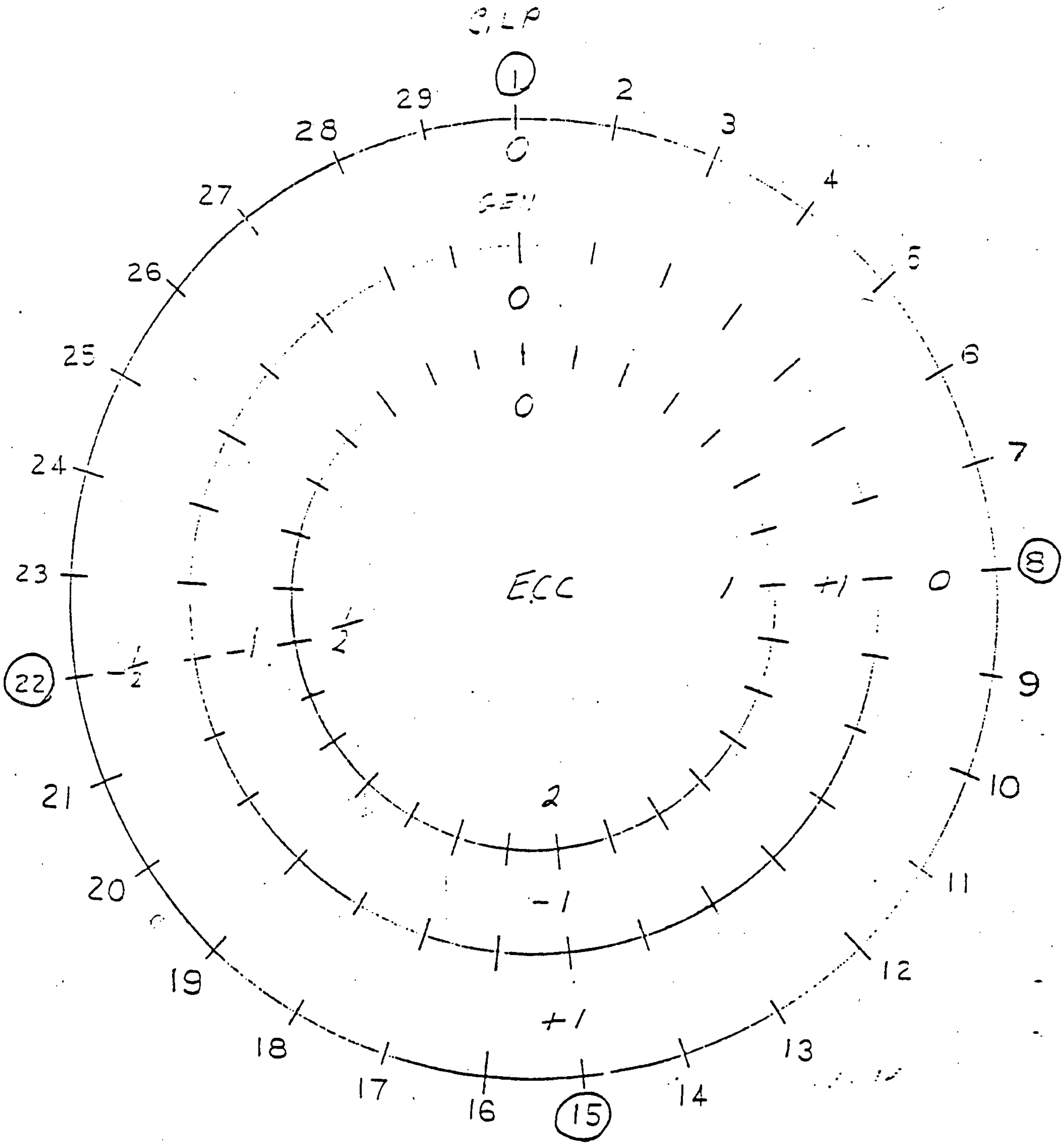
DIAGRAM



REMARKS:

[illegible] MAN 72 [illegible] B-15 [illegible] CE [illegible]

AS FOUND



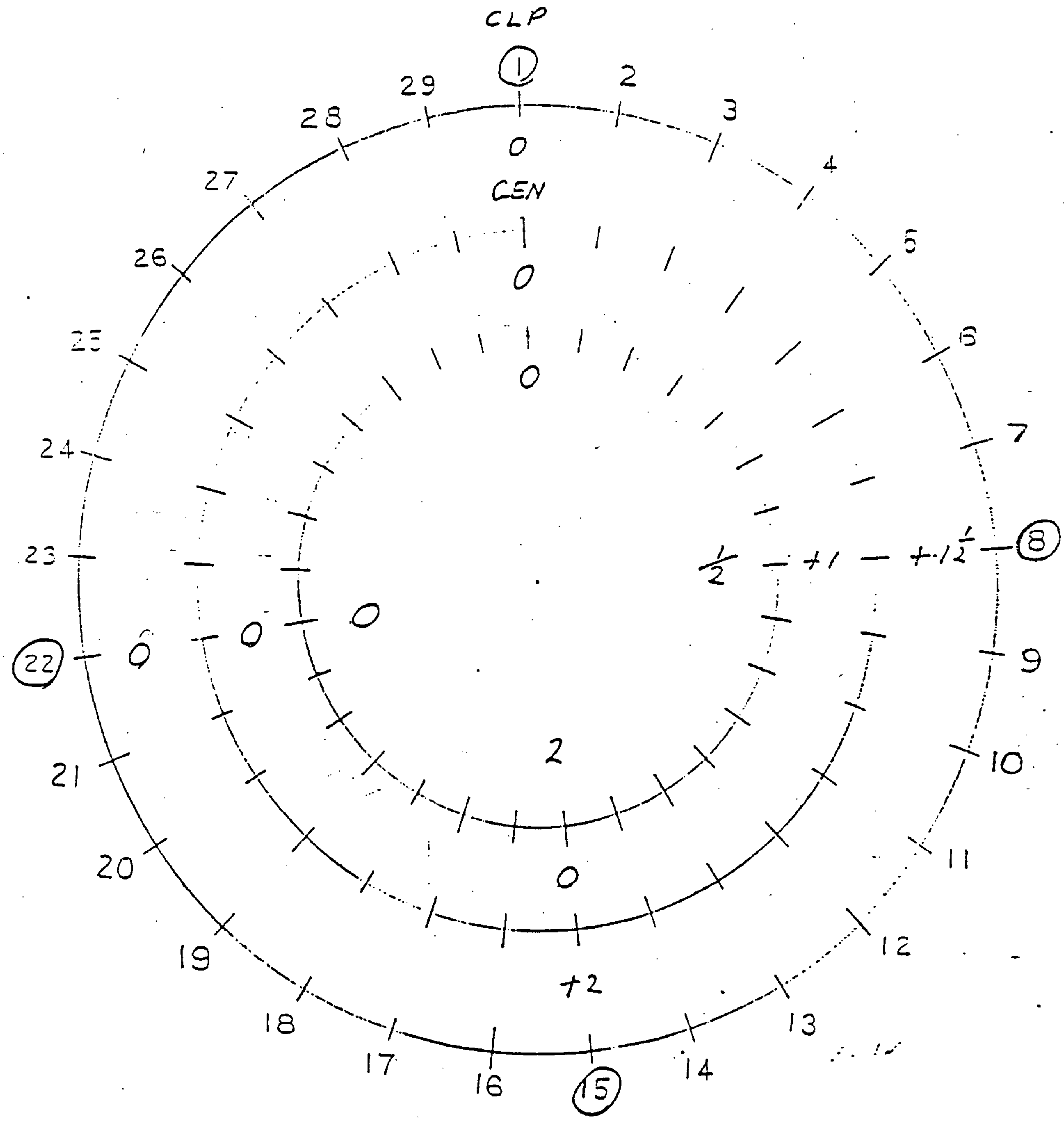
Q. A. INSPECTOR ______________ DATE 2/22/82

OR

COGNIZANT ENGINEER Ted Ortwood

Appendix III

AS LeFT



Q. A. INSPECTOR ______________ DATE 1/31-8

OR

COGNIZANT ENGINEER Ted Gatewood

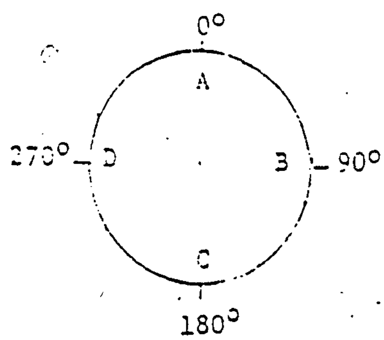
Appendix III

BRUSHLESS EXCITER

DATE 2/1/82

TURBINE Unit I

As found AS LeFT



A	B	C	D	Indicator Riding on Bearing Journal
0	-1/2	0	-1/2	

TIR .003

Cognizant Engineer/Date Ted Gatewood

or

QA Inspector/Date

Note 1: Since the magnetic pull of the PMG will affect the swing check, before attempting the swing check or the shaft deflection check, the PMG must be removed. Refer to Westinghouse Drawing 521-B-999 titled "Alignment and Dismantling of Permanent Magnet Generator." Runners are provided on all units which will prevent the fron of the stator being damaged by the magnets.

Note 2: The unit should be slow rolled on turning gear for a minimum of 30 minutes before final swing check and shaft deflection check.

Appendix III

III. Inspection and Repair of Generator Thermocouples

MAINTENANCE REPORT - SEQUOYAH NUCLEAR PLANT UNIT 1

System: UNIT 1 GENERATOR STATOR DISCHARGE WATER TEMPERATURE INDICATION

Job Performed: INSPECTION AND REPAIR OF THERMOCOUPLES

Initial inspection of the thermocouple system discovered several deficiencies that are identified, along with their corrective actions, below:

1. Thermocouples (22T, 20T, 18T, 1B, 11T, 41B, 7T, 37B, 1T, 42T, and 32B) were found to have their twisted pair connections exposed to the generator ambient atmosphere. This does not mean that they were pulled away from the header completely, but that the final twists on the wires were not braised to the header and were not insulated against the influence of the ambient atmosphere.

   Corrective Action: As a temporary fix, the wires were wrapped with glass tape and painted with a sealer. This procedure was recommended by Bob Wilson (W) Further action may be necessary at the first refueling outage to reweld these thermocouples for a better connection.

2. Thermocouples 41T, and 29B had broken cables in the cable bundle. There was also discovered a cable bundle support broken between 36B and 37B. Vibration set up by the broken cable support was responsible for the cable breaks on 41T and 29B. The insulation was damaged on several adjacent cables but they were not broken. These cables should be evaluated at the first refueling outage for possible replacement.

   Corrective Action: We repaired the broken wire temporarily by splicing in a new length of thermocouple wire then taping with glass tape for mechanical support. Over the glass tape we painted with sealer. The broken support was securely bound to the bundle with glass tape and then secured to the discharge header. We then painted with sealer. These repairs are only of a temporary nature and were discussed with Bob Wilson of Westinghouse. Permanent solutions should resolve these deficiencies at the first refueling outage.

3. Thermocouple 2T was found broken loose from the discharge header.

   Corrective Action: We did not make repair to this thermocouple. We taped the cable to the bundle with glass tape and painted with sealer.

   This deficiency will have to be resolved at the first refueling outage.

4. On the generator side of the thermocouple feed through panel the following discrepancies were found and repaired as applicable:

   A. 15T: copper wire only connected by 2 strands
   B. 23T, 25T, 26T, 38T, 3B: copper wire loose (used washers to tighten the connection)
   C. 8B: constantan wire loose (used washer to tighten)
   D. 17B: constantan wire held by only a few strands
   E. 20B & 26B, also 40B & 41B: copper wires completely broken off
   F. 28B: cable not connected (connected cable)

   These items should require no additional work.

MAINTENANCE REPORT - SNP UNIT 1 (cont.)

5. There were a number of thermocouples that did not have sufficient mechanical support between the wire bundle and the connection at the discharge header.

   Corrective Action: We provided mechanical support by binding the cable bundle adjacent to the individual thermocouple exit point with fiber cord.

   This should require no additional work.

Conclusion: All the stator cooling water discharge thermocouples, with the exception of 2T, should be available for proper temperature indication.

With the generator buttoned back up, the computer printout of stator discharge water temperature shows a 4.0°F span between the high and low readings.

Most of the work that was completed at this time was performed as a temporary fix. At the first refueling outage the generator rotor will be pulled. This will allow easy access for permanent repairs.

Michael E. Frye
Instrument Engineer

BMP:MEF:CLS

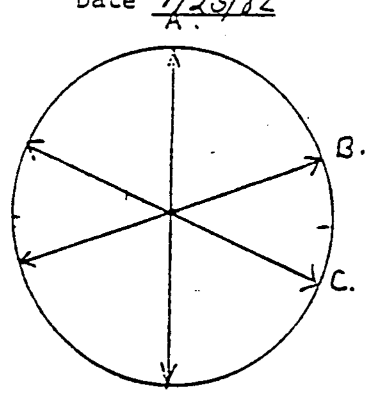
APPENDIX III

II. Couplings, Bearings, and Seal Readings

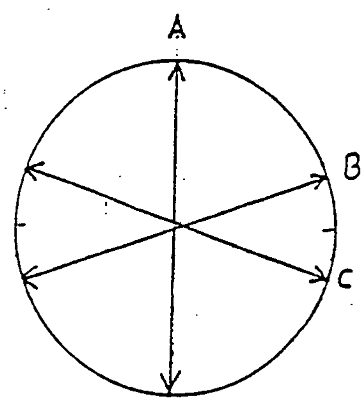
Hydrogen Seal

Unit 1

Date 1/25/82



A 27.952
B 27.949
C 27.942
AV. 27.95
SHAFT 27.942
Clearance .009



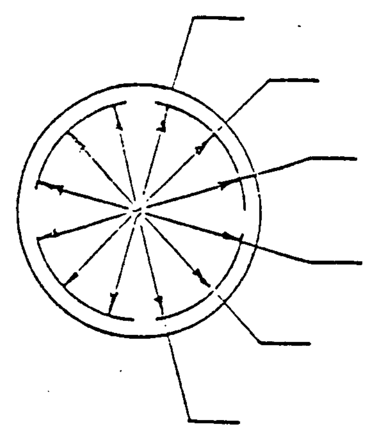
A 27.954
B 27.941
C 27.940
AV 27.9
SHAFT 27.938
Clearance .007

Ted Datewood 1/25/82

Appendix III

Exciter Bearing - Unit 1
Bearing Clearances
Date 1/31/82

EXCITER BEARING



Average Bearing id 14.023

Average Shaft od 13.999

Clearance .024

Lead Check AV. .025

Adjusted AV .020

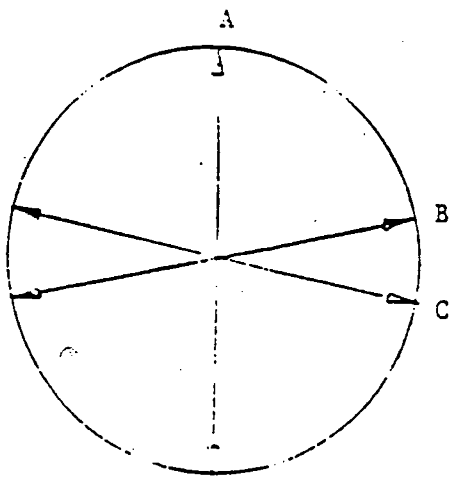
Ted Gatewood
Cognizant Engineer

1/31/82
Date

Note: Tilt pads should be locked in place before taking micrometer readings.

UNIT 1 TURBINE
CHECKED BY ED WALKER
DATE 1-25-82
ITEM
NAME #9 BEARING

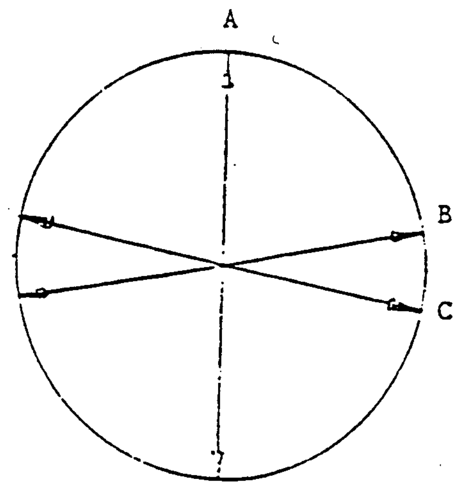
TE



A 27.988
B 27.995⁵
C 27.999

AVERAGE 27.994⁵
(A+B+C/3)
SHAFT 27.941
CLEARANCE .053⁵

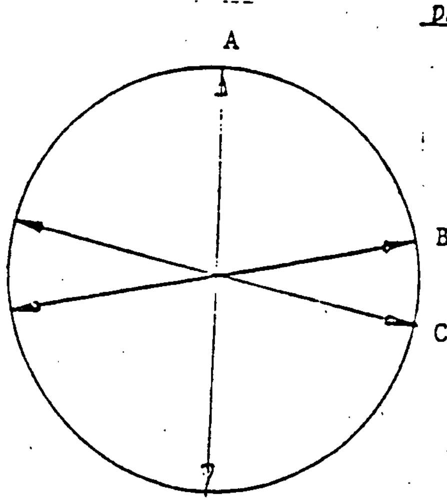
GE



A 27.989
B 27.998
C 27.999

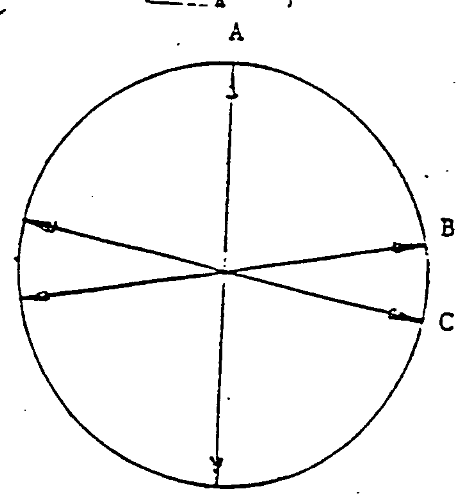
AVERAGE 27.995
(A+B+C/3)
SHAFT 27.942
CLEARANCE .053

ITEM #10 BEARING
DATE 1-26-82



A 27.995
B 27.995
C 27.999

AVERAGE 27.995½
(A+B+C/3)
SHAFT 27.937½
CLEARANCE .058



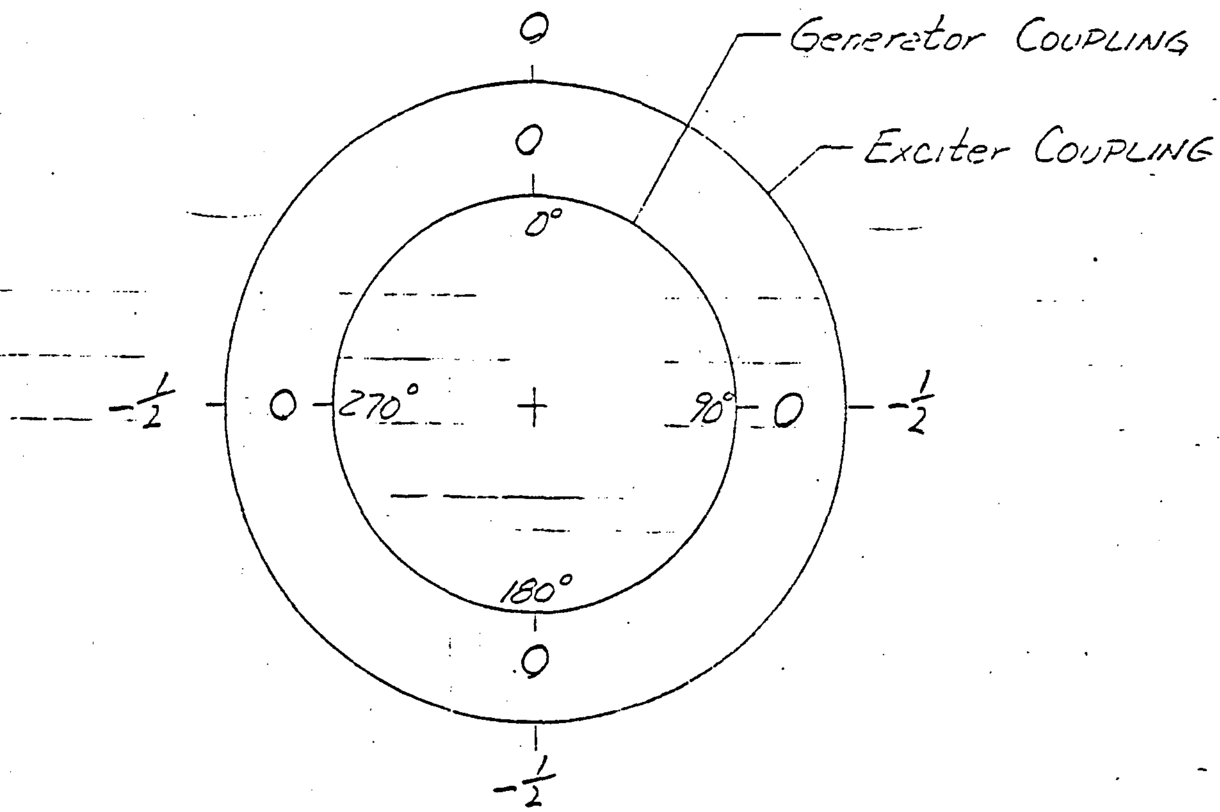
A 27.99'
B 27.9965
C 27.9905

AVERAGE 27.995½
(A+B+C/3)
SHAFT 27.940
CLEARANCE .055½

Ted Gatewood

SEQUOYAH NUCLEAR PLANT
Generator - - Exciter COUPLING Eccentricity

As Left



QA INSPECTOR ____________ DATE ____________

OR

Ted Gatewood — 2/2/82

COGNIZANT ENGINEER — DATE

Date: January 22, 1982

Appendix III

TENNESSEE VALLEY AUTHORITY
CENTRAL LABORATORIES
CHATTANOOGA POWER SERVICE CENTER

REPORT OF ANALYSIS
DISSOLVED GASES IN INSULATING OIL
SEQUOYAH NUCLEAR PLANT

LABORATORY NUMBER	82-2714	82-2715		
DATE SAMPLE TAKEN	1-20-82	1-20-82		
BANK NO. & PHASE	USS1-A	USS1-B		
MANUFACTURER	ASEA	ASEA		
SERIAL NO.	6258075	6258078		
VOLTAGE RATING, kV	22.5	22.5		
LOAD, MW	0	0		
OIL TEMPERATURE, °C	30	65		
WINDING TEMPERATURE, °C	50	87		
GASES, PPM				
HYDROGEN, H_2	20	40		
METHANE, CH_4	50	60		
ETHYLENE, C_2H_4	10	10		
ETHANE, C_2H_6	10	10		
ACETYLENE, C_2H_2	0	0		
CARBON MONOXIDE, CO	680	600		
TOTAL COMBUSTIBLE GASES	770	720		
CARBON DIOXIDE, CO_2	2,720	4,990		
NITROGEN, N_2				
OXYGEN, O_2 %	0.39	0.45		
TOTAL DISSOLVED GASES, %	8.0	8.0		

Remarks:

Distribution:

Date: January 22, 1982

TENNESSEE VALLEY AUTHORITY
CENTRAL LABORATORIES
CHATTANOOGA POWER SERVICE CENTER

REPORT OF ANALYSIS
DISSOLVED GASES IN INSULATING OIL
SEQUOYAH NUCLEAR PLANT

LABORATORY NUMBER	82-2711	82-2712	82-2713
DATE SAMPLE TAKEN	1-20-82	1-20-82	1-20-82
BANK NO. & PHASE	1 A	1 B	1 C
MANUFACTURER	ASEA	ASEA	ASEA
SERIAL NO.	6211882	6211372	6211880
VOLTAGE RATING	500	500	500
LOAD, MW	0	0	0
OIL TEMPERATURE, °C	78	70	NA
WINDING TEMPERATURE, °C	NA	85	85
GASES, PPM			
HYDROGEN, H_2	30	80	40
METHANE, CH_4	40	80	40
ETHYLENE, C_2H_4	<10	30	10
ETHANE, C_2H_6	<10	10	<10
ACETYLENE, C_2H_2	0	0	0
CARBON MONOXIDE, CO	230	240	260
TOTAL COMBUSTIBLE GASES	300	440	350
CARBON DIOXIDE, CO_2	1,770	2,130	1,000
NITROGEN, N_2			
OXYGEN, O_2 %	0.14	0.74	0.12
TOTAL DISSOLVED GASES, %	2.0	4.8	1.6

Remarks:

Distribution: C. C. Mason, Sequoyah Nuclear Plant
F. W. Chandler (Attn: E. Chitwood), W 8C126 C-K
J. D. Wright, 1330 CST2, Chattanooga

TVA 6766B (PSO-4-81)

DOBLE INSULATION TESTS

MISCELLANEOUS EQUIPMENT

(SPARE BUSHINGS, INSTRUMENT TRANSFORMERS, ETC.)

DOBLE ENGINEERING—COMPA
WATERTOWN, MASS.
FORM M—ME17

COMPANY TVA   DATE 11/22/82

LOCATION OF TESTS SEQUOYAH NUCLEAR PLANT   AIR TEMP.   OIL TEMP. —

EQUIPMENT TESTED GEN #1 REGULATOR PT'S   WEATHER INSIDE   % HUM. —

WEST. TYPE PT STYLE EED3383   DATE LAST TEST 3-21-75

24000/24000Y 200:1 60 HZ RATED   LAST TEST SHEET NO. CA-577 D3=F D

INS. CL. 25KV.

COPIES TO

	LINE NO.	SERIAL NO	TEST KV	EQUIVALENT 2.5 KV READINGS — MILLIVOLTAMPERES — METER READING	MULTIPLIER	M V A	MILLIWATTS — METER READING	MULTIPLIER	M W	% POWER FACTOR — MEASURED	COR. 20°C		INSULATION RATING
Cφ	1	71F1565	2.5	61	10	610	53	.2	10.6	1.74		OVERALL	G
	2			30	10	300	27	.2	5.4	1.80		ENG H1 GRD H2	G
	3			33	10	330	28	.2	5.6	1.70		ENG H2 GRD H1	G
	4			50	1	50	2	.2	.4			HOT COLLAR H1	G
	5			48	1	48	2	.2	.4			HOT COLLAR H2	G
	6												
Bφ	7	71F1562		59	10	590	48	.2	9.6	1.63			G
	8			28	10	280	24	.2	4.8	1.71			G
	9			30	10	300	26	.2	5.2	1.73			G
	10			52	1	52	2	.2	.4				G
	11			51	1	52	2	.2	.4				G
	12												
Aφ	13	71F15[illegible]		60	10	600	54	.2	10.8	1.80			G
	14			28	10	280	27	.2	5.4	1.93			G
	15			32	10	320	29	.2	5.8	1.81			G
	16			51	1	51	2	.2	.4				G
	17			48	1	48	3	.2	.6				G
	18												
	19												
	20												
	21												
	22												
	23												
	24												
	25												
	26												
	27												
	28												
	29												

REMARKS

KEY TO INSULATION RATING

BUSHINGS-INSULATORS-ETC.	WOOD MEMBERS-OIL-ETC.	WINDINGS
G-GOOD	XG-GOOD	WG-GOOD
D-DETERIORATED	XD-DETERIORATED	WD-DETERIORATED
I-INVESTIGATE	XI-INVESTIGATE	WI-INVESTIGATE
B-BAD (REMOVE OR RECONDITION)	XB-BAD (REMOVE OR RECONDITION)	WB-BAD (REMOVE OR RECONDITION)

TEST SET NO. MEU 167 TEST BY JONES & NICHOLS CHECKED BY CE SHEET NO.

DOBLE INSULATION TESTS

MISCELLANEOUS EQUIPMENT

(SPARE BUSHINGS, INSTRUMENT TRANSFORMERS, ETC.)

DOBLE ENGINEERING—COMPANY
WATERTOWN, MASS.
FORM M—ME17B

COMPANY TVA DATE 1/28/82
LOCATION OF TESTS SEQUOYAH NUCLEAR PLANT AIR TEMP. OIL TEMP.
EQUIPMENT TESTED GEN #1 METERING PT'S WEATHER INSIDE % HUM.
WESTINGHOUSE PT STYLE EED3383 DATE LAST TEST 3-21-75
24000/24000 Y 200:1 60HZ RATED LAST TEST SHEET NO. CA577 D25FD.
INS. CL. 25KV
COPIES TO

	LINE NO.	SERIAL NO.	TEST KV	EQUIVALENT 2.5 KV READINGS — MILLIVOLTAMPERES — METER READING	MULTIPLIER	MVA	MILLIWATTS — METER READING	MULTIPLIER	MW	% POWER FACTOR — MEASURED	COR. 20°C			INSULATION RATING
Aφ	1	71F1563	2.5	60	10	600	52	.2	10.4	1.74			OVERALL	G
	2			29	10	290	26	.2	5.2	1.79			ENG H1 GRD H2	G
	3			32	10	320	28	.2	5.6	1.75			ENG H2 GRD H1	G
	4			52	1	52	2	.2	.4				HOT COLLAR H1	G
	5			49	1	49	2	.2	.4				HOT COLLAR H2	G
	6													
Bφ	7	71F1564	2.5	59	10	590	50	.2	10.0	1.70				G
	8			29	10	290	25	.2	5.0	1.72				G
	9			32	10	320	27	.2	5.4	1.69				G
	10			51	1	51	2	.2	.4					G
	11			50	1	50	3	.2	.6					G
	12													
Cφ	13	71F1566	2.5	63	10	630	53	.2	10.6	1.68				G
	14			29	10	290	26	.2	5.2	1.79				G
	15			32	10	320	27	.2	5.4	1.69				G
	16			50	1	50	3	.2	.6					G
	17			52	1	52	3	.2	.6					G
	18													
	19													
	20	GE ALUGARD LIGHTENING ARRESTERS												
	21			MOD. NO. 9L11LAA030 30KV										
	22													
Aφ	23	B72	2.5	61	10	610	10	.2	2.0	.33				G
Bφ	24	B71		60	10	600	10	.2	2.0	.33				G
Cφ	25	B71		59	10	590	8	.2	1.6	.27				G
	26													
	27													
	28													
	29													

REMARKS

KEY TO INSULATION RATING

BUSHINGS-INSULATORS-ETC.	WOOD MEMBERS-OIL-ETC.	WINDINGS
G • GOOD	XG • GOOD	WG • GOOD
D • DETERIORATED	XD • DETERIORATED	WD • DETERIORATED
I • INVESTIGATE	XI • INVESTIGATE	WI • INVESTIGATE
B • BAD (REMOVE OR RECONDITION)	XB • BAD (REMOVE OR RECONDITION)	WB • BAD (REMOVE OR RECONDITION)

TEST SET NO. MEU 167 TEST BY JONES & NICHOLS CHECKED BY CES SHEET NO.

Appendix III

TEST RECORD -- GENERAL

REPORT NO.: CA-

SHEET NO.: D2 OF D2 SHEETS

LOCATION: SEQUOYAH NUCLEAR PLANT

DATE OF TEST: 1/20/82

SUBJECT: GEN #2 GROUND OVER VOLTAGE RELAY

DATE OF REPORT:

GENERAL DATA: GE TYPE IAV STYLE 12IAV51D2A 115V 60 HZ
DEV 259GN

SETTING SHEET # 7081 DATED 5-11-79

COPIES SENT TO:

TESTED BY: NICHOLS + BELL

CHECKED BY: CES

APPROVED BY: CES

P.U. = 15V

T.L. =	1.2			
TIME	CURVE	150V	28	CYCLES
		75V	(35)	CYCLES
		45V	41	CYCLES
		30V	47	CYCLES

EQUIP	TVA NO	DATE DUE
Relay Test Set	266151	8-14-82
VARIAC	489536	11-12-82
FLUKE	338508	5-23-82

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.: ____ OF ____ SHEET

LOCATION: SEQUOYAH NUCLEAR PLANT

DATE OF TEST: 1-20-82

SUBJECT: GEN #1 GROUND OVERVOLTAGE RELAY

DATE OF REPORT:

GENERAL DATA: GE TYPE IAV STYLE 12IAV51D2A 115V 60 Hz DEV 159GN

SETTING SHEET # 7071 DATED 5-11-79

COPIES SENT TO:

TESTED BY: Malone & Nichols

CHECKED BY:

APPROVED BY:

P.U. = 15V

T.L. =	1.3					
		VOLTS	CYCLES			
TIME CURVE		150V	28			
		75V	(35)			
		45V	41			
		30V	47			
EQUIP				TVA NO		DUE
Relay Test Set				266151		8-14-82
VARIAC				489536		11-12-82
FLUKE				338509		5-27-82

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.: OF SHEETS

LOCATION: SEQUOYAH NUCLEAR PLANT

SUBJECT: GEN # 1 ISOLATED PHASE BUS

DATE OF TEST: 1/29/82

DATE OF REPORT:

GENERAL DATA:

COPIES SENT TO:

TESTED BY: JONES + NICHOLS

CHECKED BY: CES

APPROVED BY: CES

2500V MEGGER TEST

Aϕ - GND	3000 MΩ
Bϕ - GND	2750 MΩ
Cϕ - GND	3500 MΩ
NEUTRAL BUS - GND	10,000 MΩ

DC HIGH POTENTIAL TEST

DC VOLTS	PHASE	LEAKAGE CURRENT INITIAL	1 MIN
53 KV	A	.7 MILI AMP	.7 MILI AMP
53 KV	B	.5 MILI AMP	.48 MILI AMP
53 KV	C	.4 MILI AMP	.4 MILI AMP
37.5 KV	NEUTRAL BUS	21 μ AMP	21 μ AMP

EQUIPMENT	TVA NO
DC HIGH POT SET	259106
2500V MEGGER	212703

TEST RECORD -- GENERAL

REPORT No.:

SHEET No.: OF SHEET

LOCATION: SEQUOYAH NUCLEAR PLANT

SUBJECT: GEN # 1 ISOLATED PHASE BUS

DATE OF TEST: 1/22/82

DATE OF REPORT:

GENERAL DATA:

COPIES SENT TO:

TESTED BY: JONES + NICHOLS

CHECKED BY: CES

APPROVED BY: CES

2500V MEGGER TEST

AΦ - GND		3000 MΩ		
BΦ - GND		2750 MΩ		
CΦ - GND		3500 MΩ		
NEUTRAL BUS - GND		10,000 MΩ		
DC HIGH POTENTIAL TEST				
DC VOLTS	PHASE	LEAKAGE CURRENT INITIAL	1 MIN	
53 KV	A	.7 MILI AMP	.7 MILI AMP	
53 KV	B	.5 MILI AMP	.48 MILI AMP	
53 KV	C	.4 MILI AMP	.4 MILI AMP	
37.5 KV	NEUTRAL BUS	21 μ AMP	21 μ AMP	

EQUIPMENT	TVA NO
DC HIGH POT SET	259106
2500V MEGGER	212703

TEST RECORD -- GENERAL

REPORT No.:

SHEET No.: 1 OF ____ SHEETS

LOCATION: SEQUOYAH NUCLEAR PLANT

DATE OF TEST: 1 | 28 | 82

SUBJECT: GEN #1 POT TRANS

DATE OF REPORT:

GENERAL DATA: W, TYPE PT, STYLE EEO 3383 60N, 24000/2400
RATIO 200/1 RATED INS. CLASS 25KV, FW IMP, TEST
150KV, 30°C 1750 VA

COPIES SENT TO:

TESTED BY: JFN CES

CHECKED BY: CES

APPROVED BY: CES

PT	MEGGER			RATIO		SERIAL NO.
	HI TO LO	HI TO GND	LOW TO GND	VOLTS PRI	VOLTS SEC	
METERING						
AØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1563
BØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1564
CØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1566
REG						
AØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1567
BØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1562
CØ	1000MΩ	1000MΩ	1000MΩ	6900	34.2	71F1565

EQUIP	TVA NO	DATE DUE
500 V MEGGER	149295	6/22/82
VARIAC	166539	7/5/82
VOLTMETER	76814	4/28/82
FLUKE	228503	5/23/82

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.: OF SHEE

DATE OF TEST: 1-28-82

DATE OF REPORT:

LOCATION: Sequoyah Nuclear Plant

SUBJECT: 1-EI-57-17 Neutral Transf. Indicating voltmeter

GENERAL DATA: Westinghouse, ES 0-15, ES 0-15 Kilovolts, Type VO-252

COPIES SENT TO: ELE, EBA, CCM

TESTED BY: B. G Malone

CHECKED BY: CEJ

APPROVED BY: CEJ

Input Volts	Scale Kilovolts
0	0
25	2.5
50	5
100	10
150	15

Appendix III

TEST RECORD -- GENERAL

REPORT No.:
SHEET No.:
OF SHEE
DATE OF TEST: 1/25/82
DATE OF REPORT:

LOCATION: SEQUOYAH
SUBJECT: MEGGER AND HIGH POT TEST ON GEN #1
GENERAL DATA:
STATOR

COPIES SENT TO:

TESTED BY:	CHECKED BY:	APPROVED BY:
NICHOLS	CES	CES

2500 V MEGGER TEST

WINDING	MEGGER READING
A-GND	14 MEG Ω
B-GND	14.5 MEG Ω
C-GND	15 MEG Ω

AC HIGH POTENTIAL TEST			
PHASE	KV	INPUT AMPS	LENGTH OF TIME
A	32	25	1 MIN
B	32	23	1 MIN
C	32	23.5	1 MIN

EQUIPMENT	NUMBER	DATE DUE
AC HI POT TEST SET	6-013	NA
2500V MEGGER	212703	11/2/82

TVA 6472 (PO-4-68)

Appendix III

TEST RECORD -- GENERAL

REPORT NO.: —

SHEET NO.: ____ OF ____ SHEE

LOCATION: SEQUOYAH NUCLEAR PLANT

DATE OF TEST: 1/26/82

SUBJECT: GEN #1 WINDING

DATE OF REPORT:

GENERAL DATA:

COPIES SENT TO:

TESTED BY: JONES + NICHOLS

CHECKED BY: CES

APPROVED BY: CES

BRIDGE TEST GEN #1 Stator

PHASE	READING	MULT	Ω@74°F	C.F.	Ω@75°C		Rated Ω@75°C
A-N	6.27	.001	.000627	1.197	.0007505		.0007707
B-N	6.23	.001	.000623	1.197	.0007457		.0007859
C-N	6.18	.001	.000618	1.197	.0007397		.0007746
EQUIPMENT		TVA NO					
KELVIN BRIDGE		136765					

Measured Cap. µf 3 winding in parallel to gnd .698 rated .700 measured with impedance Bridge. 379811

Appendix III

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.:

OF SHEET

LOCATION: SEQUOYAH

DATE OF TEST: 1/24-26/8

SUBJECT: GEN #1 B.T.C.T.s

DATE OF REPORT:

GENERAL DATA: WESTINGHOUSE B.T.C.T TYPE RY 40000/5 STYLE 5614D24G02 - GON, CURVE SHEET 629016, SINGLE RATIO

COPIES SENT TO:

TESTED BY:	CHECKED BY:	APPROVED BY:
BELL + NICHOLS	CEL	CEL

Aφ

SN	D.C. Ω	RATIO INPUT	SEC	500 V MEGGER		POLARIT
7	6.39	2000A	.25A	1000 MΩ +		SUBT
3	6.35	2000A	.25A	1000 MΩ +		SUBT
2	6.24	2000A	.25A	1000 MΩ +		SUBT
4	6.25	2000A	.25A	1000 MΩ +		SUBT
Bφ						
8	6.41	2000 A	.25A	1000 MΩ +		SUBT
5	6.50	2000 A	.25A	1000 MΩ +		SUBT
1	6.44	2000A	.25A	1000 MΩ +		SUBT
3	6.27	2000A	.25A	1000 MΩ +		SUBT
4	6.28	2000A	.25A	1000 MΩ +		SUBT
Cφ						
3	6.29	2000A	.25A	1000 MΩ +		SUBT
1	6.43	2000A	.25A	1000 MΩ +		SUBT
2	6.25	2000A	.25A	1000 MΩ +		SUBT
4	6.30	2000A	.25A	1000 MΩ +		SUBT

EQUIPMENT	TVA NO	DATE DUE
AC MULTI AMP	340312	4/29/82
500V MEGGER	148385	6/22/82
ANALIZER	467368	4/28/82
WHEATSTONE BRIDGE	166298	10/27/82

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Revision 2

Unit No. 1

Date 1/27/82

Numbers keyed to step number.

Biddle Low Resistance Ohmmeter
~~Kelvin bridge~~ TVA tag No. 502477 Calibration due date 6-29-82

Thermometer ID No. 127 OT Calibration due date 10-5-82

RECTIFIER WHEEL A

Fuse Temperature 74.3 °F = 23.5 °C

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.00032) @ 25°C				6.3 FUSE CLEARANCE (< 0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL R_A x10⁻³	PRESENT R_T (25°C) x10⁻³	PREV. R_T x10⁻³ (25°C)	% INCR. (< 20%)	
1		/		/		/	.260	.2614	.269		
2							.254	.2554	.262		
3							.259	.2604	.265		
4							.275	.2765	.283		
5							.277	.2785	.282		
6							.260	.2614	.270		
7							.255	.2554	.262		
8							.257	.2584	.264		
9							.263	.2644	.264		
10							.264	.2655	.267		
11							.260	.2614	.262		
12							.273	.2745	.276		
13							.273	.2745	.279		
14							.259	.2594	.266		
15							.260	.2614	.261		
16							.254	.2554	.255		
17							.272	.2735	.273		
18							.269	.2705	.270		
19							.274	.2755	.265		
20							.261	.2624	.257		
21							.276	.2775	.274		
22							.257	.2584	.275		
23							.280	.2815	.254		
24							.272	.2735	.270		
25							.259	.2604	.260		

RECTIFIER WHEEL A (Continued)

Unit 1 Date ____________

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.00032) @ 25°C				6.3 FUSE CLEARANCE (<0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL $R_A \times 10^{-3}$	PRESENT R_T (25°C) $\times 10^{-3}$	PREV. $R_T \times 10^{-3}$ (25°C)	% INCR. (<20%)	
26							.260	.2614	.257		
27							.272	.2735	.262		
28							.255	.2564	.263		
29							.261	.2624	.267		
30							.255	.2564	.264		
31							.257	.2584	.265		
32							.263	.2644	.265		
33							.249	.2494	.256		
34							.257	.2584	.248		
35							.261	.2624	.260		
36							.263	.2644	.262		
37							.289	.2906	.290		
38							.276	.2775	.278		
39							.290	.2916	.285		
40							.277	.2785	.276		
41							.262	.2634	.271		
42							.273	.2745	.251		
43							.271	.2725	.277		
44							.273	.2745	.269		
45							.283	.2846	.272		
46							.265	.2665	.263		
47							.264	.2655	.265		
48							.264	.2655	.264		
49							.277	.2785	.279		
50							.280	.2815	.283		
51							.276	.2775	.277		
52							.259	.2604	.258		
53							.260	.2614	.257		
54							.257	.2584	.257		
55							.255	.2564	.259		

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Data Sheet
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Revision 2

RECTIFIER WHEEL A (Continued)

Unit 1 Date 1/28/82

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.00032) @ 25°C				6.3 FUSE CLEARANCE (<0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL $R_A \times 10^{-3}$	PRESENT $R_T \times 10^{-3}$ (25°C)	PREV. $R_T \times 10^{-3}$ (25°C)	% INCR. (< 20%)	
56							.252	.2534	.256		
57							.259	.2604	.254		
58							.253	.2544	.259		
59							.257	.2584	.257		
60							.264	.2655	.259		

RECTIFIER WHEEL B

Fuse Temperature 74.3 °F= 23.5

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.00032) @ 25°C				6.3 FUSE CLEARANCE (<0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL $R_A \times 10^{-3}$	PRESENT R_T (25°C)	PREV. $R_T \times 10^{-3}$ (25°C)	% INCR. (< 20%)	
1							.257	.2584	.262		
2							.257	.2584	.260		
3							.259	.2604	.258		
4							.255	.2564	.257		
5							.258	.2594	.256		
6							.260	.2614	.257		
7							.266	.2675	.257		
8							.258	.2594	.257		
9							.260	.2614	.257		
10							.257	.2584	.257		
11							.259	.2604	.261		
12							.263	.2644	.265		
13							.278	.2795	.283		
14							.274	.2755	.279		
15							.275	.2765	.277		
16							.267	.2685	.267		

RECTIFIER WHEEL B (Continued) Unit 1 Date 1/23/82

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.00032) @ 25°C				6.3 FUSE CLEARANCE (<0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL R_A x10⁻³	PRESENT R_T x10⁻³ (25°C)	PREV. R_T x10⁻³ (25°C)	% INCR. (< 20%)	
17							.269	.2704	.273		
18							.260	.2614	.262		
19							.261	.2624	.263		
20							.263	.2644	.263		
21							.263	.2644	.263		
22							.259	.2604	.261		
23							.260	.2614	.264		
24							.279	.2805	.281		
25							.268	.2695	.271		
26							.265	.2665	.271		
27							.270	.2715	.269		
28							.275	.2765	.279		
29							.276	.2775	.275		
30							.260	.2614	.257		
31							.258	.2594	.256		
32							.261	.2624	.272		
33							.261	.2624	.265		
34							.259	.2604	.265		
35							.255	.2564	.259		
36							.257	.2584	.260		
37							.254	.2554	.252		
38							.252	.2534	.251		
39							.255	.2564	.255		
40							.280	.2815	.283		
41							.269	.2705	.273		
42							.261	.2624	.270		
43							.268	.2695	.278		
44							.248	.2494	.259		
45							.249	.2504	.259		
46							.265	.2665	.276		

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Data Sheet
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Revision 2

RECTIFIER WHEEL B (Continued)

Unit 1 Date 1/15/92

FUSE NO.	6.1 RAISED IND.		6.2 OR 6.6 FUSE REPLACED		6.2 DIODE REPLACED		6.4 & 6.5 FUSE RESISTANCE (0.00024 < R < 0.0003 2) @ 25°C				6.3 FUSE CLEARANCE (< 0.001") (REPLACED FUSES ONLY)
	YES	NO	YES	NO	YES	NO	ACTUAL $R_A \times 10^{-3}$	PRESENT R_T (25%) $\times 10^{-3}$	PREV. $R_T \times 10^{-3}$ (25°C)	% INCR (<20%)	
47							.266	.2675	.274		
48							.269	.2705	.272		
49							.275	.2765	.274		
50							.260	.2614	.261		
51							.257	.2584	.255		
52							.257	.2584	.256		
53							.253	.2544	.253		
54							.244	.2453	.260		
55							.251	.2524	.258		
56							.260	.2614	.267		
57							.255	.2564	.260		
58							.251	.2524	.250		
59							.262	.2634	.257		
60							.250	.2514	.256		

Total number of failed fuses 0 . Percent (%) of total 0 .

Total number of high resistance fuses 0 . Percent (%) of total 0 .

REMARKS: No fuse deviated 20% from previous reading. Highest fuse was .0002916 Ω. No remedial actions required.

Date Recorded By Tom Kontovich Date 1/29/92

Received/Approved ______________________ Date ______
Maint. Supv. or Asst. Maint. Supv.

QA Supervisor ______________________ Date ______

SI-503
Data Sheet
Page 1 of 2
Revision 0

UNIT # 1 GENERATOR ROTOR AND BRUSHLESS EXCITER ARMATURE WINDING 500-V D.C. MEGGER TEST

NOTE: Numbers are same as instruction step numbers.

6.1 Rotor temperature 21.1 °C

6.2 500-V d.c. megger TVA tag No. 467105

	STEP 6.3	STEP 6.4		STEP 6.5
TIME	MEGGER READING R_A MEGOHMS	CORRECTION FACTOR (APPENDIX A)	CORRECTED READING R_{AC} MEGOHMS	INSULATION RESISTANCE R_I MEGOHMS
15 sec	180	.42	75.60	75.60
30 sec	350	″	147.00	147.00
45 sec	500	″	210.00	[illegible]
1 min	650	″	273.00	273.00
2 min	1200	″	504.00	504.00
3 min	1500	″	630.00	630.00
4 min	2000	″	840.00	840.00
5 min	2200	″	924.00	924.00
6 min	2600	″	1092.00	1092.00
7 min	2900	″	1218.00	1218.00
8 min	3100	″	1302.00	1302.00
9 min	3500	″	1470	1470.00
10 min	3700	.42	1554	1554.00
11 min				
12 min				
13 min				
14 min				
15 min				

Insulation resistance (R_I) is acceptable if $R_I \geq 1$ megohms after values level out.

Unit #____

6.6 P.I. (polarization index) = $\frac{1554 \text{ megohms (10 min)}}{273 \text{ megohms (1 min)}}$ = ≃ 5.6

P.I. is acceptable if P.I. ≥ 2.0.

Remarks:

TEST WERE MADE WITH
TELEMETRY DISCONNECTED.

Data Taken By Tom Kovitovich Date 1/31/72

Reviewed/Approved By ____________ Date ______
Maint. Supv. or Asst. Maint. Supv.

QA Supervisor ____________ Date ______

B

Appendix III

TEST RECORD -- GENERAL

REPORT No.:

SHEET No.: ______ OF ______ SHEET

LOCATION: Sequoyah Nuclear Plant

SUBJECT: Main Bank #1 Transformer, BΦ.

DATE OF TEST:

DATE OF REPORT:

GENERAL DATA: ASEA Single Phase 60 ~ 500 KV / 22.5 KV Type TFEY 1245-A FOA 420,000 KVA GRDY SN 6211-881

COPIES SENT TO: WBM, WAD, CCM, GGS, TDW, ELE, EBA

TESTED BY: C. Cox

CHECKED BY: CEJ

APPROVED BY: CEJ

Bridge Test

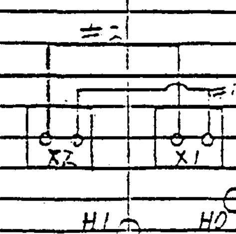
H1-H2	Reading Ω	K	Ω	Temp.	C.F.	Ω @ 75°C
Tap 1	1.4620	.1	.14620	20°C	1.216	.17777
2	1.4380		.14380			.17486
3	1.4060		.14060			.17097
4	1.3765		.13765			.16738
5	1.3490	↓	.13490	↓	↓	.16404
#1 X1-X2	1.598	.001	.001595	20°C	1.216	.001943
#2 X1-X2	1.782	.001	.001782	20°C	1.216	.002167

Ratio Test (TTR)

Tap	#1	#2
1	13.774	13.774
2	13.450	13.450
3	13.123	13.123
4	12.801	12.802
5	12.477	12.478

Megger

ΩΩ		
H-G	1000+	MΩ
#1 X-G	1000+	MΩ
#2 X-G	1000+	MΩ
H-X#1	1000+	MΩ
H-X#2	1000+	MΩ



C.T. Megger Test

ΩΩ			
X Sec	- Gnd	1000+	MΩ
Y Sec	- Gnd	1000+	MΩ
X - Y		1000+	MΩ

Equipment	No	Due Date
Kelvin Bridge	130697	12-1-82
Regulator	239683	10-20-82
Megger	166258	6-22-82
TTR	338574	

TVA 6472 (PD-4-68)

DOBLE INSULATION TESTS

TWO-WINDING TRANSFORMERS

Appendix III

OIL ☒
ASKAREL ☐
AIR ☐
GAS ☐

COMPANY TVA | DIVISION PSO | DATE 1-25-72

LOCATION OF TESTS Sequoyah Nuclear Plant | AIR TEMP. 41° F | TOP OIL TEMP. 16° C

TRANSFORMER Main Bank #1 C Ø | WEATHER Clear | % HUMIDITY 65 %

MFR. ASEA | SERIAL NO. 6211.885 | AGE | TYPE/CLASS FOA | KVA 415 000

FREE BREATHING ☐ | SEALED ☒ | GAS BLANKETED ☐ | CONSERVATOR ☐ | GALLONS OF OIL

	BUSHINGS MFR.	TYPE	CLASS	DWG. NO.	CAT. NO.	KV	YEAR
HIGH SIDE KV 500 Y☐ Δ☐	H. ASEA	GOB 1500	B11 1800 kv	6F125[illegible]			19[illegible]
LOW SIDE KV 22.5 Y☐ Δ☐	X. ASEA	35B 650	138kv B11 650 kv		12[illegible]		19[illegible]
NEUTRAL							

DATE LAST TEST 7-21-7[illegible]

COPIES TO | LAST SHEET NO. CA-734 DL[illegible]

OVER-ALL TESTS

Pico Farads	TEST	WINDING ENERGIZED	WINDING GROUNDED	WINDING GUARDED	TEST KV	MILLIAMPERES METER READING	MULTIPLIER	MILLIAMPERES	WATTS METER READING	MULTIPLIER	WATTS	% POWER FACTOR CF=1.16 MEASURED	COR. 20°C	KEY TO INSULATION RATING	INSULATION RATING
21,860	1	HIGH	LOW		10	83	1	83	9.5	.2	1.9	— —	— —		
10,110	2	HIGH		LOW		38	1	38	4	.2	0.8	.21	.24	C_H	[illegible]
16,080	3	LOW	HIGH			61	1	61	9.5	.2	1.9	— —	— —		
4,335	4	LOW		HIGH	↓	82	.2	16.4	9	.1	0.9	.55	.64	C_L	10
	CALCULATED RESULTS					— —	— —	45	— —	— —	1.1	.25	.29	C_{HL} (TEST 1 MINUS TEST 2)	[illegible]
						— —	— —	44.6	— —	— —	1.0	— —	— —	(TEST 3 MINUS TEST 4)*	—

KEY TO INSULATION RATING: G = GOOD; D = DETERIORATED; I = INVESTIGATE; B = BAD (REMOVE OR RECONDITION)

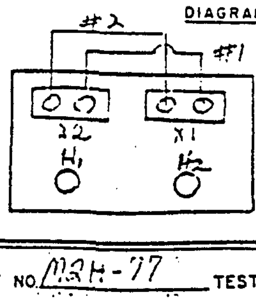
*CURRENT AND WATTS SHOULD COMPARE WITH THOSE FOR C_{HL}

BUSHING TESTS

	LINE NO.	BUSH. NO.	PHASE	BUSHING SERIAL NO.	TEST KV	MICROAMPERES METER READING	MULTIPLIER	MICROAMPERES	WATTS METER READING	MULTIPLIER	WATTS	% POWER FACTOR CF=1.00 MEASURED	COR. 20°C	COLLAR TESTS (WATTS/CURRENT) TOP		INSULATION RATING
HIGH SIDE	1	H1		109595	5	88	.02	1.76	7.5	.01	.075	.43	.43	.014/[illegible]	EST	[illegible]
HIGH SIDE	2	H2		111369	5	65	.02	1.30	7.5	.02	.070	.54	.54	.007/125	EST	[illegible]
HIGH SIDE	3	H1			10	89	.02	1.78	7	.01	.070	.39	.39		UST	[illegible]
HIGH SIDE	4	H2				65	.02	1.30	6	.01	.060	.46	.46			[illegible]
LOW SIDE	5	X1		111372		98	.02	1.96	10.5	.01	.105	.54	.54	.032/250		[illegible]
LOW SIDE	6	X1		111373		95	.02	1.90	10.5	.01	.105	.55	.55	.040/250		[illegible]
LOW SIDE	7	X2		111378		96	.02	1.92	11.5	.01	.115	.60	.60	.038/250		[illegible]
LOW SIDE	8	X2		111387	↓	94	.02	1.88	10	.01	.100	.53	.53	.032/250	↓	[illegible]
	9															
	10															
	11			Excitation Test		Tap 4										
	12				10	67.5	1	67.5						Energ H1 UST H2		
	13				10	67.5	1	67.5						Energ H2 UST H1		
	14															
	15															
	16															
	17															
	18												CF=1.46				
	19	OIL SAMPLE			10	90.5	10m	905m	6.	.002	.012	.13	.19	OIL TEMP. °C 60 F		X

N = NEUTRAL

DIAGRAM



REMARKS:

TEST SET NO. M2H-77 | TEST BY MNC-HEC | CHECKED BY CED | SHEET NO.

Appendix III

TEST RECORD -- GENERAL

REPORT No.:	
SHEET No.:	
___ OF ___ SHEETS	
DATE OF TEST:	
DATE OF REPORT:	

LOCATION: Sequoyah Nuclear Plant

SUBJECT: Main Bank #1 Transformer C Ø

GENERAL DATA: ASEA Single Phase 60 ~ 500 KV / 22.5 KV Type TFEV 1245-D FOA 420,000 KVA GRDY SN 6211-810

COPIES SENT TO: WRM, WEO, CCM, GGS, JDW, ELE, EBA

TESTED BY:	CHECKED BY:	APPROVED BY:
C. Cox	CES	CES

Bridge Test

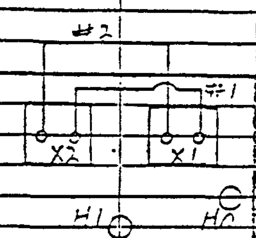
H_1-H_2	Reading	K	Ω	Temp.	C.F.	Ω @ 75°
Tap 1	1.4630	.1	.1463	20°C	1.216	.17790
2	1.4350		.1435			.17450
3	1.4070		.1407			.17109
4	1.3770		.1377			.16756
5	1.3440		.1344			.16344
#1 X_1-X_2	1.492	.001	.001492	16°C	1.235	.001844
#2 X_1-Y_2	1.474	.001	.001474	16°C	1.236	.001822

Ratio Test (TTR)

Tap	#1	#2
1	13.775	13.774
2	13.450	13.450
3	13.126	13.126
4	12.802	12.802
5	12.475	12.478

Megger

H-G	1000 + MΩ
#1 X-G	1000 + MΩ
#2 X-G	1000 + MΩ
H - X#1	1000 + MΩ
H - X#2	1000 + MΩ



CT Megger Test

X Sec. - Gnd	150 MΩ
Y Sec. - Gnd	200 MΩ
X - Y	400 MΩ

Equipment	No	Due Date
Kelvin Bridge	132697	12-1-82
Regulator	239683	10-22-82
Megger	166258	6-22-82
TTR	329514	

Appendix III

DOBLE INSULATION TESTS

DOBLE ENGINEERING COMPANY
BELMONT, MASS.
MEU-2W686 DATA SHEET

TWO-WINDING TRANSFORMER

OIL [ ]
ASKAREL [ ]
AIR [ ]
GAS [ ]

COMPANY Tennessee Valley Authority DIVISION DPSO DATE 1-24-82
LOCATION OF TESTS Sequoyah Nuclear Plant AIR TEMP. 41°F TOP OIL TEMP 16°C
TRANSFORMER U.SST 1A WEATHER Clear % HUMIDITY 29%
MFR. ASEA SERIAL NO. 6258-375 AGE 7 yr TYPE/CLASS TET 759 OA/FA KVA [illegible]
FREE BREATHING ☐ SEALED ☑ GAS BLANKETED ☐ CONSERVATOR ☐ GALLONS OF OIL -

		BUSHINGS MFR.	TYPE	CLASS	DWG. NO.	CAT. NO.	KV	YEAR
HIGH SIDE KV 22.5	Y☐ △☑	Ohio Brass	12PS0				34.5	1971
LOW SIDE KV 6.9	Y☑ △☐	Quadrant Ohio Brass R-5					8.7	
NEUTRAL		Quadrant Ohio Brass R-5				DATE LAST TEST	4-6-78	

COPIES TO ELF, EMF, COM, WBM, DTC, JDW LAST SHEET NO. CF-372 D1971

OVER-ALL TESTS

TEST	TEST CONNECTIONS: WINDING ENERGIZED	WINDING GROUNDED	WINDING GUARDED	TEST KV	EQUIVALENT 2.5 KV READINGS — MILLIVOLTAMPERES: METER READING	MULTIPLIER	MVA	MILLIWATTS: METER READING	MULTIPLIER	MW	% POWER FACTOR (CF=1.04) MEASURED	COR. 20°C	KEY TO INSULATION RATING: G = GOOD, D = DETERIORATED, I = INVESTIGATE, B = BAD (REMOVE OR RECONDITION)	INSULATION RATING
1	HIGH	LOW		2.5	33	1000	33000	3.5	20	70	—	—		
2	HIGH		LOW	|	80	100	9000	12	2	24	.30	.33	C_H	WG
3	LOW	HIGH		|	52	1000	52000	6.5	20	130	—	—		
4	LOW		HIGH	↓	27	1000	27000	4	20	80	.30	.33	C_L	WG
CALCULATED RESULTS					—	—	25000	—	—	46	.18	.20	C_{HL} (TEST 1 MINUS TEST 2)	WG
					—	—	25000	—	—	50	—	—	(TEST 3 MINUS TEST 4)*	—

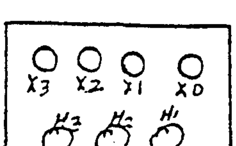
*MVA AND MW SHOULD COMPARE WITH THOSE FOR C_{HL}

BUSHING TESTS

SIDE	LINE NO.	BUSH. NO.	PHASE	BUSHING SERIAL NO.	TEST KV	EQUIVALENT 2.5 KV READINGS — MILLIVOLTAMPERES: METER READING	MULTIPLIER	MVA	MILLIWATTS: METER READING	MULTIPLIER	MW	% POWER FACTOR (CF=1.23) MEASURED	COR. 20°C	COLLAR TESTS (MW/MVA) TOP		INSULATION RATING
HIGH SIDE	1	H1		UST	2.5	51	20	1020	25	.2	5.0	.49	.60	19/20		G
HIGH SIDE	2	H2		↓	|	51.5	20	1030	25	.2	5.0	.49	.60	1.8/21		G
HIGH SIDE	3	H3		↓	|	51	20	1020	20	.2	4.0	.39	.48	.5/21		G
HIGH SIDE	4	N			|											
LOW SIDE	5	X1			|									.5/99		G
LOW SIDE	6	X2			|									44/99		G
LOW SIDE	7	X3			|									45/102		G
LOW SIDE	8	X0			↓										42/97		G
	9															
	10															
	11			Excitation	Test		Tap 1	2.5 KV								
	12															
	13			H1 - H2		52	1000	52000								
	14			H2 - H3		28	1000	28000								
	15			H3 - H1		62	1000	62000								
	16															
	17															
	18												CF=	1.46			
	19	OIL SAMPLE			2.5	56	10	560	2.5	.2	.5	.09	.13	OIL TEMP. °C		XG

N = NEUTRAL

DIAGRAM



REMARKS:

MEU 11-? TESTED BY RGM CHECKED BY CED

TEST RECORD -- GENERAL

REPORT No.:

SHEET No.: ____ OF ____ SHEE

LOCATION: Sequoyah Nuclear Plant

DATE OF TEST: 1-22-82

SUBJECT: USST 1A Test

DATE OF REPORT:

GENERAL DATA: ASEA 22.5 KV/6.9 KV Transformer OA/FA 31000/[illegible] KVA S/N 6252-075

COPIES SENT TO: [illegible] SRA [illegible] WEM WHD JDW [illegible]

TESTED BY: Malone

CHECKED BY: CES

APPROVED BY: CES

Bridge Test

H1-H2	Reading	K	OHMS	Temp	Corr	Ω @ 75	Man. Ω
Tap 1	5.625	.01	.0563	16°C	1.236	.0696	.0713
2	5.49		.0549			.0679	
3	5.375		.0535			.0665	
4	5.244		.0524			.0648	
5	5.095		.0509			.0629	
H2-H3							
1	5.625	.01	.0563	16°C	1.236	.0696	.0713
2	5.495		.0550			.0680	-
3	5.37		.0537			.0664	
4	5.246		.0525			.0649	
5	5.09		.0509			.0629	
H3-H1							
1	5.625	.01	.0563	16°C	1.236	.0696	.0713
2	5.496		.0550			.0680	
3	5.375		.0538			.0665	
4	5.25		.0525			.0649	
5	5.095		.0595			.0630	
X1-X0	2.05	.001	.00205	16°C	1.236	.00253	
X2-X0	2.06		.00206			.00255	
X3-X0	2.07		.00207			.00256	

1-22-82

TTR Ratio Test				Megger Test	
Tap	H1-H2—X1X0	H2-H3—X2X0	H3-H1—X3X0	DC	
1	6.070	6.070	6.070	H1 - Gnd	2000 MΩ
2	5.922	5.922	5.922	H1 - Lo	200 MΩ
3	5.792	5.793	5.792	Lo - Gnd	200 MΩ
4	5.663	5.663	5.663		
5	5.496	5.496	5.496		

GTOT Megger	
H1-G	79 MΩ
H2-G	400 MΩ
H3-G	400 MΩ
X1-G	250 MΩ
X2-G	50 MΩ
X3-G	30 MΩ
X0-T	1.5 MΩ
T-G	2000 MΩ
H2-T	2000 MΩ

Equipment Used	No.	Due Date
Megger	166253	6-22-82
TTR [illegible]	320[illegible]	
Kelvin Bridge	425227	

DOBLE INSULATION TESTS

DOBLE ENGINEERING COMPANY
BELMONT, MASS.
MEU-2W666 DATA SHEET

TWO-WINDING TRANSFORMER

OIL ☐
ASKAREL ☐
AIR ☐
GAS ☐

COMPANY Tennessee Valley Authority DIVISION DPSO DATE 1-22-72

LOCATION OF TESTS Sequoyah Nuclear Plant AIR TEMP. 41° F TOP OIL TEMP. 12°C

TRANSFORMER USST 1B WEATHER Clear %HUMIDITY 38°

MFR. HSEM SERIAL NO. 4257-008 AGE 8 mo. TYPE/CLASS KVA 21000/28000

FREE BREATHING ☐ SEALED ☑ GAS BLANKETED ☐ CONSERVATOR ☐ GALLONS OF OIL -

	BUSHINGS MFR.	TYPE	CLASS	DWG. NO.	CAT. NO.	KV	YEAR
HIGH SIDE KV 22.5 Y☐ △☑	Ohio Brass	AK22	200 KV			345	1971
LOW SIDE KV 6.9 Y☑ △☐	Ohio Brass	4.5				27	
NEUTRAL	Ohio Brass						

DATE LAST TEST

COPIES TO ELE, EBA, CJM, WBM, DTR, JDW LAST SHEET NO.

OVER-ALL TESTS

TEST	TEST CONNECTIONS WINDING ENERGIZED	WINDING GROUNDED	WINDING GUARDED	TEST KV	EQUIVALENT 2.5 KV READINGS MILLIVOLTAMPERES METER READING	MULTIPLIER	MVA	MILLIWATTS METER READING	MULTIPLIER	MW	% POWER FACTOR CF = 1.16 MEASURED	COR. 20°C	KEY TO INSULATION RATING G = GOOD D = DETERIORATED I = INVESTIGATE B = BAD (REMOVE OR RECONDITION)	INSULATION RATING
1	HIGH	LOW		2.5	24	1000	24000	5	20	100	—	—		
2	HIGH		LOW	|	82	100	8200	13	2	26	.32	.37	C_H	G
3	LOW	HIGH		|	53	1000	53000	8.5	20	170	—	—		
4	LOW		HIGH	↓	37	1000	37000	5	20	100	.37	.42	C_L	G
CALCULATED RESULTS					—	—	25800	—	—	74	.29	.33	C_{HL} (TEST 1 MINUS TEST 2)	G
					—	—	16000	—	—	70	—	—	(TEST 3 MINUS TEST 4)*	—

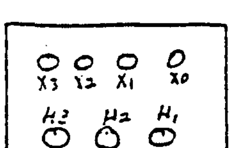
*MVA AND MW SHOULD COMPARE WITH THOSE FOR C_{HL}

BUSHING TESTS

LINE NO.	BUSH. NO.	PHASE	BUSHING SERIAL NO.	TEST KV	EQUIVALENT 2.5KV READINGS MILLIVOLTAMPERES METER READING	MULTIPLIER	MVA	MILLIWATTS METER READING	MULTIPLIER	MW	% POWER FACTOR CF = 1.33 MEASURED	COR. 20°C	COLLAR TESTS (MW/MVA) TOP		INSULATION RATING
HIGH SIDE 1	H1			2.5	51	20	1020	21	.2	4.2	.41	.50	1.4/32		G
2	H2			|	51	20	1020	20.5	.2	4.1	.40	.49	1.7/34		G
3	H3			|	51	20	1020	24	.2	4.8	.47	.57	1.2/35		G
4	N														
LOW SIDE 5	X1												.9/22		G
6	X2												1.4/23		G
7	X3												1.4/23		G
8	X0			↓									.8/23		G
9															
10															
11			Exciting Test												
12			USST												
13			Tap 1		52	1000	52000								
14			|		32	1000	32000								
15					64	1000	64000								
16															
17															
18													CF 1.46		
19	OIL SAMPLE				56	10	560	3	.2	.6	.11	.16	OIL TEMP. °C		G

N = NEUTRAL

DIAGRAM



REMARKS:

MEU TEST SET NO. MEU 1127 TEST BY BGM CHECKED BY CE SHEET NO.

Appendix III

TEST RECORD -- GENERAL

REPORT NO.:

SHEET NO.: ____ OF ____ SHEETS

LOCATION: Sequoyah Nuclear Plant

DATE OF TEST: 1-22-82

SUBJECT: "CSST" IR Test

DATE OF REPORT:

GENERAL DATA: ASEA 22.5 KV / 6.9 KV Transformer OA/FA
21000 / 28000 KVA SN 6258-098

COPIES SENT TO: FLE EBA CCM WEM DTP JDW WLD

TESTED BY: Malone

CHECKED BY: CES

APPROVED BY: CES

Bridge Test

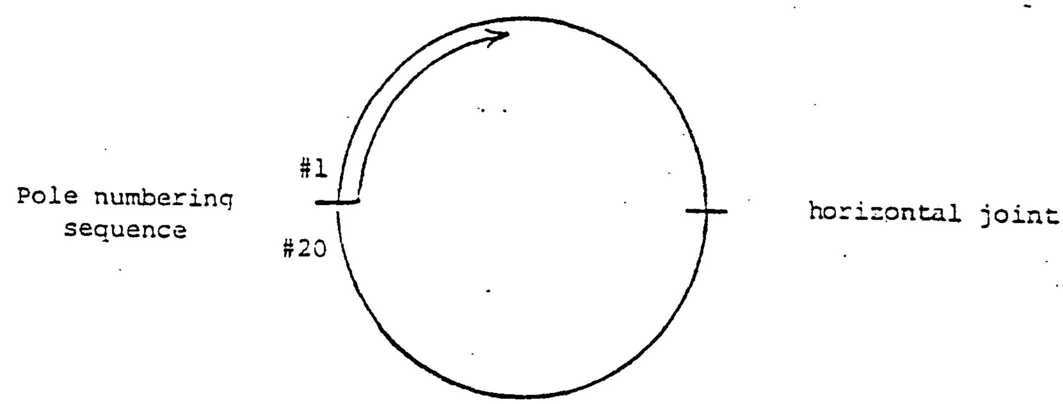
H1 - H2	Reading	K	Ω	Temp	Const	Ω @ 75°	Max Ω
Tap 1	5.65	.01	.0565	16°C	1.236	.0699	.0717
2	5.52	|	.0552	|	|	.0682	
3	5.40	|	.0540	|	|	.0667	
4	5.28	|	.0528	|	|	.0653	
5	5.12	↓	.0512	↓	↓	.0633	
H2 - H3							
Tap 1	5.65	.01	.0565	16°C	1.236	.0698	
2	5.52	|	.0552	|	|	.0682	-
3	5.40	|	.0540	|	|	.0667	
4	5.28	|	.0528	|	|	.0653	
5	5.12	↓	.0512	↓	↓	.0633	
H3 - H1							
Tap 1	5.66	.01	.0566	16°C	1.236	.0699	
2	5.53	|	.0553	|	|	.0684	
3	5.41	|	.0541	|	|	.0669	
4	5.30	|	.0530	|	|	.0655	
5	5.13	↓	.0512	↓	↓	.0634	
X1 - X0	2.14	.001	.00214	16°C	1.236	.00265	
X2 - X0	2.14	|	.00214	|	|	.00266	
X3 - X0	2.16	↓	.00216	↓	↓	.00267	

TTR Ratio Test 1-23-82

Tap	H1-H2-X1-X0	H2-H3-X2-X0	H3-X1-X3-X0	Megger Test	
1	6.070	6.070	6.069		
2	5.921	5902	5.921	Hi - Gnd	300 MΩ
3	5.792	5792	5.792	Hi - Lo	200 MΩ
4	5.662	5.663	5.662	Lo - Gnd	150 MΩ
5	5.496	5.496	5.496		

BTCT	Megger	Equipment	No.	Date Cal.
H1 - G	450 MΩ			
H2 - G	400 MΩ			
H3 - G	350 MΩ	Megger	166359	6-23-81
X1 - G	80 MΩ	TTR Tester	338514	
X2 - G	200 MΩ	Kelvin Bridge	122607	12-1-82
X3 - G	200 MΩ	Resistance	222623	10-20-81
X0 - G	50 MΩ			
T - G	2000 MΩ			
H2 - T	2000 MΩ			

EXCITER FIELD POLE DROP TEST
Data Sheet



POLE		VOLTAGE DROP		POLE		VOLTAGE DROP
1		6.6		11		6.1
2		7		12		6.8
3		6.5		13		6.3
4		7.		14		6.6
5		6.5		15		6.5
6		7.3		16		6.3
7		5.9		17		6.5
8		2.8		18		6.6
9		6.2		19		6.8
10		7.3		20		6.7

Avg 6.42

Applicable Voltage 130 VAC

% AVG. .963

Number of poles found unacceptable 0

Low Limit 5.4

Corrective action: NONE WARRANTED AT THIS TIME.

High Limit 7.3

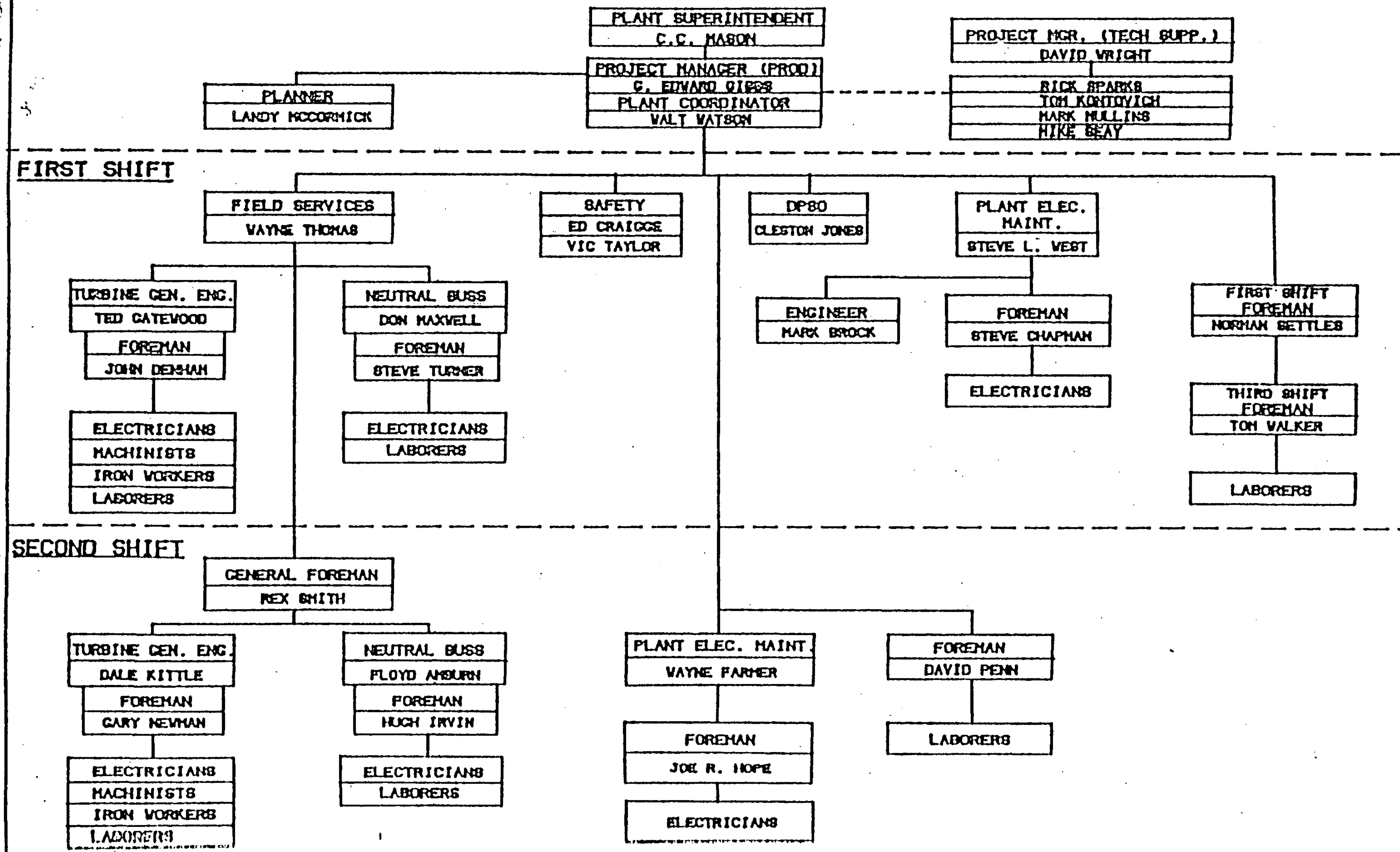
Comments: Replace pole #8 during cycle 1 refueling outage

Test Conducted by: TA Kontovich

Appendix IV

SEQUOYAH NUCLEAR PLANT

ISOLATED PHASE BUS REPAIR PROJECT ORGANIZATION

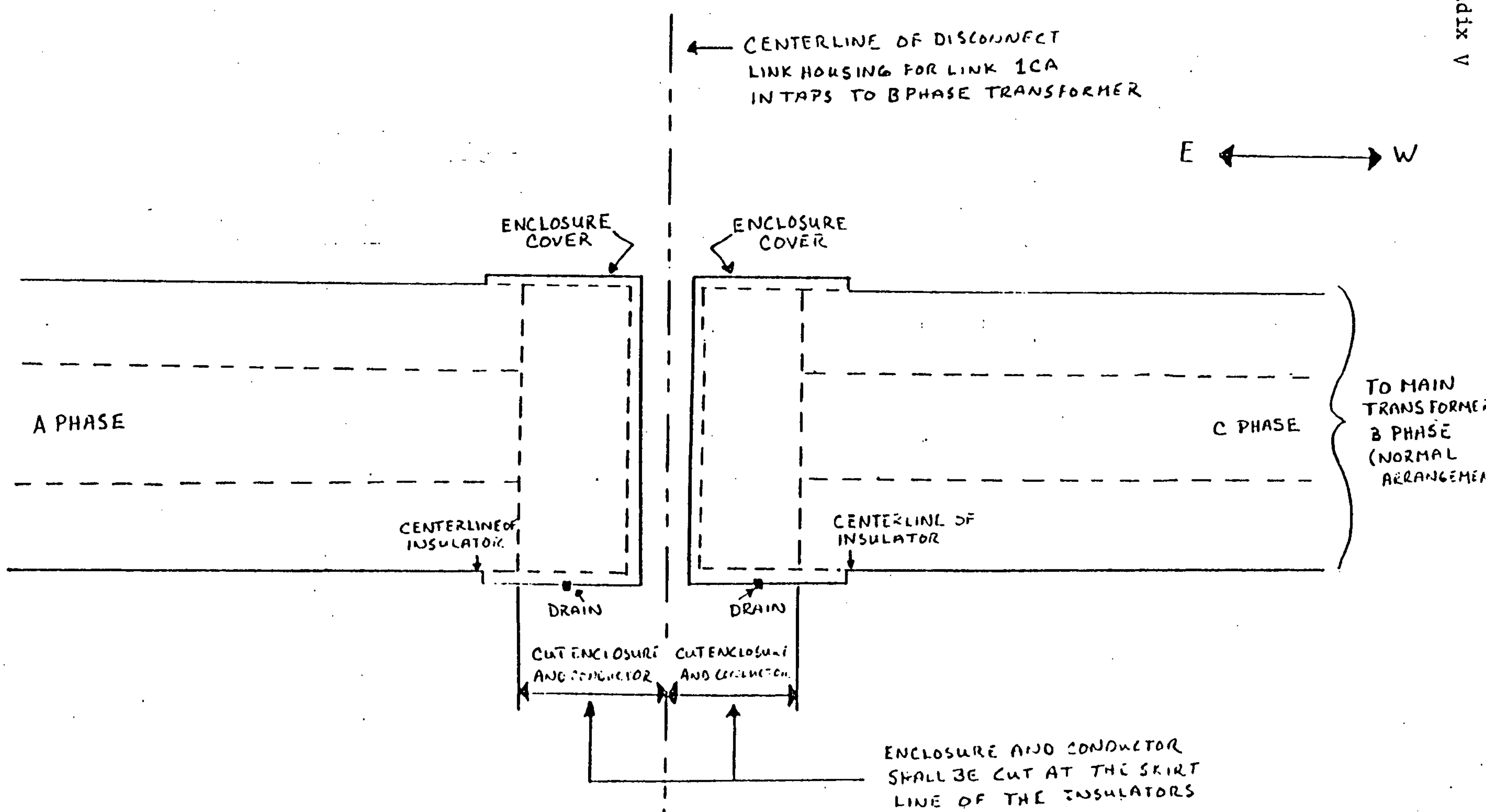


Appendix IV

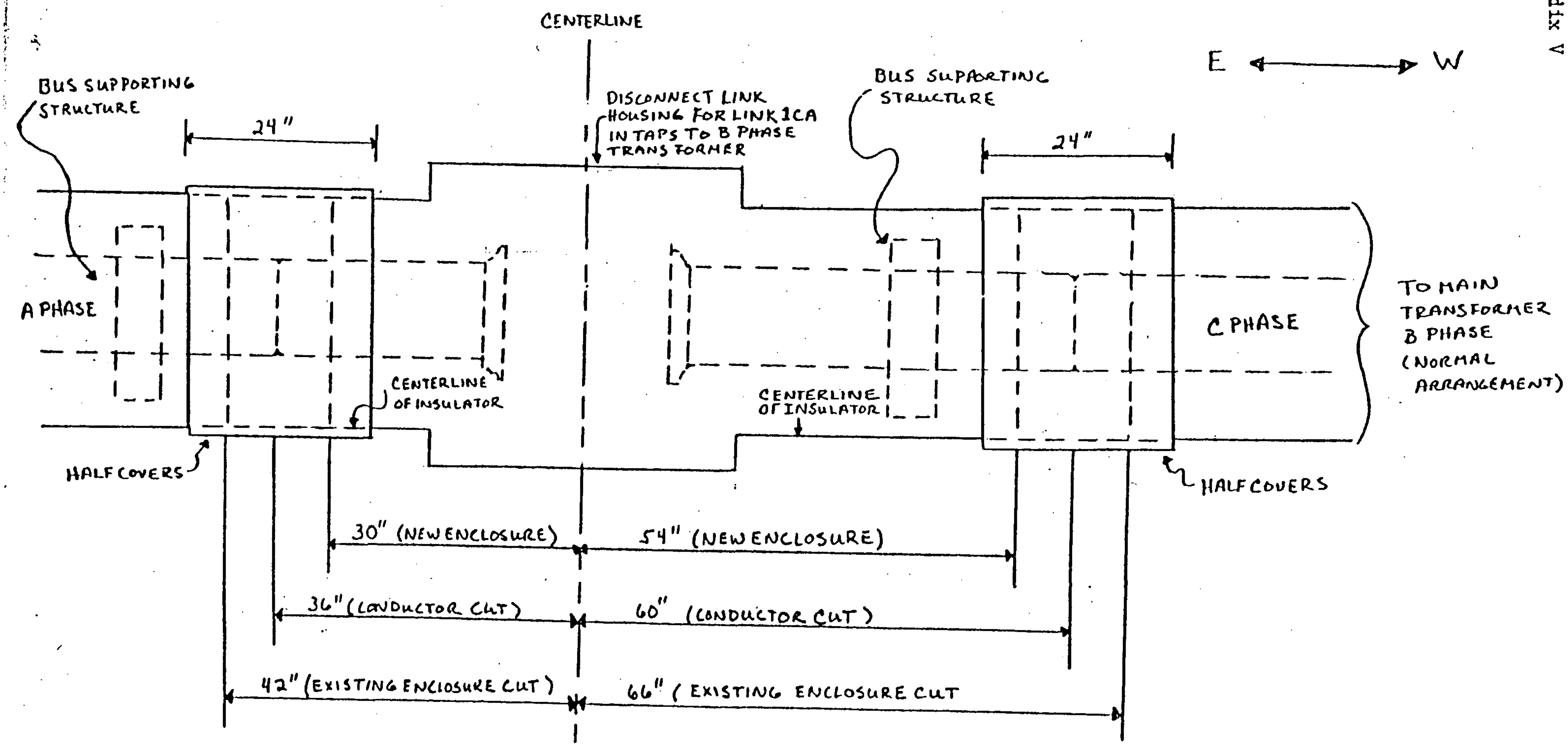
APPENDIX V

1. Link Position 1CA Temporary Repair

2. Link Position 1CA Permanent Repair



ELEVATION VIEW



ELEVATION VIEW

Appendix VI

Appendix VI

Table 1

Parts Obtained From WBN

Quantity	Drawing Item No.	Drawing No.	Description
2 each	1	W638F485	Bus enclosure mounting adapter and mounting hardware.
1 each	2	W638F485	Bus enclosure mounting adapter.
1 lot	6	W638F485	Neutral bus and mounting hardware.
1 lot	12, 13, 14, 17	W638F485	Ground connection and mounting hardware.
1 lot	38, 10, 11, 16	W638F485	Neutral enclosure and mounting hardware.
1 each	82	W638F485	1" standard brass washer. Style No. 70500BP30N.
1 each	83	W638F485	1" hex stainless-steel nut. Style No. 70Z10GA61Q.
1 lot	1 thru 48	CN7C0258 CN7D0838	Neutral grounding cubicle and bus connectior as shown on referenced drawings. Unable to provide exact parts list due to unreadable drawings.
3 each	24	1105F89	Resistor assembly style 176A08 consisting of bracket, spacers, and mounting hardware.
1 each			Transformer - Neutral single phase, sub polarity, 60 cycles, 75-kVA at 65°, SN-PXC78275 HV-24000 LV240, 5.5% impedance at 85°C, 45 gallons, Interteen 1350 weight.

Appendix VI

Table 2

Parts Obtained From Westinghouse

Isolated Phase Bus Housing

Reference Contract: 82K5830872

Drawing Reference: Westinghouse Drawing CN64C2455L36

Item	Quantity	Description
2-1	2	36-3/8" outside diameter enclosure extension 1/4" thick with backup rings.
2-2	2	End cap enclosure for 36-3/8" outside diameter. Enclosure per W drawing CN64C2455L36.
2-3	2	Clamping band and gasket assembly per W drawing CN7C4009L36.
2-4	8	Ground assembly per W drawing CN58C2819,
4-1	2	Support insulator - 15-kV. Style No. 304C750G01.
8-1	12	Krayrex windows. Assembled with drain boss (2) and gaskets.
8-2	4	Krayrex window assembly with drain boss (1) and gaskets.
8-3	8	Krayrex window assembly with drain boss.
6-1	250	1/2" - 14 pipe plugs.

Generator Bus Connection

Item	Quantity	Description
5-1	1	Generator bus connection assembly B phase per W drawing CN7D1847, sub-4.
5-2	1	Support insulator 15-kV. Style No. 304C750G01.
5-3	1	Insulated mounting pan per W drawing CN7D2286H19.
5-4	1	Repaired stainless-steel channel.
5-5	1	Conductor support plate per W drawing 113D277.
5-6	4	1/2" - 13 x 2" hex hardware steel bolts.
5-7	4	1/2" steel lockwasher.
5-8	4	5/8" steel lockwasher.
5-9	4	1/2" standard steel flatwashers.
5-10	4	5/8" - 11 x 1-1/4" hex hardware steel bolts.

Hardware for Mounting Generator Connection

A, B, and C Phase

Item	Quantity	Description
5-11	6	Bolting collar segments per W drawing CN7A9243G01.
5-12	48	5/8" - 11 x 3/4" hex hardware zinc chromate steel bolts.
5-13	48	5/8" steel washers - lock - zinc chromate.
5-14	48	5/8" steel flat washers - zinc chromate.
5-15	60	1/2" - 13 x 2-1/4" hex hardware steel. Zinc chromate bolt
5-16	60	1/2" - 13 hex steel zinc chromate nut.
5-17	60	1/2" - 13 hex steel zinc chromate palnut.
5-18	120	1/2" steel zinc chromate flatwasher.

Appendix VI

Neutral Bus Housing

Item	Quantity	Description
7-1	1	Removable cover assembly per W drawing CN7D2286H11 with window assembly (undrilled) mounting hardware for item 7-1.
7-2	48	1/4" - 20 plugnuts.
7-3	48	1/4" - 20 x 3/4" hex head zinc chromate steel bolts.
7-4	48	1/4" steel zinc chromate flatwasher.
7-5	1	Gasket - Cork neoprene 1/8" thick by 1-1/2" wide.

Other Westinghouse Acquisitions

Item	Quantity	Description
1		High-potential test set. Reference RD-852921.
1		Services of W winder technicians.
1		Generator repair parts and material. Reference RD-845345.

APPENDIX III

IV. Data Sheet for Unit Startup

APPENDIX III

DATA SHEET

DATE ____________

Load Increment	0%	25%	50%	75%	100%
Generator Load MG/MVAR					
Generator Field Volts					
Generator Field Amps					
Generator Line Amps AØ					
Generator Line Amps BØ					
Generator Line Amps CØ					
Exciter Field Volts					
Exciter Field Amps					
Neutral Voltage at Meter in Control Room					
Neutral Voltage on the 159GN Relay					

Appendix VI

Table 3

Material Obtained From Power Service Shops

Quantity	Description
1	Services of vacuum oil dehydrator (Purivac) for oil handling on the spare main transformer. 1663 No. 82-23.
1 lot of material	1663 No. 82-24. Bushing enamel paint - 2 quarts Cleaning solvent XL-99 - 55 gallons
1	Fabrication of neutral transformer bus connection. 1663 No. 82-26. Consists of 1 each bus 2 gav connections 2 each shunts.

Appendix VI

Table 4

Other Material

Material Obtained From Power Stores (SQN)

Requisition Number	Quantity	Description
	5 gallons	Flat black lacquer
	5 gallons	Lacquer Thinner
	25 feet	1/4" x 2" x 2" aluminum angle
	25 feet	1/4" x 2" x 2-1/2" aluminum angle
	3 sheets	1/4" x 48" x 48" aluminum plate

Material Obtained From Sequoyah Field Services

Requisition Number	Quantity	Description
	3 sheets	1/2" x 48" x 48" lomacoid board for A, B, and C phase bus link installation.
	100 each	3/8" x 1" flathead nylon bolts.
	100 each	3/8" nylon bolts for isolated phase bus installation.
	6 each	Flexitallic seals 1" x 1.38" outside diameter x .125" thick for water cooled connection on B and C neutral bus connections.

Appendix VI

Table 4

Material on Order to be Installed or Returned to WBN at the First Available Opportunity

Status	Item	Quantity	Description
WBN		1	1" standard brass washer W drawing 638F485, style 70500BP30N.
WBN		1	1" - 8 stainless steel nut W drawing 638F485, style 70210GA61Q.
SNP	3-1	2	Hartzell fan - Propeller type L Model L20, series 01 with 3/4 horsepower motor, 460-V, 3 phase 60 cycle, ordered on contract 82K5830872.
SNP	9-1 9-1	10	Support insulator with mounting assembly and hardware to fit with existing design ordered on contract 82K5830872.
WBN		3	Resistors for unit 1 exciter. Style No. - 176A487A08.
SNP		6	Thermocouples for unit 1 generator exciter Style No. 2605A31G01.
WBN		1	Neutral transformer - W Interteen filled, sub. polarity. Single phase, 60 cycle HV 24000 LV 240 5.5% impedance at 85°C 45-gallon capacity - Interteen 1350 weight 75-kVA cont at 65°C rise Layout drawing - W CN7D0838 Reference - W CN7D0258

Appendix VII

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
Hazard Control Instruction

CONFINED SPACE ENTRY

This instruction applies to any confined space entry by plant employees or any entry into a confined space under this plant's jurisdiction. If the Division of Construction makes an entry into a confined space where plant or outage personnel are not working, they may utilize their own permit system in lieu of the permit included in this instruction. If the Division of Construction makes an entry into a confined space where plant or outage personnel are working, the permit system included in this instruction shall be used and the appropriate plant or outage safety staff shall approve the permit and test the atmosphere. Contractors entering confined spaces shall use the permit system contained in this instruction and the appropriate plant or outage safety staff shall approve the permit and test the atmosphere.

Confined space is defined as an enclosed space, vessel or structure which by virtue of its design and/or use, could contain an environment harmful for human occupancy or require special procedures for emergency egress. Pipe chases, valve rooms, pump rooms and reactor building containment are not generally considered to be confined spaces although certain areas in containment will be designated as confined spaces.

Work in confined spaces presents many potential hazards. Adequate preplanning and protective measures must be taken by the responsible supervisor to protect employees from potential hazards. Hazards which may be encountered in confined spaces include the following: oxygen deficiency, toxic vapors, explosive gases, elevated temperatures, inadvertant flow of harmful material into a confined space, mechanical mixers, electrical shock, and fire.

Appendix A of this instruction is a listing of confined spaces identified by the plant safety staff. This listing is not necessarily all-inclusive. As additional confined spaces are identified, the listing will be updated. Unless specifically exempted in writing by the responsible safety staff, treat every manhole, handhole or pit greater than 5' deep as a confined space. Whenever you need to work in an area that you believe is a confined space, but is not listed in Appendix A, contact the responsible safety staff prior to entry.

It is the responsibility of the employee to inform his supervisor of any known physical condition which could hamper his working in an confined space. If he is unsure of his physical condition, he should contact the plant nurse or his private physician for guidance (with approval of his supervisor).

General

Mobile tank vehicles shall be grounded prior to personnel entry if the vehicle has contained flammables.

When ventilation equipment is provided in an area where flammable gases or vapors may be present, it shall be explosion proof.

Toxic materials or coatings on surfaces to be heated shall be removed prior to applying heat or appropriate respiratory protection shall be provided.

Electrically-operated tools and equipment used in environments where flammable vapors, gases, or dusts may exist shall be approved by Underwriters Laboratory for use in these environments. Nonsparking handtools shall be used in these environments. If nonsparking handtools are not available, the responsible safety staff shall provide adequate precautions to prevent an explosion.

Portable electrical tools, equipment, and lighting used inside confined spaces shall be supplied through a ground fault circuit interrupter, battery operated, or low voltage (12 volts or less).

Compressed gas cylinders, except those for breathing apparatuses, shall not be taken into confined spaces unless approved by the responsible safety staff. Valves leading to welding and cutting lines which enter the confined space shall be turned to the "off" position when all employees exit the confined space for a break and at the end of a shift. The lines shall then be disconnected from the cylinder until needed again or the lines shall be removed from the confined space.

Fuel-burning heating equipment (catalytic heaters, salamanders, etc.) shall not be used in confined spaces.

Permit Procedure

A confined space entry permit (Appendix B) shall be prepared by the responsible foreman and issued and posted prior to entering any confined space. If more than one craft or division will be working in the confined space during the same shift, one permit may be used but each immediate supervisor shall sign the permit.

When copies of the permit are needed, have them reproduced on both sides of one sheet of paper and have the accountability log reproduced on a separate sheet of paper.

Before any confined space entry permit is posted and work begins, the responsible supervisor shall develop an emergency plan and discuss it with all employees involved in the entry, and included in the permit. This plan shall include, as a minimum, the following elements:

1. Description of work to be performed
2. Emergency evacuation plan for injured employees
3. Necessary personal protective equipment to accomplish job tasks
4. Necessary rescue equipment

Before entry into any confined space (except for rescue operations), the atmosphere shall be tested by the responsible safety staff unless this requirement is specifically waived by the safety staff due to one of the following conditions:

1. The only probable hazard expected would be an oxygen deficiency and this condition is evaluated by a trained supervisor using approved surveillance equipment in proper calibration.

or

2. The confined space has been initially reviewed and surveyed by the appropriate safety staff prior to initial entry and both the confined space and the work within it are such as to preclude the development of a hazardous atmosphere following initial entry.

However, if Health Physics determines that a confined space presents significant radiological problems, then Health Physics will follow their section instructions for radiological monitoring and confer with the responsible safety staff to determine which group (Health Physics or Safety Staff) is best suited to test the atmosphere for potentially hazardous conditions.

*If the testing of the atmosphere in the confined space requires that a
*member of the Safety Staff enter the confined space but if that person is
*unable to enter due to the size of the manway, an alternate employee can
*be utilized who is able to enter through the manway. This alternate
*employee will be provided with adequate training in the use of atmospheric
*monitoring equipment by the Safety Staff.

After the atmosphere is tested and the checklist completed, the responsible safety staff shall approve entry into the confined space. This approval will be invalid if work other than that described on permit is conducted. If the scope of the work has to be revised or if different tools or equipment have to be used that could introduce new hazards unique to confined spaces, a new permit shall be issued.

All employees entering the confined space shall log in/out on the accountability log (or Special Work Permit if work has to be performed in areas requiring a Health Physics Special Work Permit) unless specifically exempted by the appropriate safety staff due to the following conditions:

1. No more than three persons will be inside the confined space at any one time.

2. The safety observer can maintain visual contact with the employee(s) inside the confined space at all times from his safe vantage point.

3. All employees do log in on initial entry during the work period and log out at the end of the work period. Log-ins and log-outs shall include exit for meals and entry after meals.

If hazardous environmental conditions could develop during the work period, the atmosphere shall be continuously monitored for oxygen content by continuous monitoring equipment (unless a self-contained breathing apparatus is used). Tests of the atmosphere (for combustible vapors/gases and oxygen, if not continuously monitored) shall be repeated after a lunch period and after other extended periods of not working in the confined space.

*Revision JMM for CCh

Confined space entry permits shall be posted at the entrance to the confined space by the responsible foreman and returned to the responsible safety staff's office after the work is complete.

The confined space entry permit is valid for one shift (not to exceed 12 hours) unless an extension is authorized by the responsible foreman and approved by the responsible safety staff.

Isolation of Confined Space

Clearance procedures shall be followed and the required hold orders shall be obtained prior to the approval of the confined space entry permit.

Any piping which begins or terminates (either by design or as a result of work activities) within the confined space shall be evaluated for the possible introduction of hazardous materials (acid, steam, water, inert gases, etc.). The clearance procedure shall be used whenever possible to isolate piping that could introduce a hazardous material into the confined space and to deenergize electrical circuits or equipment in the confined space that could endanger employees.

Entry Into Areas Immediately Hazardous to Life or Health

The following precautions shall be taken when entering an area which is immediately hazardous to life or health (an area where an employee may suffer serious health effects or death):

1. Self-contained breathing apparatus shall be used by each employee entering the confined space.

2. Each employee entering the confined space shall wear a harness and lifeline secured to a fixed object.

3. The safety observer shall ensure that the lifelines do not become tangled.

4. The safety observer shall wear a self-contained breathing apparatus and harness with lifeline unless stated otherwise on the permit. The self-contained breathing apparatus shall be in a ready state. If this is not practical, due to size of opening or configuration of space, then alternate means shall be approved by the safety engineer or plant Safety Staff supervisor.

5. The responsible safety staff shall assist the responsible supervisor in preparing the emergency plan.

6. There shall be at least two employees designated as rescue personnel present at the entrance to the confined space or an acceptable alternate position when the entrance area is in a high radiation area. They shall be provided with self-contained breathing apparatuses and harnesses with lifelines.

Safety Observer

During all operations in a confined space, a safety observer shall be stationed outside to provide constant communication (visual or audio) with the employees inside. The observer shall have adequate equipment available for rescue should an emergency occur. This equipment should include:

1. Communication equipment to summon assistance.

2. Appropriate lifelines, safety belts, etc. (as required in the emergency plan).

3. Self-contained breathing apparatus (as required in the emergency plan).

Each safety observer shall be briefed by the immediate supervisor as to his responsibilities and duties (routine and emergency). Each observer shall comply with the following rules:

1. Remain in safe area immediately outside the confined space.

2. Remain in communication with employees inside confined space.

3. Ensure all employees comply with requirements in checklist and sign in/out on accountability log.

4. Ensure proper rescue equipment is readily available and used during rescue.

5. Know location of nearest phone and number to contact for emergency assistance (PAX 299).

Plant Superintendent

Attachments

General Revision

Hazard Control Instruction

APPENDIX A

CONFINED SPACES

Reactor Buildings

1. Upper Containment - Refueling Cavity
2. Upper Containment - Reactor Vessel
3. Lower Containment - Reactor Coolant Drain Tanks
4. Lower Containment - Area Underneath Reactor Vessel
5. Lower Containment - Floor Drain and Equipment Sump
6. Lower Containment - RHR Containment Sump
7. Lower Containment, Fan Rooms - Fan Motor Enclosures
8. Lower Containment, Accumulator Rooms - Accumulator Tanks
9. Lower Containment - Pressurizer Relief Tank
10. Lower Containment - Pressurizer
11. Lower Containment - Upper 15 Feet of Pressurizer Enclosure
12. Lower Containment - Steam Generators
13. Lower Containment - Upper 15 Feet of Steam Generator Enclosures

Auxiliary Building

El. 791.75

1. Demin Water Tanks
2. Raw Water Tanks

El. 734

1. Filter Trains "A" and "B" Emergency Gas Filter Treatment Room
2. New Fuel Storage Vault
3. Spent Fuel Pit
4. Fuel Transfer Canal
5. Component Cooling Surge Tanks
6. Auxiliary Boration Make-Up Tank

El. 714

1. Waste Evap. Cond. Demin Pit
2. Evap. Feed Ion Exchange Pits
3. Waste Evap. Cond. Filter Pit
4. Spent Fuel Pit Demin Pit
5. Spent Fuel Pit Demin Filter Pit
6. Evap. Cond. Demin Pits
7. Evap. Cond. Filter Pits
8. Evap. Cond. Feed Ion Exchange Filter Pit
9. Reactor Coolant Filter Pit
10. Seal Water Filter Pit
11. Seal Water Injection Filter Pits
12. Cation Bed Demin Pit
13. Mixed Bed Demin Pits
14. Spent Fuel Pit and Skimmer Filter Pit
15. Auxiliary Building Gas Treatment System

APPENDIX A
(Continued)

CONFINED SPACES

El. 706

1. Pipe Tunnel at Waste Packaging Area

El. 690

1. Boron Injection Tanks
2. Gas Decay Tank Rooms
3. Gas Decay Tanks
4. Caustic Batch Tank
5. Boric Acid Storage Tanks
6. Boric Acid Batch Tank
7. Boric Acid Filter Pits
8. Monitor Tank
9. Reactor Coolant Filter Rooms
10. Seal Water Filter Rooms
11. Seal Water Injection Filter Rooms
12. Volume Control Tanks
13. Containment Purge Air Fan Enclosures

El. 669

1. Transformers for Light Boards
2. Valve Rooms at Refuel and Primary Water Storage Tanks
3. Spent Resin Storage Tank
4. Cask Decon Collector Tank
5. Laundry and Hot Shower Tanks
6. Chemical Drain Tank
7. Hold Up Tanks
8. B. A. Evap. Pkgs. "A" and "B" Tanks
9. Concentrate Filters Pit
10. Waste Evaporator Package Tank
11. Auxiliary Waste Evaporator Package Tank
12. Waste Condensate Tanks
13. Refueling Water Purification Filters

El. 653

1. Floor and Equipment Drain Sump
2. Passive Sump
3. Evap. Cond. Drain Tank
4. Tritiated Drain Collector Tank
5. Waste Evap. Feed Filter Pit
6. Sump Tank
7. Auxiliary Waste Evap. Feed Filter Pit
8. Floor Drain Collector Tank
9. Enclosure Approximately 5 Feet North of Fixed Ladder to Elev. 669
10. Elevator Pit

APPENDIX A
(Continued)

CONFINED SPACES

Turbine Building

El. 773

1. Gland Seal Water Tanks
2. Potable Water Tanks

El. 732

1. Steam Chests of Turbines
2. Moisture Separator Reheaters (Including Crossovers)
3. Auxiliary Boiler
4. Generator

El. 706

1. 6.9kV Transformers for Lighting Boards 1, 2, 3, and 4
2. MSR Crossunders
3. MFPT Lube Oil Tanks
4. MFPT
5. Condensers
6. Turbine Oil Storage Tanks
7. Heating Sediment Tank
8. Heating System Expansion Tank

El. 685

1. Floctreator Tank
2. Deaerator Tank
3. Water Heater Tank
4. Mixed Bed Tanks
5. Cation Tanks
6. SGB Tanks
7. Stator Water Supply Tank
8. Turbine Oil Sump
9. Condenser Water Boxes
10. MFPT Condensers
11. Heater Drain Tank #3
12. Heater Drain Tank #7
13. Service Air Receivers
14. Elevator Pit

El. 662.5

1. Discharge Conduit
2. Intake Conduit
3. MFPT Drain Tanks
4. Demin Waste Neutralization Tanks
5. Caustic Storage Tank

Hazard Control Instruction

APPENDIX A
(Continued)

CONFINED SPACES

El. 662.5 (Continued)

6. Auxiliary Caustic Storage Tank
7. Primary Hydrazine Storage Tank
8. Primary Ammonia Storage Tank
9. Clearwells
10. Sand Filter Tanks
11. Demin Waste Sump
12. Inlet and Outlet Pipes from Water Boxes
13. Condenser Drain Sump
14. Hotwells
15. Station Sump

Service Building

1. Sewage Ejector Pit, Elev. 690 (Power Stores)
2. Sump, Elev. 690 (Power Stores)
3. Elevator Pits

Con-Demin Building

El. 706

1. Anion Tank
2. Cation Tank
3. Sodium Sulfite Tank
4. Pre-Coat Body Feed Tank
5. Condensate Polishers
6. Electrical Vault

El. 685

1. Neutralization Tank
2. Non-Reclaimable Waste Tank
3. Sump
4. High Crud Tanks
5. Resin Storage Tank
6. Acid Reclaim Tank
7. Caustic Reclaim Tank
8. Caustic Storage Tank
9. Hot Water Tank

Additional Equipment Building #1

1. Accumulator Tanks
2. Sump
3. Valve/Pipe Pit

Hazard Control Instruction

APPENDIX A
(Continued)

CONFINED SPACES

Additional Equipment Building #2

1. Accumulator Tanks
2. Glycol Mixing Tanks
3. Borax Overflow Drain Tank
4. Borax Mixing Tanks
5. Sump
6. Valve/Pipe Pit
7. Ice Bins

CDWE Building

1. Distillate Tanks
2. Vapor Body Tank
3. Separator Tank
4. Blow Down Tank
5. Heater Tank
6. Bottoms Tank
7. Valve Pit Below Elev. 707.5

Intake Pumping Station

1. Pumpwells
2. Sump
3. Gate Slots

Diesel Generator Building

1. Diesel Oil Storage Tanks

Sodium Hypochlorite Building

1. Sodium Hypochlorite Storage Tank
2. Caustic Storage Tank
3. Brine Storage Tank
4. Cable Vault

Lift Pump Station

1. 1D, 2A Valves
2. Bearing Lube Water Storage Tank
3. Pumpwells
4. Valve Vault
5. Valve Vault Sump

Acid Storage Building

1. Acid Storage Tanks

APPENDIX A
(Continued)

CONFINED SPACES

Temporary DI Building

1. Caustic Storage Tank
2. Acid Storage Tank
3. Tank Trailers
4. Mixing Bed Tanks
5. Cation Bed Tanks

500-kV Yard

1. Pits - "A", "B", and "C"
2. Transformers
3. Isolated Phase Bus AHU

Outside Storage Tanks

1. Insulating Oil Storage Tanks in 500-kV Yard
2. Lay-Up Water Holdup Tank
3. Gasoline Storage Tank
4. Primary Water Storage Tanks
5. Refueling Water Storage Tanks
6. Lube Oil Storage Tanks
7. Condensate Storage Tanks
8. Diesel Oil Storage Tanks

Flow Monitoring and Sampling Station

1. Entire Structure

Discharge Structure

1. Gate Slots
2. Manholes

Cooling Towers

1. Cooling Tower By-Pass Systems

Manholes, Handholes, Catch Basins, Curb Inlets, Valve Boxes

1. Every Structure That Is At Least 5 Feet Below Grade (Specific Locations Will Be Added At A Later Date)

Cable Tunnels

1. Cable Tunnel from CCW Intake Pumping Station to Turbine Building
2. Cable Tunnels from Turbine Building to 161kV and 500kV Yards

Hazard Control Instruction

APPENDIX A
(Continued)

CONFINED SPACES

ERCW Building

1. Traveling Screen Slots, Elev. 720
2. Concrete Air Vent Structure, Elev. 720
3. Stop Log Storage Slots, Elev. 720
4. Sump in Middle Compartment, Elev. 720
5. Electrical Manholes, Elev. 688

AERCW Structure

1. Gate Slots
2. Pump Wells

Yard Areas

1. CO_2 Vault, South of Turbine Building
2. Septic Tanks
3. Valve Rooms Above Septic Tanks
4. Pump Pits At Diffuser Gate Structure

Heating, Ventilating, and Air Conditioning Systems

1. Every System That Can Be Completely Entered By Workers (Includes Duct Work)

______ Permit #

Hazard Control Instruction

APPENDIX B

CONFINED SPACE ENTRY PERMIT

Location: ____

____

Date: ________________ Time Permit Starts ________________

Time Permit Expires ________________ Extended to ________________

Brief description of work: ____

____

____

NO WORK OTHER THAN THAT DESCRIBED ON THIS PERMIT SHALL BE ALLOWED

Atmospheric Monitoring

Oxygen Concentration (Continuous Monitoring Yes No) Equip # ________

____% ____ Time ______ Checked by ____% ____ Time ______ Checked by
____% ____ Time ______ Checked by ____% ____ Time ______ Checked by

Toxic Vapors (Suspected Contaminant ____________ TLV ____________)

Equipment Used ____________

____% of TLV ____ Time ____ Checked by ____% of TLV ____ Time ____ Checked by
____% of TLV ____ Time ____ Checked by ____% of TLV ____ Time ____ Checked by

Flammable/Combustible Vapors Equip # ____________

____% of LEL ____ Time ____ Checked by ____% of LEL ____ Time ____ Checked by
____% of LEL ____ Time ____ Checked by ____% of LEL ____ Time ____ Checked by

Checklist completed and Job Safety Analysis performed.

______________________ ______________________
Responsible Foreman Date/Time

______________________ ______________________
Responsible Foreman Date/Time

Entry Approved: ______________________ ______________________
Safety Staff Date/Time

Extension Approved: ______________________ ______________________
Safety Staff Date/Time

Exemption Approved: ______________________ ______________________
Safety Staff Date/Time

Safety Observer(s) ____

Return this permit to Safety engineer after work has been completed.

APPENDIX B
(Continued)

CHECKLIST

1. Hold order authorized and required equipment tagged? Yes No N/A
   Hold Order Number ____________

2. Are lines carrying hazardous materials to confined space blanked or removed? Yes No N/A

3. Confined space purged? Yes No N/A
   Method ____________

4. Written emergency plan discussed with all employees involved? Yes

5. Respiratory protection required? Yes No
   Type Required ____________

6. Portable lighting and tools required:

   ____________ None
   ____________ through GFCI
   ____________ 12 volt or less
   ____________ battery operated

7. Proper protective clothing/equipment provided? Yes No N/A

8. Harness or body belt with lifeline required? Yes No

9. Communication with employees inside confined space? Yes

   ____________ voice/visual
   ____________ radio
   ____________ other (Specify) ____________

10. Does potentially explosive atmosphere exist? (If yes, complete this section.) Yes No

    Will explosive-proof electric tools, equipment and nonsparking devices be used? Yes No

    Will no smoking (cigarettes, cigars, etc.) or spark-producing equipment within 50 feet of entrancebe prohibited? Yes No

11. Special Instructions: ____________

12. Emergency Plan: ____________

13. Exemption: ____________

Hazard Control Instruction

APPENDIX B
(Continued)

Accountability Log

PERSON / DATE	TIME IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT

Appendix VIII

TENNESSEE VALLEY AUTHORITY
Sequoyah Nuclear Plant
Standard Practice

SOLID AND HAZARDOUS WASTE MANAGEMENT - DPM NO. N81E2

References: DPM N81E3
DPM N78S2
SQA120
SQA127
SQS40
SQS44

1.0 PURPOSE

This procedure describes how the Division of Nuclear Power (NUC PR) will execute its responsibility for management of solid waste activities at all TVA nuclear plants. This procedure will clarify Environmental Protection Agency (EPA) and the state, local, and TVA requirements on the management of solid waste activities and will establish a uniform policy and environmentally satisfactory methods for the management of solid waste activities at all TVA nuclear plants.

2.0 SCOPE

This procedure applies to the responsibilities of nuclear plant personnel and Nuclear Power Central Office (NCO) personnel relating to:

(a) PCB material or PCB-contaminated material handling, equipment maintenance, collection, storage, onsite transportation, container labeling, and disposal.

(b) Demolition and construction waste storage, collection, and disposal.

(c) Management of clearing wastes at any TVA nuclear plant, primarily disposal if any.

(d) Commercial solid waste storage, collection, and disposal.

(e) Asbestos removal, handling, waste storage, waste collection, and disposal.

3.0 REFERENCES

3.1 The Solid Waste Disposal Act of 1965, as amended by the Resource Conservation and Recovery Act of 1976 (Public Law 94-580)

3.2 Clean Air Act of 1970, as amended by the Clean Air Act Amendments of 1977

3.3 Executive Order 11752 (December 17, 1973)

3.4 40 CFR, Part 61, Sections 61.21-61.25

3.5 TVA Hazard Control Standard No. 302

3.6 TVA Hazard Control Standard No. 407

3.7 U. S. Environmental Protection Agency, "Guidelines for Thermal Processing and Land Disposal of Solid Waste"

3.8 U. S. Environmental Protection Agency, "Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste"

3.9 U. S. Environmental Protection Agency, "Guidelines for Procurement of Products That Contain Recycled Material (Not Mandatory)"

3.10 U. S. Environmental Protection Agency, "Source Separation for Materials Recovery Guidelines"

3.11 U. S. Environmental Protection Agency, ' Guidelines for Beverage Containers"

3.12 The Toxic Substances Control Act of 1976 (Public Law 94469)

3.13 EPA's Rules and Regulations for Polychlorinated Biphenyls (PCB's) Manufacturing, Processing, Distribution in Commerce, and use Prohibitions (40 CFR Part 761)

3.14 Hazard Awareness Bulletin No. 66, Polychlorinated Biphenyls

3.15 Spill Prevention Control and Countermeasure Plan for Oil and Hazardous Substances - All Nuclear Plants, DPM No. N75A4

4.0 ABBREVIATIONS AND DEFINITIONS

4.1 EPA--Environmental Protection Agency

4.2 C&TB--Controls and Test Branch

4.3 M&ES--Assistant Director of Nuclear Power (Maintenance and Engineering Services)

4.4 NCO--Nuclear Power Central Office

4.5 OPS--Assistant Director of Nuclear Power (Operations)

4.6 PCB--Polychlorinated Biphenyls

4.7 RCRA--Resource Conservation and Recovery Act of 1976

4.8 NUC PR--Divison of Nuclear Power

4.9 PSS--Power Services Shop

4.10 Solid Waste--Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Does not include solid or dissolved material in domestic sewage; solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended; or source, special nuclear, or byproduct material, as defined by the Atomic Energy Act of 1954, as amended.

4.11 Hazardous Waste--A solid waste or combination of solid wastes which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may:

(a) Cause or significantly contribute to an increase in mortality; or an increase in serious irreversible illness or incapacitating reversible illness; or

(b) Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

4.12 Asbestos Wastes--Any material contaminated with or containing friable asbestos that is removed or stripped from pipe, duct, boiler, tank, reactor, turbine, furnace or structural member; and scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing (consigned for disposal) used in relation to work because of renovation, repair, modification, or demolition.

4.13 Clearing Waste--Trees, stumps, trimmings, brush, fencing (post and wire), remains of buildings, rocks, rubble, etc., generated during the process of clearing land.

4.14 Commercial Solid Waste--All types of solid wastes - generally food wastes, paper, floor sweepings, rags, plastics, food and drink cans, leather, rubber, glass, light bulbs, air and oil filters, packing materials, small quantities of wood (not lumber), tree limbs, and leaves generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities (power generating plants). Residential and industrial wastes are excluded.

4.15 Construction and Demolition Waste--The building material waste and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures. This material is primarily scrap lumber, scrap metal, unusable concrete, broken bricks, concrete blocks, rocks, and dirt.

4.16 Food Waste--The organic residues generated by the handling, storage, sale, preparation, cooking and serving of foods. It is commonly called garbage.

4.17 Oily Waste--Liquid waste (nonhazardous) containing some oil (but primarily water) sludge from bottom of storage containers and residue from oil filtering or cleaning.

4.18 Waste Oil--This oil consists of waste engine oil, transformer oil (non-PCB's), fuel oil, cutting oil, hydraulic fluid, and other oil-base material (except oil-base paint).

4.19 Solid Waste Management--The systematic administration of activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste.

4.20 Hazardous Waste Management--The systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of hazardous waste.

4.21 Chemical Waste Landfill--A landfill at which protection is provided from PCB's deposited therein against risk of injury to health or the environment by locating, engineering, and operating such landfill so as to prevent migration of PCB's to land, water, or the atmosphere.

4.22 Demolition Waste Landfill--An area or site used for the disposal of demolition waste.

4.23 Sanitary Landfill--A facility for the disposal of solid waste which meets the criteria published under section 4004 of RCRA.

4.24 Storage--The interim containment of solid waste after generation and prior to collection for ultimate recovery or disposal.

4.25 Storage Container (Solid Waste)--A receptacle used for the temporary storage of solid waste while awaiting collection.

4.26 Collection--The act of removing solid waste from a central storage point.

ATTACHMENT 1

Black

Yellow

CAUTION

CONTAINS

PCBs

(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761. For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800-424-8802

Also Contact Shift Engineer

Telephone No. ____________________

ATTACHMENT 2

TO: Assistant Director of Nuclear Power (Operations)

FROM:

DATE:

__________ NUCLEAR PLANT

FROM ______ TO ______, ____

LOCATION	TVA PERFORMANCE		CONTRACTOR PERFORMANCE	
	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
Maintenance Shops				
Other Shops				
Offices				
Plant Grounds				
Food Areas				
Dumpsters				

Comments:

Plant Superintendent

11.4 Storage

11.4.1 Transfer to Power Stores--All PCB liquid waste (500 ppm or greater PCB) resulting from NUC PR activities at all TVA nuclear plants shall be transported immediately to Power Stores, Muscle Shoals for storage or disposal. The PCB-contaminated liquid waste (50-500 ppm PCB) and solid waste must be transferred from temporary storage within 30 days to the storage facility at Muscle Shoals.

11.4.2 Onsite Storage--All PCB wastes from TVA nuclear plants temporarily stored on site shall be stored as follows:

11.4.2.1 Until January 1, 1983, intact capacitors may be stored on pallets placed next to the storage area.

11.4.2.2 Drummed liquid and solid waste shall be stored indoors on a smooth, impervious floor without drains and constructed with a continuous 6-inch-high curb providing a containment volume equal to at least two times the internal volume of the largest PCB times the internal volume of the largest PCB container or item or 25 percent of the total internal volume of all PCB equipment or containers stored, whichever is greater.

11.4.2.3 All waste stored indoors or outdoors and transformers shall be inspected at least once every 90 days. An inspection log shall be kept and any leaks discovered shall be reported immediately to the C&TB.

11.4.2.4 Warehoused new PCB materials shall be labeled and stored in containment areas of sufficient volume to contain 110 percent of the volume of the original container. The storage bin shall be labeled.

11.4.3 All spills or leaks shall be reported to the shift engineer as required by DPM No. N75A4.

11.5 Servicing PCB and PCB-Contaminated Transformers

11.5.1 500 ppm or Greater--PCB transformers (containing 500 ppm or greater of PCB) cannot be rebuilt. Rebuilding a transformer may involve completely draining the transformers, removing and disassembling the core, reworking the coil or rewinding a new coil, reassembling the core, and refilling the transformer with new fluid.

11.5.2 Safety--Testing the dielectric fluid, filtering the fluid, removal of some fluid and then returning or replacing it, replacing gaskets, and some repairs shall be performed so as to minimize PCB exposure.

11.5.3 Reclassification--When necessary, PCB transformers shall be reclassified to PCB-contaminated transformers by draining and refilling them with non-PCB dielectric fluid and testing and finding them to contain less than 500-ppm PCB after at least three (3) months of inservice use.

11.5.3.1 Until the test requirements are met, the marking, handling, transporting, storage, and disposal of all transformers shall be as for PCB transformers.

11.5.3.2 The manufacturer's nameplate designating the transformer as containing PCB material or the TVA PCB label shall not be altered until sufficient proof is obtained by laboratory analysis that the dielectric fluid in the transformer contains less than 500-ppm PCB (see Section 6.2.5). A copy of the report must be kept on site until disposal of the transformer.

11.5.4 Removal From Service--When a PCB transformer or other PCB equipment is removed from service (for repairs, etc.), the plant superintendent is to notify NCO personnel as required by 6.2.5 of this procedure.

11.5.5 Service Restrictions--There are no service restrictions for PCB-contaminated transformers other than normal safety precautions and those restrictions for the disposal of the dielectric fluid.

11.6 Disposal

11.6.1 Power Stores--Disposal of PCB liquid and PCB-contaminated waste shall be arranged by representatives of Power Stores. PCB-contaminated transformers, after draining dielectric fluid, will be disposed of in a sanitary landfill or sold for scrap.

11.6.2 Transformer Disposal--Transformers containing PCB material (containing 500 ppm or greater of PCB) to be disposed of shall be drained, refilled with kerosene, xylene, or toluene, and redrained after 18 hours. Disposal shall be in a chemical waste landfill.

11.6.3 Miscellaneous PCB Waste--All PCB-soaked software, contaminated hardware, containers, and all other materials or items containing or contaminated with PCB's shall be collected in labeled 5-gallon, 24-gauge or 55-gallon, 18-gauge steel drums or placed in drums as filler material.

11.7 Labels

11.7.1 Form--Labels shall be made of materials equivalent to W. H. Brady Company, B-120 fiberglass and B-946 outdoor film, sized 6 inches by 6 inches, and printed as shown in Attachment 1.

11.7.2 Locations Used--Fiberglass labels with grommetted mounting holes may be used for labeling transformers, vehicles, pole structures, storage areas, and security fences while self-adhesive labels may be used for labeling capacitors, drums, equipment, and storage areas.

11.7.3 Obtaining Labels--Labels for use at the nuclear plants may be obtained from the nuclear plants' Power Stores storerooms.

11.8 Safety

11.8.1 Protective Clothing--If contact with PCB's is required, suitable protective clothing, including aprons and neoprene gloves, shall be used. To protect the eyes, safety glasses with side shields or a full-face shield shall be worn.

11.8.2 Eye Contact--If liquid PCB's contact the eyes, the eyes shall be irrigated immediately with large quantities of running water for approximately 15 minutes and then examined by a physician.

11.8.3 Cuts, Abrasions, etc.--In the event PCB's seep into an open cut or abrasion, irritation will result. The irritation can be reduced by applying medicinal washes or mild detergents followed by the application of cold cream.

11.8.4 Contact With Hands--If hands should come in contact with PCB's despite above precautions, they should be cleaned before eating, drinking, smoking, or using the toilet. Waterless hand cleaner and wipe towels used for this purpose shall be disposed of in the same manner as other PCB-contaminated materials.

11.8.5 Breathing Vapors--Personnel should avoid breathing vapor or fumes from heated PCB's.

12.0 COMPLIANCE AND TECHNICAL ASSISTANCE

12.1 Solid Waste Services--The plant superintendent shall develop and issue plant instructions for implementing and carrying out the requirements of these procedures. The Compliance Section, C&TB shall provide any assistance as requested by the plant superintendent in the preparation of solid waste management services' requisitions, and maintain and provide information on solid waste storage equipment or systems and collection systems available to the plants.

12.2 Landfill Assistance--The Compliance Section, C&TB shall assist the plant superintendent in locating and constructing an onsite demolition waste landfill, if needed.

12.3 Compliance--All disposal operations shall be coordinated with the Compliance Section, C&TB. These operations shall be monitored for compliance with applicable regulations by the Compliance Section, C&TB.

12.4 Updates and Corrections--The Compliance Section, C&TB shall review all new or proposed solid waste legislation and regulations and revise the division procedure as required.

CLMason

Power Plant Superintendent

Attachments

wtm

BK General Revision

pc

properly disposed of in accordance with Federal or State regulations. In some instances, it may be more economical to bury the entire unit or section without stripping the asbestos. In making the decision as to whether to strip the asbestos or to bury the whole piece of equipment, a thorough economic analysis should be made considering the following factors:

(1) Labor cost for stripping the equipment;

(2) Cost for burying the equipment versus the cost of burying the asbestos alone;

(3) Revenue from the sale of salvaged metals;

(4) Employee health protection costs; and

(5) Cost of dedicating as a permanent disposal area the extra land required for burying the whole piece of equipment. Any onsite area used for disposal of any asbestos waste must be marked as a disposal area and cannot be used for any other purpose.

10.3 Collection--Each container (plastic bag, box, bulk storage container, etc.) shall have an asbestos warning label or tag with the following information:

ASBESTOS

CAUTION

Breathing Asbestos is Hazardous to Your Health.

Keep Container Closed and Avoid Breathing Dust.

10.4 Transportation--Asbestos waste must be properly collected, contained, and labeled prior to transporting. The containers must be then handled carefully to prevent rupture.

10.5 Disposal--All asbestos waste shall be disposed of in a local, state-approved sanitary landfill.

10.6 Onsite Landfill Operation--The disposal site for asbestos shall be operated and maintained in accordance with the following procedures.

10.6.1 Approval--All onsite disposal areas must be approved by the Compliance Section, C&TB.

10.6.2 Daily Covering--At the end of each day or at least every 24 hours during which asbestos waste is being disposed, the waste shall be covered with 6 inches of nonasbestos-containing material. Covering of contained asbestos waste shall be done in such a manner as to prevent rupture of the disposal container or plastic bags.

10.6.3 Previous Sites--Filled, completed, abandoned, or previously used sites shall be covered with 24 inches of soil and maintained to prevent erosion.

10.6.4 Site Marking--All sites, active or inactive, shall be posted and permanently marked or identified by a 20-by-14-inch sign reading:

CAUTION
ASBESTOS WASTE DISPOSAL SITE
AVOID CREATING DUST
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

The marker shall be constructed and labeled in accordance with TVA Hazard Control Standard No. 302.

10.6.5 Accessibility to Site--The disposal area shall be made inaccessible to the general public.

11.0 PCB WASTE PROCEDURES

11.1 Marking--Each PCB transformer, power factor capacitor, PCB waste container, or temporary PCB storage area operated by NUC PR at all TVA nuclear plants shall be marked using the label described in Section 11.7 of this procedure.

11.2 Handling

11.2.1 General--All PCB liquids being transferred, removed, and processed because of transformer installation, repair, or disposal shall be handled as instructed in Attachment 1 of the plant appendices in DPM No. N75A4.

11.2.2 Intact Large Capacitors--Intact large capacitors removed for disposal shall be dated at the time of removal from service and transferred within 30 days to Power Stores, Muscle Shoals for storage or disposal.

11.2.3 PCB Spill Materials--Failed or leaking large capacitors, packs, and liquid-soaked soil and waste resulting from rupture or spill shall be placed in sealable steel drums (17C with open head) which are dated when filled and transferred within 30 days to Power Stores, Muscle Shoals for storage or disposal.

11.2.4 Labeled Drums Storage--Labeled drums of PCB solid waste and PCB-contaminated liquid waste (50 to 500 ppm PCB) and intact large capacitors shall be placed in a secure location at the facility where they can be removed from use and easily inspected.

11.2.5 Transfer to Power Stores--The accumulated inventory of PCB solid waste and PCB-contaminated liquid waste shall be transferred within 30 days to Power Stores, Muscle Shoals.

11.2.6 Large Quantities of Small PCB Capacitors--When large quantities (i.e., 100 units or more) of small PCB capacitors (contained in small appliances and fluorescent light ballasts) are generated, they should be handled and disposed of in accordance with the provisions contained in this procedure pertaining to large capacitors.

11.2.7 PCB Shipments--The Compliance Section, C&TB shall be regularly notified by the plant superintendent of all shipments of PCB material or equipment from all TVA nuclear plants. The C&TB shall also be notified of all leaking equipment or containers and/or spills at all TVA nuclear plants.

11.3 Transporting

11.3.1 Vehicle Marking--Each vehicle loaded with PCB transformer(s) or drum(s) containing PCB waste, or a combination of the two, shall be marked with the label described in Section 11.7 of this procedure.

11.3.2 Label Locations--Labels shall be attached to the front and to each door of the vehicle, and to the material being transported if not already labeled.

11.3.3 Spills--Any spills or leaks shall be reported to the shift engineer as required by DPM No. N75A4.

8.4 Waste Oil--All onsite storage facilities (tanks, drums, etc.) shall be protected to prevent spills or leaks. Provision for containment shall be in conformance with DPM No. N75A4. The plant superintendent shall determine the storage capacity required based upon the disposal method utilized and frequency of disposal. Waste oil may be sold to a waste oil collector/processor. TVA has a contract with a collector to buy waste oil. A copy of the present contract and other information may be obtained from the Compliance Section, C&TB.

8.5 Oily Waste

8.5.1 Oily Waste Storage--Permanent storage containers will probably not be required. Most storage containers will probably be 55-gallon drum category or smaller. Adequate spill precautions shall be taken in accordance with DPM No. N75A4.

8.5.2 Disposal by Contractor--This method will probably require more permanent storage facilities and more extensive spill protection measures. The contractor may charge an additional fee for collecting and disposing of oily waste. Information on contractors is available from the Compliance Section, C&TB.

9.0 DEMOLITION AND CONSTRUCTION WASTES

9.1 Storage

9.1.1 Recoverable Portion--The recoverable resources portion of demolition and construction, if salvaged, shall be stored in an area established for such materials and separated by type (metals, lumber, batteries, bricks, rubber products, etc.).

9.1.2 Lumber Scavenging--If scrap lumber is offered to the general public for scavenging, it shall be stored in an area that is easily accessible to the public and that will not interfere with plant operations or personal safety.

9.1.3 Mixed Wastes--Every effort shall be made to keep commercial, asbestos, and hazardous waste from being mixed with demolition and construction wastes.

9.1.4 Lumber Storage Area--Scrap lumber storage areas shall be thoroughly cleaned every three (3) months and all residue disposed of in a satisfactory manner. All other areas shall be thoroughly cleaned when scrap material is sold at least once a year.

9.1.5 Litter Control--A litter-control program shall be initiated for all salvage material storage areas. Areas should be mowed on a regular basis or some other means of growth control may be used. Graveled areas would be desirable but not mandatory.

9.1.6 Nonsalvageable Waste--Nonsalvageable material (bricks, broken blocks, dirt, nonasbestos insulation, wood, etc.) should be removed either directly to the disposal site if onsite disposal is used or stored in bulk (30-40 cubic yard) roll-off storage containers if offsite disposal is used.

9.1.7 Contaminated Wastes--Any material containing or contaminated with asbestos, PCB's, or hazardous waste shall be stored in accordance with provisions contained in this procedure for the appropriate waste.

9.2 Collection--All demolition and construction waste should be removed from the site of generation for disposal as soon as the vehicle/container is filled.

9.3 Disposal

9.3.1 Landfill Disposal--Demolition and construction waste shall be disposed of in an approved demolition waste landfill.

9.3.2 Contaminated Waste--Any demolition and/or construction waste containing commercial waste shall be disposed of in an approved sanitary landfill.

9.3.3 Salvage Area Residue--Residue from salvage storage areas and operations shall be disposed of in an approved demolition waste landfill or in an approved sanitary landfill.

9.3.4 Wood Waste--Wood waste may be disposed of by open burning, buried in a demolition waste landfill, or made available to the general public for scavenging. Open-burning operations may require an open-burning permit.

9.3.5 Compliance Monitoring--All disposal operations conducted on site shall be coordinated with the Compliance Section, C&TB. These operations shall be monitored for compliance with applicable regulations by the Compliance Section, C&TB.

9.3.6 Landfill Location--The Compliance Section, C&TB shall assist the plant superintendent in locating and constructing an onsite demolition waste landfill, if needed.

9.3.7 Landfill Closing--Upon completion of an onsite landfill, it shall be covered with at least two (2) feet of compacted soil, contoured, mulched, and seeded with grasses as appropriate to control soil erosion and provide an environmentally acceptable appearance. If a site has not been filled within one month of the date it was started, all material placed within that period shall be covered with an intermediate cover of at least 12 inches of compacted soil and at each 30-day interval thereafter if additional material has been placed in the landfill.

10.0 ASBESTOS WASTE PROCEDURES

10.1 Notification Requirements--Notification of intention to renovate shall be provided to the Compliance Section, C&TB as required in Section 6.2.6 of this procedure.

10.2 Removal and Handling

10.2.1 Wetting--Friable asbestos material used to insulate or fireproof pipes, ducts, boilers, tanks, reactors, turbines, or structural members shall be adequately wetted during stripping or cutting.

10.2.2 Handling--Asbestos units shall not be dropped or thrown to the ground, but shall be carefully lowered to ground level (this includes bags of asbestos wastes).

10.2.3 Ventilation--In lieu of the wetting requirement (during removal) above, a local exhaust ventilation and collection system may be used to prevent emissions to the outside air. Such local exhaust ventilation systems shall be designed and operated to capture the asbestos particulate matter produced by the stripping of friable asbestos material. There shall be no visible emissions to the outside air from such local exhaust ventilation and collection systems.

10.2.4 Economic Evaluation--Where economically practical, asbestos and asbestos-containing material shall be removed from any pipe, duct, boiler, tank, reactor, turbine, or structure which is taken out of service. The ferrous metal material shall be collected for recycling and the waste asbestos material shall be

6.2.5 PCB Equipment Reclassification--When a PCB transformer or other PCB equipment is removed from service or reclassified as PCB contaminated, the plant superintendent shall notify the NMB and the C&TB. The notification shall contain:

(1) Serial number of the transformer

(2) Electrical size

(3) Location and function

(4) Liquid capacity

(5) Date removed from service

(6) If retrofilled, filled with what type of fluid

(7) If reclassified, a copy of the test results

(8) Replacement (if not existing) serial number, type of dielectric fluid, fluid capacity, electrical size, and date put into service.

6.2.6 Renovaton Involving Asbestos--If asbestos is involved, notification of intention of renovation shall be provided to the Compliance Section, C&TB at least 30 days prior to commencement of any planned renovation or as early as possible prior to commencement of any emergency renovation. The Compliance Section, C&TB shall prepare and submit notification of the plant's intentions to the State at least 10 days prior to commencement of any work (if given sufficient notice). The notice shall include:

(1) Approximate amount of friable asbestos to be removed;

(2) Facility name;

(3) Scheduled starting and completion dates;

(4) Nature of planned renovation (i.e., scheduled outage, emergency outage, turbine repair, etc.);

(5) Procedures to meet State requirements and TVA Hazard Control Manual (G19, DPM No. N78S2) requirements; and

(6) Waste disposal site.

6.2.7 Open Burning--All open burning operations shall be conducted and reported as specified in SQA120.

6.2.8 Reports to Regulatory Agencies--The Compliance Section, C&TB shall prepare any compliance reports for submittal to regulatory agencies, coordinating with the Policy and Compliance Staff of the Office of Natural Resources, the Nuclear Regulation and Safety Staff of the Office of Power, and the Office of Health and Safety, as required.

6.2.9 Record Keeping--All audit and/or compliance reports may be destroyed after a period of 24 months from the date of issue. All other general correspondence shall remain on file for a period of three (3) years, after which it may be destroyed. This includes both plant and central office files. All records of spill events shall be kept for the life of the plant.

6.2.10 Commercial Solid Waste Inspections--Using the form shown in Attachment 2 the plant superintendent shall submit written reports of quarterly inspections of solid commercial waste.

7.0 CLEARING WASTE PROCEDURES

7.1 Alternatives to Burning--Clearing waste such as small trees or brush that have no commercial value may be cut, piled, and burned on site as specified in SQA120 after considering the following alternatives:

(1) Chip, stockpile, and compost for future use as a mulch (landscaping) or soil conditioner;

(2) Scavenging by public for firewood; and

(3) Onsite burial-demolition waste landfill or unclassified fill.

7.2 Timber--Trees of commercial value, if in sufficient quantity to warrant sale, should be sold as timber; otherwise, it should be disposed of as a commercial solid waste (see Section 8.0).

7.3 Stumps and Residue From Burning--Stumps from all size trees and residue from burning shall be disposed of by burial.

7.4 Open Burning--All open-burning operations shall be conducted in accordance with the requirements of SQA120.

7.5 Non-Burnable Wastes--There shall be no burning of commercial, hazardous, or PCB wastes.

8.0 COMMERCIAL SOLID WASTE PROCEDURES

8.1 Storage

8.1.1 Vectors and Spillage--All commercial solid wastes shall be stored in such a manner that they do not constitute a fire, health, or safety hazard or provide food or harborage for vectors and shall be contained to prevent spillage.

8.1.2 Food Wastes--All commercial solid waste containing food wastes shall be securely stored in covered or closed containers which are nonabsorbent, leakproof, durable, easily cleanable, and designed for safe handling.

8.1.3 Containers--Containers shall be of adequate size and numbers to contain all commercial solid waste generated between collections.

8.1.4 Container Cleanliness--All containers shall be maintained in a clean condition so that they do not constitute a nuisance and so that they retard the harborage, feeding, or breeding of vectors.

8.1.5 Manually Emptied Containers--Reusable waste containers which are emptied manually shall not exceed 75 pounds (34.05 kg) or a capacity of 35 gallons, and shall contain plastic garbage can liners.

8.1.6 Collection Vehicles--Because of the potential fire hazard (fuel tanks, tires, etc.), collection vehicles shall not be used as storage containers (i.e., use of truck-mounted packer body rather than use of a stationary compactor).

8.1.7 Compaction Equipment--The compaction equipment used for the storage of solid waste shall be constructed, operated, and maintained in such a manner as to minimize health and safety hazards to personnel and the public.

8.1.8 Litter Control--Areas around all storage containers and equipment shall be kept clean and litter controlled.

8.1.9 Drains--All drains in storage containers and equipment shall be kept closed. All containers shall be kept closed or covered at all times except when in use (filling or emptying).

8.1.10 Mixing Wastes--Commercial solid waste shall not be mixed with other solid waste such as industrial wastes or construction or demolition wastes.

8.2 Collection

8.2.1 Frequency--All commercial solid waste shall be collected for disposal at a minimum of once every seven (7) days.

8.2.2 Scavenging--Scavenging of material from storage and collection equipment shall be prohibited at all times to avoid injury.

8.2.3 Collection Vehicle Drains--All collection vehicles shall have all drains in the packer body closed so as to prevent leakage or spillage of any liquids contained in the collected waste upon plant or public roads.

8.2.4 Vehicles--All vehicles used for the collection and transportation of solid waste shall be enclosed or adequate provision shall be made for suitable cover (tarps, nets, etc.) so that there can be no spillage while in transit.

8.3 Disposal

8.3.1 Unsalvageable Commercial Waste--The unsalvageable portion of commercial solid waste shall be disposed of in an approved sanitary landfill.

8.3.2 Salvageable Commercial Waste--The recoverable resource portion of commercial solid waste may be recovered for sale, extended use at the plant or other plants, or temporarily made available to schools for teaching purposes.

8.3.3 Open Burning--Commercial solid waste shall not be disposed of by open burning or as a fuel in fire barrels.

4.27 Disposal--The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste, PCB waste, or hazardous waste into or on any land or water so that such solid waste or hazardous waste, or any constituent thereof, may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

4.28 Open Burning--The burning of any material in such a manner that products of combustion resulting from the burning are emitted directly into the ambient air without passing through an adequate stack, duct, or chimney.

4.29 Transport Vehicle--A motor vehicle or rail car used for the transportation of cargo by any mode. Each cargo-carrying body (e.g., trailer, railroad freight car) is a separate transport vehicle.

4.30 Vectors--Carriers, usually arthropods, that are capable of transmitting a pathogen from one organism to another.

4.31 Friable Asbestos Material--Any material that contains more than one-percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder (when dry) by hand pressure.

4.32 Adequately Wetted--Sufficiently mixed or coated with water or an aqueous solution to prevent dust emissions.

4.33 Renovation--The removing or stripping of friable asbestos material used to insulate or fireproof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member.

4.34 Removing--Taking out friable asbestos materials used to insulate or fireproof any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member from any building, structure, facility, or installation.

4.35 Stripping--Taking off friable asbestos materials used for insulation or fireproofing from any pipe, duct, boiler, tank, reactor, turbine, furnace, or structural member.

4.36 PCB Article--Any manufactured item, other than a PCB container, whose surface has been in direct contact with a PCB chemical substance or a PCB mixture; includes capacitors, transformers, electric motors, pumps, and pipes.

4.37 PCB Container--Any package, can, bottle, bag, barrel, drum, tank, or other device used to contain a PCB chemical substance, PCB mixture, or PCB article and whose surface has been in direct contact with a PCB chemical substance or PCB mixture.

4.38 PCB Equipment--Any manufactured item, other than a PCB container or a PCB article container, which contains a PCB article or other PCB equipment; includes microwave ovens, electronic equipment, and fluorescent light ballasts and fixtures.

4.39 PCB Mixture--Any mixture which contains 0.05 percent (on a dry weight basis) or greater of a PCB chemical substance and any mixture which contains less than 0.5 percent PCB chemical substance because of any dilution of a mixture containing more than 0.05 percent PCB chemical substance. This definition includes, but is not limited to, dielectric chemicals, rags, soil paints, debris, sludge, slurries, dredge spoils, and materials contaminated as a result of spills.

4.40 PCB Transformer--Any transformer that contains 500-ppm PCB or greater.

4.41 PCB-Contaminated Transformer--Any transformer that contains 50 ppm or greater of PCB but less than 500 ppm. Transformers filled with mineral oil dielectric fluid are assumed to be PCB-contaminated transformers until proven otherwise.

4.42 Totally Enclosed Manner--Any manner that will ensure that any exposure of human beings or the environment to any concentration of PCB's will be insignificant; that is, not measurable or detectable by any scientifically acceptable analytical method.

4.43 Capacitor--A device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric. Types of capacitors are as follows:

4.43.1 Small Capacitor--A capacitor which contains less than 1.36 kg (3 lbs.) of dielectric fluid.

4.43.2 Large, High-Voltage Capacitor--A capacitor which contains 1.36 kg (3 lbs.) or more of dielectric fluid and which operates at 2,000 volts ac or above.

4.43.3 Large, Low-Voltage Capacitor--A capacitor which contains 1.36 kg (3 lbs.) or more of dielectric fluid and which operates below 2,000 volts ac.

5.0 RESPONSIBILITIES

5.1 Director of Nuclear Power--Is responsible for the overall management of the division's power generation and maintenance programs such that solid waste produced by these activities are managed in a manner fully compatible with all Federal and State solid waste management laws and regulations.

5.2 Assistant Director (Operations)--Is responsible for the overall management of all division programs and activities such that all solid waste generated at these facilities will be managed in both an economical and environmentally acceptable manner that complies with Federal and State laws and regulations.

5.3 Assistant Director (Maintenance and Engineering Services)--Is responsible for overall management of compliance services to ensure the adequacy of the division's solid waste management activities relative to Federal and State solid waste management laws and regulations. Provides technical assistance and advice to other division branches, generating plants, and other facilities in the development and maintenance of solid waste management programs. Reviews proposed Federal and State regulations and comments as appropriate. Maintains liaison and technical exchanges of information with other TVA divisions and Federal and State health and environmental agencies engaged in solid waste management activities. Responsible for economic evaluation of all NUC PR solid waste management systems. Reviews all solid waste management procedures and revisions formulated by the plant superintendent. Reviews bids and assists in preparation of contracts by the Office of Power (Power Stores) for PCB, hazardous waste, and commercial solid waste disposal services (transport and disposal). Reviews procedures formulated by the NCO Nuclear Maintenance Branch (NMB) for compliance with these procedures and EPA's regulations and shall review all new or proposed solid waste legislation and regulations and revise this division procedure as required.

5.4 Plant Superintendent--Is responsible for the day-to-day management of the plant such that all solid waste generated by plant activities will be managed in a manner that meets applicable Federal and State solid waste management requirements. Issues instructions to supervisors for the management of solid waste generated by all activities at the plant that will ensure continuing compliance. Receives advice and technical assistance from the NCO Controls and Test Branch (C&TB) personnel in planning and implementing plant solid waste management systems.

5.5 Plant Shift Engineer--Is designated as the Spill Prevention and Containment Supervisor and is responsible for plant operation to minimize the amount of hazardous or PCB substances spilled at the plant site. His duties will include control of access to the keys for entrance gates to areas storing or handling hazardous or PCB substances. He is also responsible for spill notification as specified in the Spill Prevention Control and Countermeasure Plan for Oil and Hazardous Substances - All Nuclear Plants (DPM No. N75A4).

6.0 GENERAL SOLID WASTE PROCEDURES

6.1 Contract Information

6.1.1 Contracts for disposal of PCB or hazardous wastes shall be arranged by representatives of Power Stores and reviewed by the NCO Compliance Section, C&TB.

6.1.2 Oil waste contract information is available from the Compliance Section, C&TB.

6.1.3 Lists of EPA/State-approved disposal sites for all types of wastes shall be kept by the Compliance Section, C&TB.

6.1.4 All requisitions for solid waste management services shall be initiated by the plant superintendent and reviewed by the Compliance Section, C&TB.

6.2 Reports and Inspections

6.2.1 Waste Oil--An annual report of the quantity of waste oil disposed of and the disposal method utilized shall be submitted to the Chief, C&TB.

6.2.2 Plant PCB Inventory Report--Each NUC PR plant superintendent shall submit a yearly report to the C&TB indicating the total number of PCB transformers and capacitors remaining in service and the quantity of fluid contained.

6.2.3 Power Service Shops PCB Reports--PSS shall maintain records of all PCB transformers or capacitors repaired or disposed of and submit a quarterly report on repairs or disposals of PCB equipment to the C&TB. The reports shall include (1) quantities of PCB liquid transported to or from NUC PR facilities and (2) any difficulties (spills, accidents, etc.) encountered.

6.2.4 PCB Storage Inspections--All PCB materials stored inside or outside and all PCB transformers shall be inspected at least once every 90 days. An inspection log shall be kept for all stored PCB materials and for PCB transformers (see Attachment 3) containing date, location, identification, and condition. Any leaks discovered shall immediately be reported to the C&TB.

APPENDIX IX

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
Hazard Control Instruction

ASKAREL

References: SQA126
SQM12 - "Disposal of Askarel," Westinghouse Bulletin I.B.
45-063-99B - "Instructions for Inerteen Insulating Fluid"
DPM-N81E2

1. Askarel is supplied by electrical apparatus manufacturers under the following trademarks:

   Chlorextol - Allis-Chalmers Manufacturing Company
   Inerteen - Westinghouse Electric Corporation
   Noflamol - Wagner Electric Corporation
   Phranol - General Electric Company
   Saf-T-Kuhl - Kuhlman Electric Company

   This liquid will be found throughout the plant as a nonflammable substitute for insulating oil in all of the indoor transformers.

   Askarel is an inert mixture and thus is immune to the natural biological processes that normally attack and degrade such materials in the environment. They can then be comsumed by fish and other forms of life. Then when these lower forms of life are eaten by people their body accumulates this material which is though to be harmful to various organs.

2. Each supervisor is responsible for the safe handling and disposal of askarel and should ensure that all necessary personnel are made aware of its harmful effects.

3. Each employee is responsible for informing his supervisor of any potential hazards observed during the handling or disposal of askarel.

4. Askarel is not normally toxic but some may find it slightly irritating to the skin during prolonged use. For this reason contaminations should be avoided and protective gloves or aprons should be worn during prolonged use. Breathing of vapors or fumes should be avoided. Exposed skin should be washed thoroughly with soap and water.

5. Contaminations shall be cleaned using rags and then washed with soap and water. Spills shall be cleaned with rags and followed by flushing with large quantities of water. The contaminated rags should be disposed of as described below.

6. Askarel shall not be discharged into streams, sewers, or water systems, nor shall its vapors be allowed to enter the atmosphere in an uncontrolled manner. In the event of an

APPENDIX X

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
Hazard Control Instruction

PROCEDURES FOR THE CLEANUP OF PCB SPILLS AND CONTROL OF CONTAMINATION (INTERIM)

The following precautions shall be implemented in the cleanup of PCB spills until such time that sample analysis verifies the extent of PCB contamination. As cleanup progresses and contamination levels are reduced, the safety staff may authorize relaxation or selective elimination of these precautions.

(1) The area of possible PCB contamination shall be marked by flagging or barriers. Locations within the zoned-off areas shall be restricted to cleanup crews and others specifically authorized by the management representative serving as the cleanup coordinator, the safety staff supervisor or the duty shift engineer.

(2) Cleanup personnel and others permitted within the zoned-off areas shall use the following personal protective equipment:

(a) Ultra-Twin respirators with appropriate cartridges shall be worn. The safety staff shall be contacted if questions arise concerning cartridges or usage. Respirator cartridges shall be changed once per shift.

(b) Protective gloves, shoe covers, and coveralls shall be worn. Selection shall be coordinated with the safety staff.

(3) All employees involved in the cleanup operation or other work activities presenting any appreciable exposure hazard shall be logged on an exposure sheet with the duration of exposure recorded.

(4) The zoned-off PCB contaminated areas shall be treated in a manner similar to C-zones. Entrance to and exit from these areas shall be handled in the following manner:

(a) Employees shall put on all protective equipment before entering the zoned areas (no outer street clothing shall be worn underneath cover-alls).

(b) Before exiting the zone, employees shall remove all protective clothing and deposit it in the appropriately labeled containers.

(5) Solvents and cleaning agents used shall be approved by the safety staff and any indicated precautions implemented.

(6) During the cleanup procedure employees shall follow these instructions:

(a) Skin contact with any potentially contaminated surface shall be avoided. If skin contact occurs, the safety staffs should be consulted for guidance.

PCB Interim Measures Report Form

Attachment 3

Plant: ______________________

Transformer ID: ______________________

Manufacturer and Serial No. ______________________

Location: Unit No. __________ Elevation __________

Column __________ Bay __________

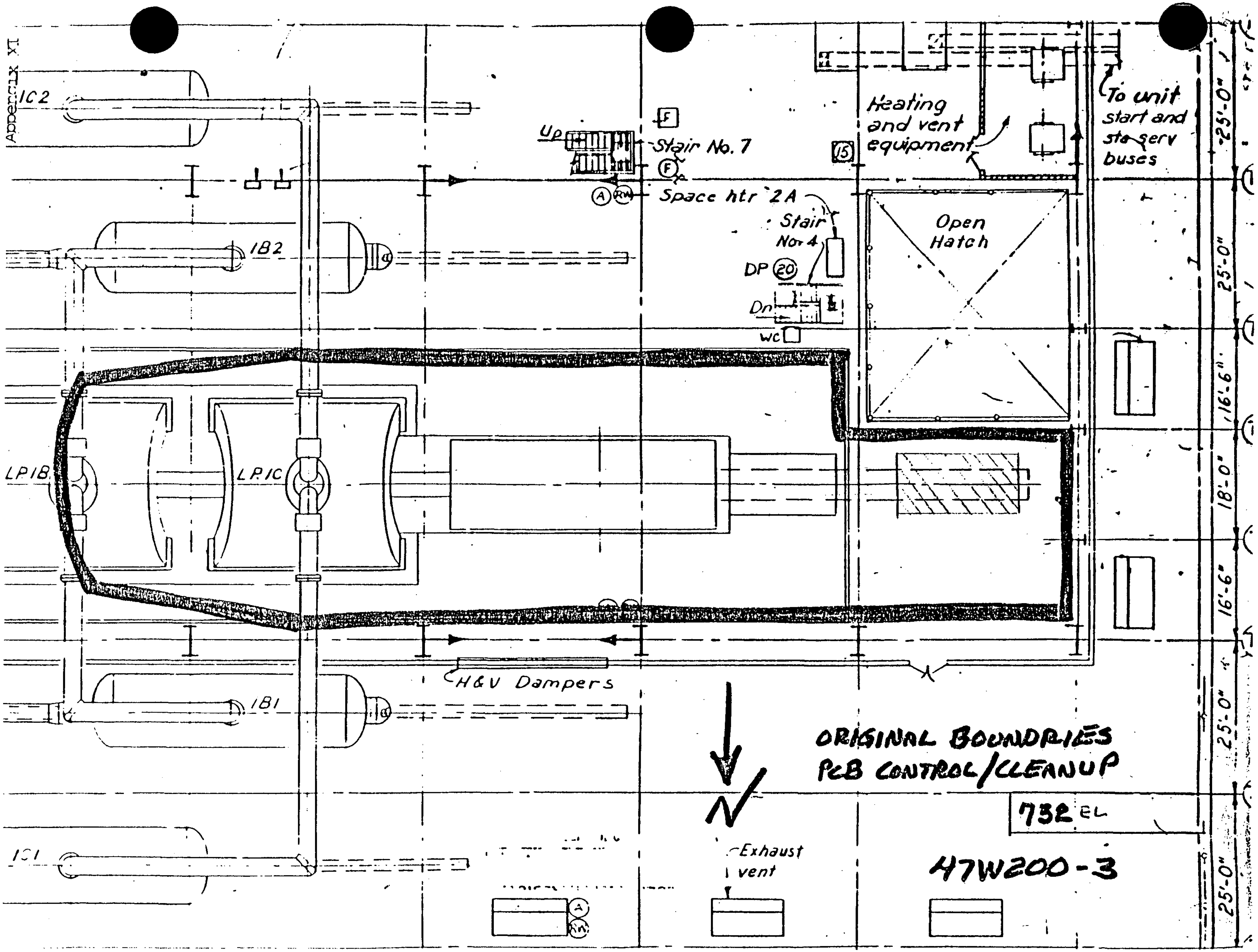
(__) Quarterly Inspection (__) Weekly Inspection

Exposure Risk to Food and Feed (__) Yes (__) No

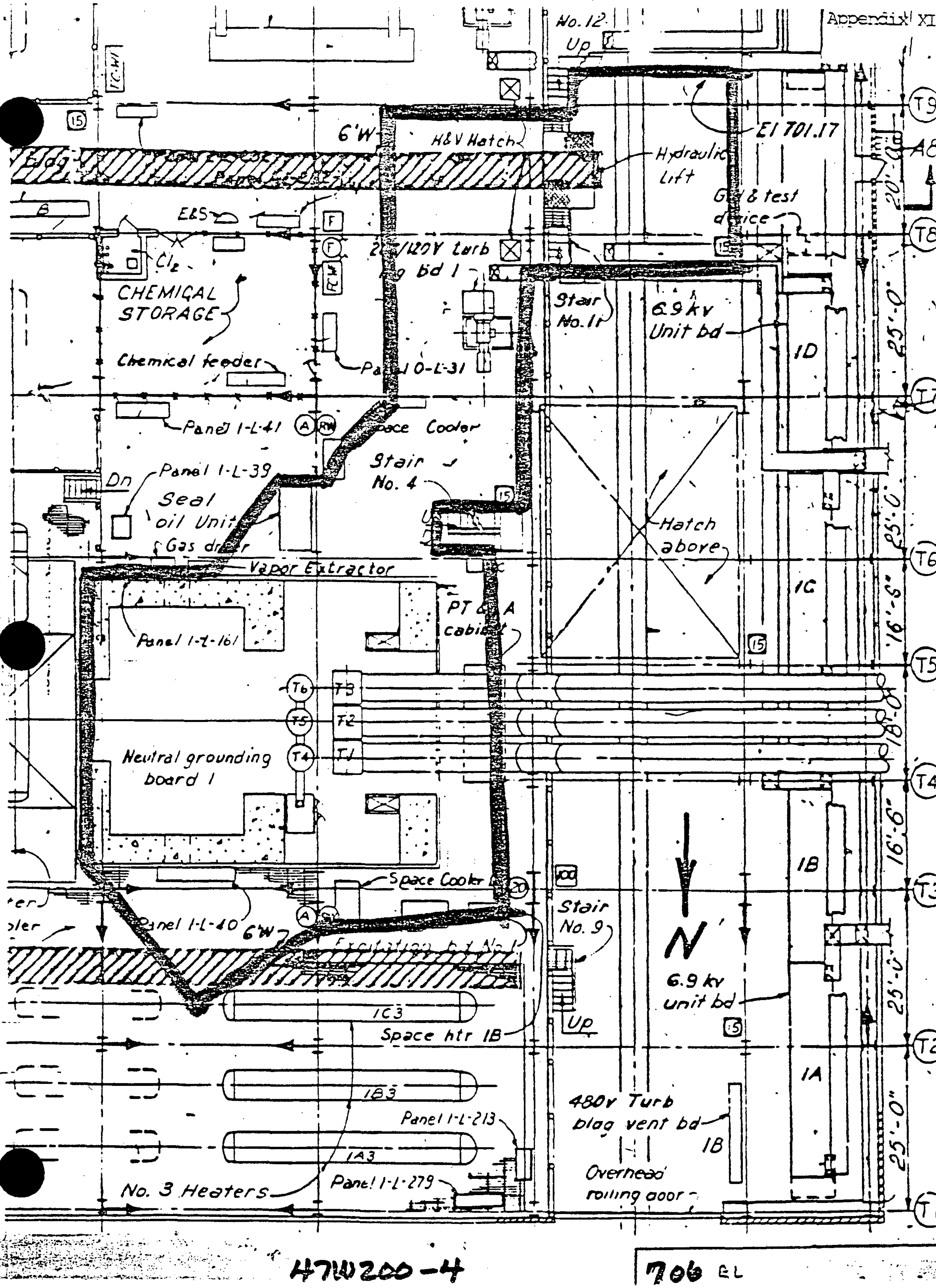
VISUAL INSPECTION REPORT				MAINTENANCE AND SERVICE HISTORY		
Date Insp.	Insp. By	Type Leak	Location of Leak on Transformer	Date Serv.	Serv. By	Description of Repairs

S - Stain - Dry, Discoloration
SL - Small Leak - Any PCB Dielectric Fluid on External Surface of Transformer (No Servicing Required)
ML - Moderate Leak - Any PCB Dielectric Fluid Running Off External Surface of Transformer (Servicing Required)
R - Rupture - Any Serious Leak Requiring Shutdown of Transformer

APPENDIX XI



Appendix XI
IC2
Up
F
Stair No. 7
F
A
RW
Space htr 2A
Heating
and vent
equipment
15
To unit
start and
sta serv
buses
Stair
No. 4
DP 20
Dn
WC
Open
Hatch
IB2
LPIB
LPIC
IB1
H&V Dampers
IC1
Exhaust
vent
A
RW
N
ORIGINAL BOUNDRIES
PCB CONTROL/CLEANUP
732 EL
47W200-3
25'-0"
25'-0"
16'-6"
18'-0"
16'-6"
25'-0"
25'-0"


No. 12
Up
T9
15
6'W
H&V Hatch
El 701.17
A8
Hydraulic lift
20'
G & test device
E&S
F
T8
Cl_2
CHEMICAL STORAGE
Stair No. 11
6.9 kv Unit bd
1D
25'-0"
Chemical feeder
Panel 0-L-31
T7
Panel 1-L-41
Space Cooler
Stair No. 4
Dn
Panel 1-L-39
Seal oil Unit
Gas drier
Hatch above
Vapor Extractor
T6
1C
16'-6"
Panel 1-L-161
PT & A cabinet
T5
T6
T3
T5
T2
T4
T1
18'-0"
Neutral grounding board 1
T4
16'-6"
1B
Space Cooler
T3
Stair No. 9
N
Panel 1-L-40
6'W
6.9 kv unit bd
1C3
Space htr 1B
Up
T2
1A
1B3
480v Turb bldg vent bd
1B
Panel 1-L-213
1A3
Overhead rolling door
No. 3 Heaters
Panel 1-L-279
T1
47W200-4
706 EL

incident resulting in a spill or release, the notifications and instructions as noted on Attachment A, or the placard on the equipment, shall be followed. A placard similar to Attachment A shall be placed on each piece of equipment containing askarel to caution that this equipment contains polychlorinated biphenyls (PCBs).

7. Hot apparatus containing askarel should not be opened except in a well-ventilated area.

8. Askarel exerts a strong solvent action on most varnishes, gums, rubber, and paints. Therefore, all-metal hose or pipe shall be used when handling askarel.

9. The disposal, storage, handling, and accounting procedures specified in SQA126 shall be complied with for all PCB (askarel) wastes.

First Aid

Chemical Burns--Dilute the contaminating substance immediately with large amounts of water. This can be done by emergency shower, hose, buckets or other means.

Eye Burns--Wash the eye immediately with clean water. This can be done by an eyewash or other means of clean water. After the eye has been washed, medical personnel shall be consulted.

Power Plant Superintendent

General Revision

ATTACHMENT A

Black

Yellow

CAUTION

CONTAINS

PCBs

(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761. For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800-424-8802

Also Contact Operations Duty Specialist

Tel. No. (615) 755-2495

APPENDIX XII

Copy handed to F. Clark on [illegible]

Sequoyah Nuclear Plant
Procedure for Flushing Floor Drains

Purpose: The purpose of this instruction is to provide a procedure for flushing out the floor drain lines near the area where the unit 1 neutral transformer exploded (Turbine Bldg, el 706, underneath Unit 1 Generator

General: There are two floor drains near the area where the transformer exploded. Each of these drains go into a common drain line that terminates at elevation 662 in the turbine building. A blind flange has been attached to the end of the drain line so that liquid from the drain will not enter the trench drains at elevation 662.

Procedure:

1. Rope off the area where the drain is blanked off. Post this area with "PCB" signs
2. Dress-out and respiratory protection requirements are contained in HCI-HM26. The safety staff shall provide guidance.
3. Herculite should be placed over the floor in the roped off area where the drain is blanked off.

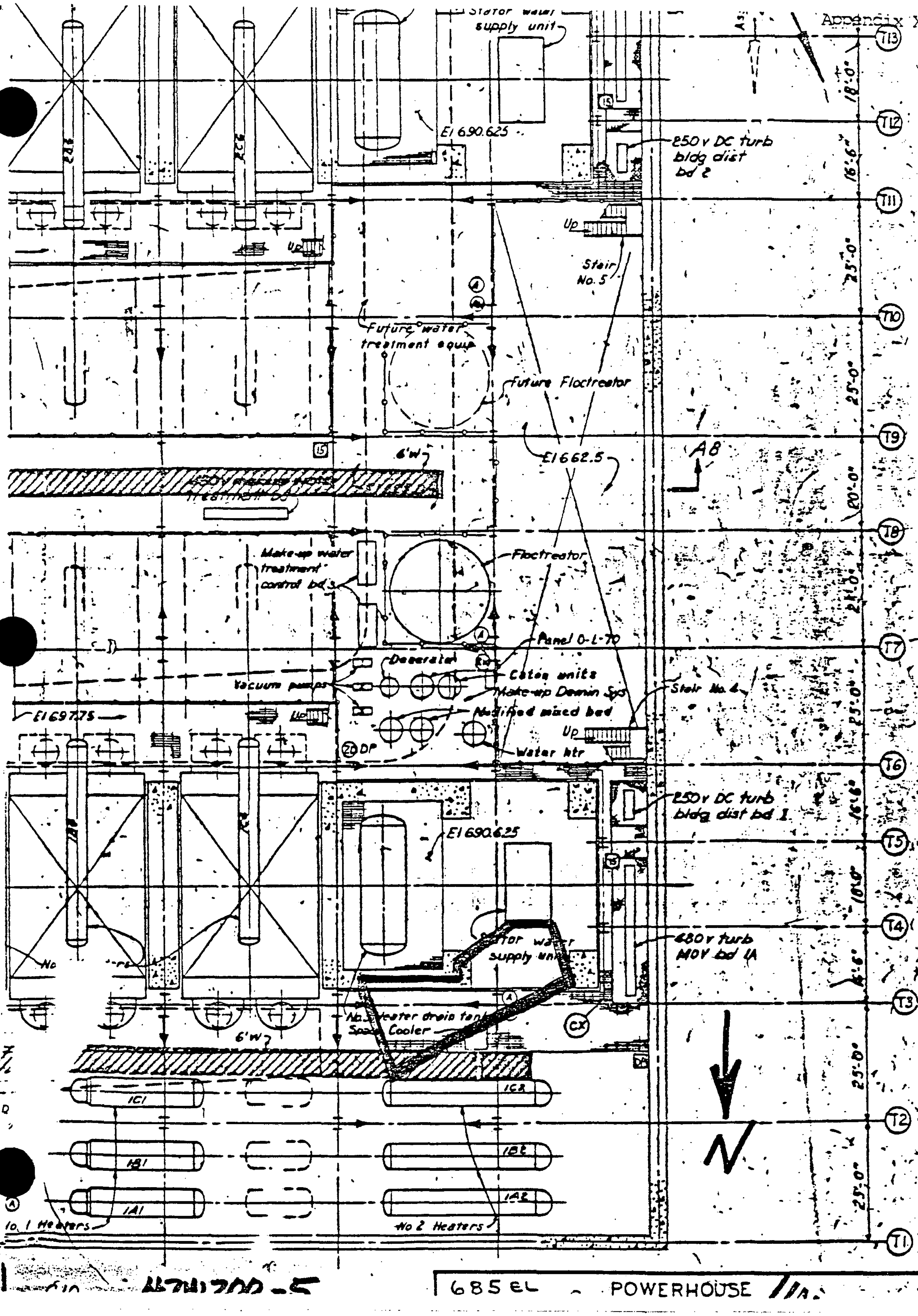
(b) Eye contact with PCB's should be avoided. If eye contact occurs, the eyes shall be immediately washed with large quantities of water.

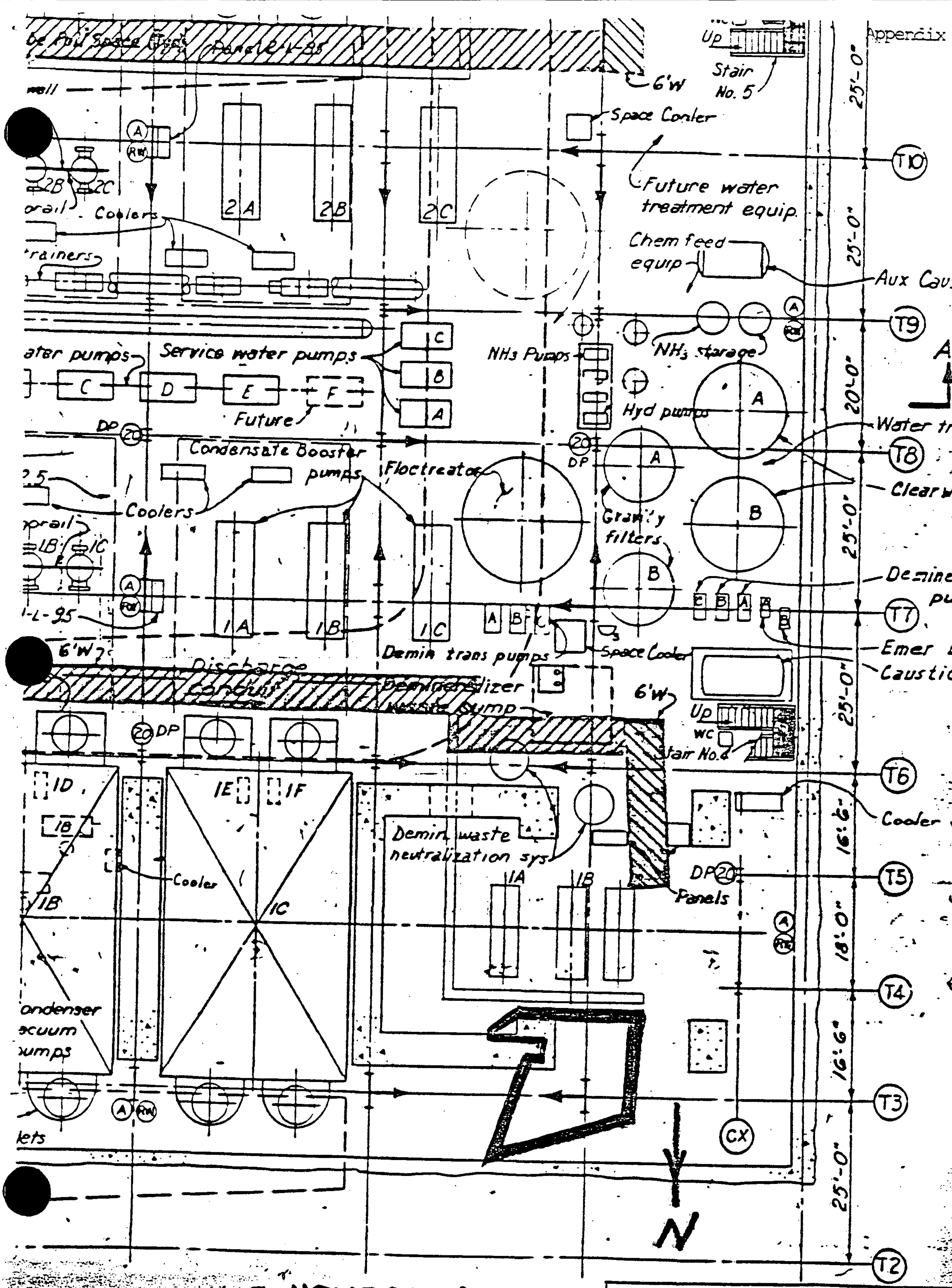
(c) Employees shall wash their hands before eating, drinking, smoking, or using toilet facilities. Food, drink, or smoking materials shall not be permited in the zoned areas.

(6) All PCB contaminated materials shall be stored and labeled in accordance with SQA126. All such materials shall be placed in the designated staging areas.

Power Plant Superintendent

APPENDIX XIII


Stator water supply unit
El 690.625
250 v DC turb bldg dist bd 2
Up
Stair No. 5
Future water treatment equip
Future Floctreator
El 662.5
A8
6'W
Make-up water treatment control bd
Floctreator
Panel 0-L-70
Deaerator
Vacuum pumps
Cation units
Make-up Demin Sys
Modified mixed bed
Stair No. 4
El 697.75
Up
Water htr
20 DP
250 v DC turb bldg dist bd 1
El 690.625
480 v turb MOV bd 1A
No. 1 Heater drain tank Space Cooler
6'W
CX
1C1
1C2
1B1
1B2
1A1
1A2
No 1 Heaters
No 2 Heaters
N
T13
T12
T11
T10
T9
T8
T7
T6
T5
T4
T3
T2
T1
18'-0"
16'-6"
25'-0"
25'-0"
20'-0"
24'-0"
25'-0"
16'-6"
18'-0"
16'-6"
25'-0"
25'-0"
685 EL - POWERHOUSE



47W20B-6

667 EL.

Appendix XIII

LIST OF PERSONNEL IN GENERAL AREA
FROM TIME OF ACCIDENT UNTIL 2 HOURS AFTERWARD

J. M. Alexander
Coleman Amrstrong, III
Joel Armstrong
William E. Armstrong, Jr.
Ogden Ballentine
Tony Barfield
Bob Barnes
Leslie Bell
Billy Benefield
Vicki Bogan
Mark Brock
L. T. Carr
John Carroll
Irvin L. Childers
Barry Childs
Johnny Churchwell
Cheryl Clayton
Calvin Coleman
Franklin L. Cook
Edward Cooley
Bill Cottle
Ed Craigge
Doug Craven
John Creighton
R. E. Crews
Danny Cross
Jonnie Daniel
Richard Daverson
John E. Dodd
Jim Doty
Joseph Downs
R. J. Dwyer
Mark Eisenbise
Vince Eldridge
R. L. Ellison
John Ettien
Hugh Fairfax
R. W. Farner
Ralph G. Fine
Lawrence K. Flake
Orysia Gann
John R. Gass
P. H. Gass
Pete Gilmartin
Jim Goodlet
Billy Joe Green
David G. Hamby
William P. Hayes
Bob Herrod
Ernie Hill
Joe Hope
James A. Howard
Kenneth L. Huskey
Hugh Irvin
G. W. Johnson
Lyndia Johnson
John Jones
J. E. Killian
Fred Knight
Tom Kontovich
P. C. Lawrence
Rocco Lepere
Fred Lewis
John Lewis
Harold S. Link
Elmer D. Mangrum
A. W. Mansfield
John Marsh
C. C. Mason
Fred Massengale
James Massengale
Martha Massengale
R. D. Mayfield
Steve McMcMahan
Herbert A. Morris
L. M. Morrison
John Ogle
Bill Payne
W. G. Payne
Hippie Phillips
H. W. Price
Kabah Raheen
Glenn R. Raines
James M. Reagan, Jr.
R. M. Rector
B. C. Ritchie
Robert Roberson
Jim Robinson
Charles L. Rogers
Norman S. Rogers
C. E. Rosenthal
Joe Skineer
H. T. Sliger
Tom Sliger
James Smith
Perry Smith
Rex Smith
C. E. Sowers
Carroll Sivley
Bill Sparks
Arvel E. Stafford
Wanda K. Strunk
Donald W. Thomas
Gary Thompson
Jerry Travis
R. E. Vandergriff
Charles Wadley
Walt Watson
Cot ton Weller
F. L. White
Marvin E. Wilkey
Janet Williams
R. C. Worley
Dewey Wright
J. E. Wright

APPENDIX XIV

Appendix XIV

Sampling, Analysis, and Results for PCB Contaminated Areas

The attached data summarizes the dates, types, locations and results of analysis associated with the evaluation of PCB contaminated areas and their cleanup.

Legend

W - wipe sample
A - airborne sample
TBS - turbine building station sump
TDI - temporary D.I. building
CE - cleanup evaluation
Den - area east of the unit 1 neutral transformer underneath the generator
ND - none detectable
NA - results not yet available

~~4. 2-way radios should be obtained to provide communication between those the steam jenny operator and those employees collecting the drain water at elevation 662~~

4. The steam jenny should be positioned in the railroad bay so that the hose can reach both drains. Any hose and attachments entering the contaminated area must be decontaminated before being used again. ~~Date~~

5. The steam jenny should be set for a temperature of approximately 160°F and detergent added.

6. The floor drain covers should be removed as well as ~~as~~ any obvious obstructions.

7. The blind flange should be removed from the drain line and the ~~field~~ plant-fabricated drain fixture should be attached, so that the flushed water can enter the 55 gallon drums. Liquids draining out of this line prior to flushing should be placed into the 55 gallon drums rather than being allowed to spill onto the floor.

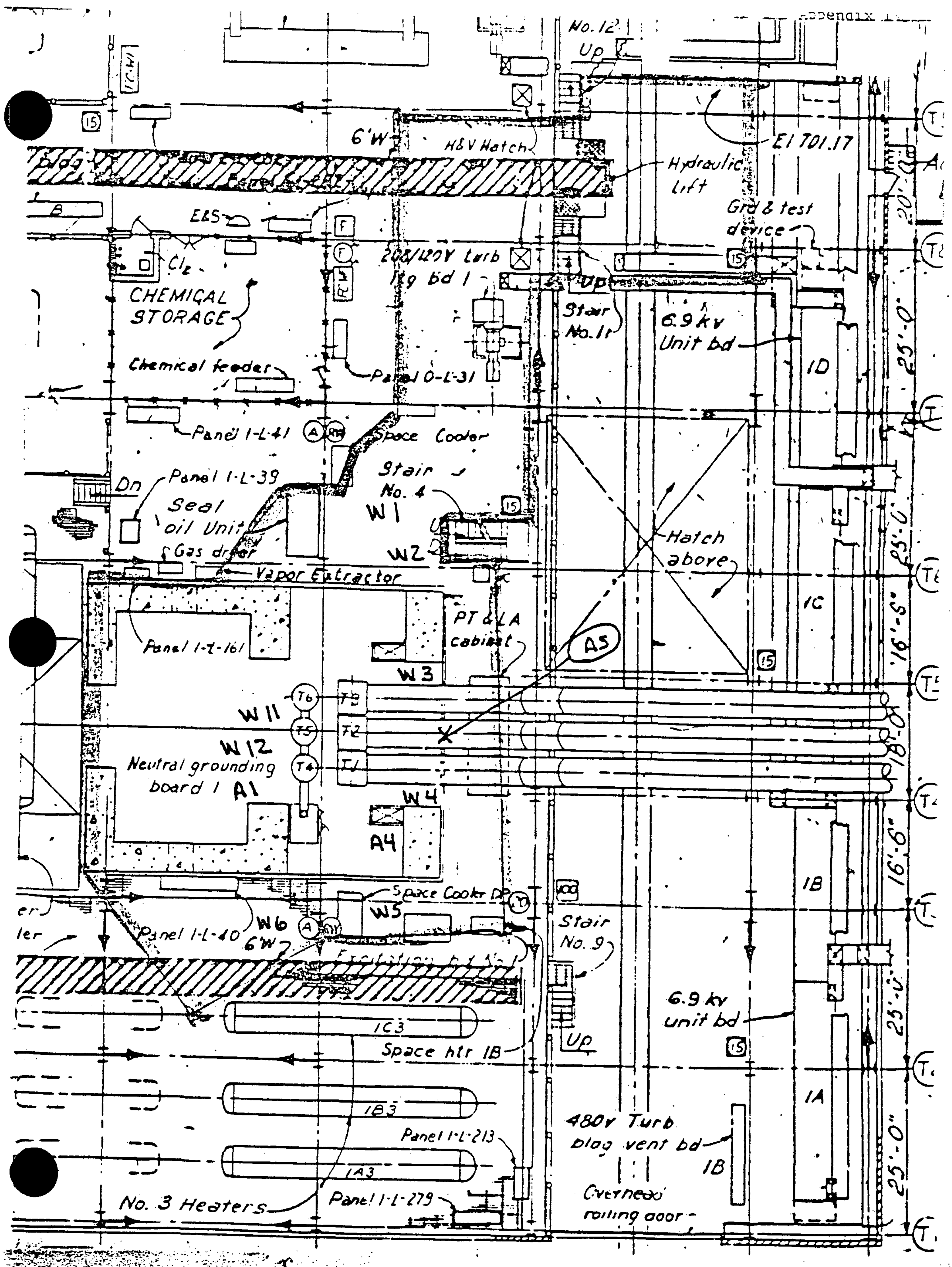
8. Approximately 50 gallons of water should be ~~flus~~ flushed through each drain using the steam jenny. At the completion of each flush, with the jenny, another clear water flush of approximately 2 gallons shall be performed. One gallon of this water will be collected at the end of the drain line for evaluation. The drums of contaminated water shall be placed in the contaminated material staging area in the railroad bay.

9. The blind flange should be reinstalled until the lab test results verify ~~that~~ the cleanliness of the drain lines.

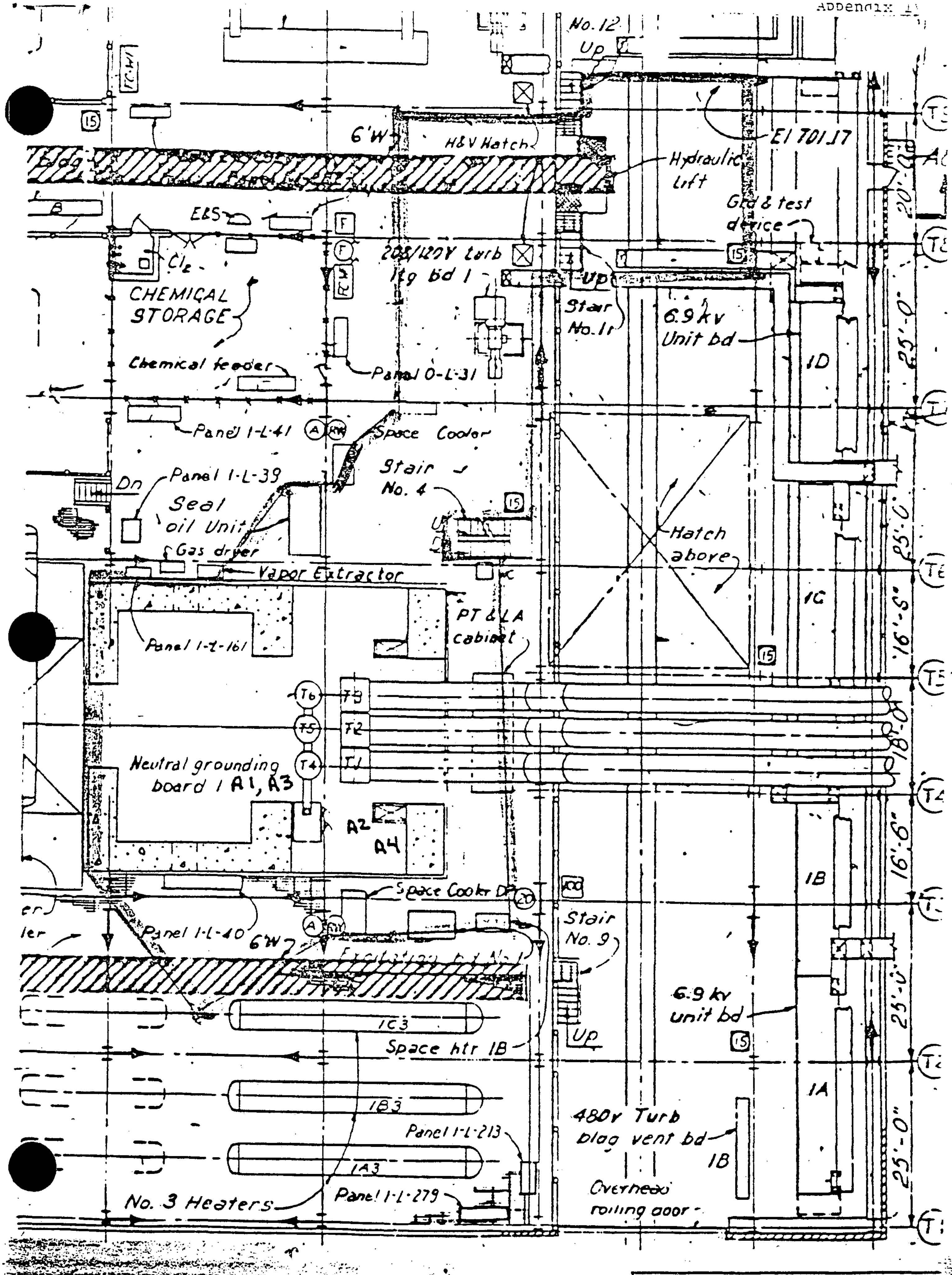
Edward H. Craggs
1/20/82

PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentration
2-4-82	W1[4]	Hanger support E of xfmr, 6' below (CE)	20 $\mu g/ft^2$
	W2[4]	North wall E end-abv suspended scaffolding	<5 (2) $\mu g/ft^2$
	W3[4]	North wall W end- " " "	<5 (2) $\mu g/ft^2$
	W4[4]	South wall E end- " " "	<5 (2) $\mu g/ft^2$
	W5[4]	South wall W end- " " "	<5 ND
	W6[4]	Bottom of gen E end-abv suspended scaffolding	<5 ND
	W7[4]	Bottom of gen,middle section abv susp scaf	<5 ND
	W8[4]	Bottom of gen, West end-abv susp scaffolding	<5 ND
	W9[4]	Overhead pipe middle E end-abv susp scaf	<5 (2) $\mu g/ft^2$
	W10[4]	Conduit East end	5 $\mu g/ft^2$
	W11[44]	East wall - from T-4 D line	<5 (4) $\mu g/ft^2$
	W12[4]	N wall - " " "	<5 (2) $\mu g/ft^2$
	W13[4]	S wall - " " "	44 $\mu g/ft^2$
	W14[4]	Overhead pipes North wall	22 $\mu g/ft^2$
	W15[4]	Overhead pipes East wall	5 $\mu g/ft^2$
	W16[4]	Overhead pipes South wall	<5 (2) $\mu g/ft^2$
	W17[4]	Void	-
	W18[4]	Hori piping 1' abv xfmr <10'>	<5 (2) $\mu g/ft^2$
	W19[4]	Hori pipe 3' South of transformer <3'>	-
	W20[4]	5' N of xfmr on cement wall <1'>	10 $\mu g/ft^2$
	W21[4]	Steel support 3' E of T-3 D line <22[30] >	<5 ND $\mu g/ft^2$
	W22[4]	Piping (1-24-568) 12' E of xfmr <42[30] >	6 $\mu g/ft^2$
	W23[4]	Piping sys (1-24-562) 35' SE of xfmr <38[30] >	51 $\mu g/ft^2$
	W24[4]	Vert pipe 5' high 10' SE of xfmr <35[30] >	8 $\mu g/ft^2$



ELEVATION 706



No. 12
Up
6'W
H&V Hatch
El 701.17
Hydraulic lift
Grd & test device
E&S
Cl_2
CHEMICAL STORAGE
208/120Y Turb ltg bd 1
Up
Stair No. 11
6.9 kv Unit bd
1D
Chemical feeder
Panel 0-L-31
Panel 1-L-41
Space Cooler
Stair No. 4
Panel 1-L-39
Dn
Seal oil Unit
Gas dryer
Vapor Extractor
Hatch above
PT & LA cabinet
1C
Panel 1-L-161
Neutral grounding board 1 A1, A3
T6
T5
T4
T3
T2
T1
A2
A4
1B
Space Cooler Dn
Stair No. 9
Panel 1-L-40
6'W
1C3
Space htr 1B
6.9 kv unit bd
Up
1A
1B3
480v Turb bldg vent bd 1B
Panel 1-L-213
1A3
Overhead rolling door
No. 3 Heaters
Panel 1-L-279
20'-0"
25'-0"
25'-0"
16'-5"
18'-0"
16'-6"
25'-0"
25'-0"

PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentration
1-22-82	W7	Cement wall E. of transformer (cleaned)	4.7 $\mu g/ft^2$
	W8	Pipe just S. of transformer (cleaned)	110 $\mu g/ft^2$
	W9	Pipe just N. of transformer (cleaned)	22 $\mu g/ft^2$
	W10	Cement wall NW of transformer	560 $\mu g/ft^2$
	W11	1-24-552 H_2 seal oil at air drain valve	75 $\mu g/ft^2$
	W12	From drain near the transformer	370,000 $\mu g/ft^2$
	W13	2' W of T-8-D line	13 $\mu g/ft^2$
	W14	2' E of dress out clothing rack	17 $\mu g/ft^2$
	W15	12' W of T-9-D line, 2' from boundry	6.5 $\mu g/ft^2$
	W16	8' S of W15 location	7.8 $\mu g/ft^2$
	W17	20' W of T-9-D line, 2' from boundry	<10 $\mu g/ft^2$
	W18	8' S of W17 location	<10 $\mu g/ft^2$
	W26	15' NW of T-3-D line, 4' from boundry	<10 $\mu g/ft^2$
	W27	8' N of T-3-D line, 4' from boundry	20 $\mu g/ft^2$
	W28	25' NW of T-3-D line, 4' from boundry	61 $\mu g/ft^2$
1-23-82	W 706-1[23]	On neutral bus cover	12 $\mu g/ft^2$
	W 706-2[23]	Outside pipe S. of transformer	310 $\mu g/ft^2$
	W 706-3[23]	On angle iron 5' above floor at T-6-D line	47 $\mu g/ft^2$
	W 706-4[23]	At T-3-D line on transformer pad	13,000 $\mu g/ft^2$
	W 706-5[23]	On middle pipe at T-3-D line in front of xfmr	39 $\mu g/ft^2$
	W 706-6[23]	5' high on concrete support E. of T-3-D line	280 $\mu g/ft^2$
	W 706-7[23]	Valve 1-24-888 at T-3-D line	87 $\mu g/ft^2$
	W 706-8[23]	4' high on S side of column at T-3-D line	<10 $\mu g/ft^2$
	W 706-9[23]	At T-8-C line	<10 $\mu g/ft^2$

Appendix XIV

PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentration
1-28-82	W 706-1[28]	On floor by H_2O fountain (CE)	<10 (5) $\mu g/ft^2$
	W 706-2[28]	On back and sides of cable trays near ftn. (CE)	<10 (2) $\mu g/ft^2$
	W 706-3[28]	On the small overhead piping W of the xfmr (CE)	<10 (6) $\mu g/ft^2$
	W 706-4[28]	On the piping insulation N of the S column (CE)	<10 (4) $\mu g/ft^2$
	W 706-5[28]	On the sides and bottom of the 3 bus ducts (CE)	<10 (3) $\mu g/ft^2$
	W 706-6[28]	On the floor between the two columns (CE)	22 $\mu g/ft^2$
	W 706-7[28]	On the floor W of the N column (CE)	12 $\mu g/ft^2$
1-29-82	W 706-1[29]	↑706, Piping on E wall of the den (abv scaf) (CE)	<10 (2) $\mu g/ft^2$
	W 706-2[29]	↑706, Cement wall on E side of den " (CE)	<10 (2) $\mu g/ft^2$
	W 706-3[29]	↑706, Cement wall on S side of den " (CE)	<10 (4) $\mu g/ft^2$
	W 706-4[29]	↑706, Bottom of generator (abv scaf) (CE)	<10 (2) $\mu g/ft^2$
	W 706-5[29]	↑706, F stl on ceiling of den (abv scaf) (CE)	<10 (2) $\mu g/ft^2$
1-30-82	W1	S. side (inside) the S bus duct (CE)	6 $\mu g/ft^2$
	W2	N. side (inside) the S. bus duct (CE)	<5 (2.5) $\mu g/ft^2$
	W3	S. side (inside) the middle bus duct (CE)	<5 (1.7) $\mu g/ft^2$
	W4	N. side (inside) the middle bus duct (CE)	<5 (1.3) $\mu g/ft^2$
	W5	S. side (inside) the N. bus duct (CE)	<5 (2.8) $\mu g/ft^2$
	W6	N. side (inside) the N. bus duct (CE)	<5 (<1) $\mu g/ft^2$
	W10	N. of S. column on floor, SW of xfmr (CE)	<5 (2.6) $\mu g/ft^2$
	W11	Between N and S column on floor, SW of xfmr (CE)	29 $\mu g/ft^2$
	W12[30]	W of N col on floor, W of transformer (CE)	<5 (3.2) $\mu g/ft^2$
	W13[30]	↑706, Side of cable tray, W end of scaf (CE)	ND
	W14[30]	↑706, Steel beam 6' E of W end of scaf (CE)	ND
	W15[30]	↑706, Vertical conduit 15'E of W end of scaf (CE)	ND
	W16[30]	↑706, Void	—

PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentration
1-30-82	W17[30]	†706, Steel support 5' W of col T-3-D line (CE)	ND
	W18[30]	†706, Steel support 5'E of T-3-D line (CE)	ND
	W19[30]	†706, Cement wall 8' E of T-3-D line (CE)	<5 (2) $\mu g/ft^2$
	W20[30]	†706, X-member (steel) 15'E of T-3-D line (CE)	<5 (4) $\mu g/ft^2$
	W21[30]	Instrument panel 1-L-40B, 15'W of T-3-D line (CE)	ND
	W22[30]	Steel 3'W of T-3-D line, 5' high (CE)	21 $\mu g/ft^2$
	W23[30]	S. side of T-3-D line, 5' high (CE)	<5 (13) $\mu g/ft^2$
	W24[30]	Cement wall 2' E of transformer, 5' high (CE)	<5 (3) $\mu g/ft^2$
	W25[30]	Pipe insulation 5'N of transformer, 6' high (CE)	7 $\mu g/ft^2$
	W26[30]	D. Busch air unit, 6'NW of xfmr, 2.5' high (CE)	<5 (2.7) $\mu g/ft^2$
	W27[30]	Cement column due W of transformer (CE)	1.1 $\mu g/ft^2$
	W28[30]	Pipe insulation just abv DB air unit (CE)	1.2 $\mu g/ft^2$
	W29[30]	Horizontal conduit 1' abv flr, 7' NW of xfmr (CE)	6 $\mu g/ft^2$
	W30[30]	S. side of phone booth N of xfmr. (CE)	3 $\mu g/ft^2$
	W31[30]	Shutter unit 20' NW of the transformer (CE)	ND
	W32[30]	Horizontal pipe over phone booth, 20' from xfmr (CE)	1.4 $\mu g/ft^2$
	W33[30]	S. side of col 3' E of transformer (CE)	8 $\mu g/ft^2$
	W34[30]	Horizontal pipe 7.5' h, 6'SE of xfmr (CE)	38 $\mu g/ft^2$
	W35[30]	Vertical pipe 5' h, 10'SE of xfmr (CE)	41 $\mu g/ft^2$
	W36[30]	Vertical pipe 5' h, 20'SE of xfmr (CE)	3.7 $\mu g/ft^2$
	W37[30]	Cement wall, 25'SE of xfmr (CE)	4.5 $\mu g/ft^2$
	W38[30]	Piping system 1-24-562, 35'SE of xfmr (CE)	84 $\mu g/ft^2$

PCB Sampling
Elevation 706

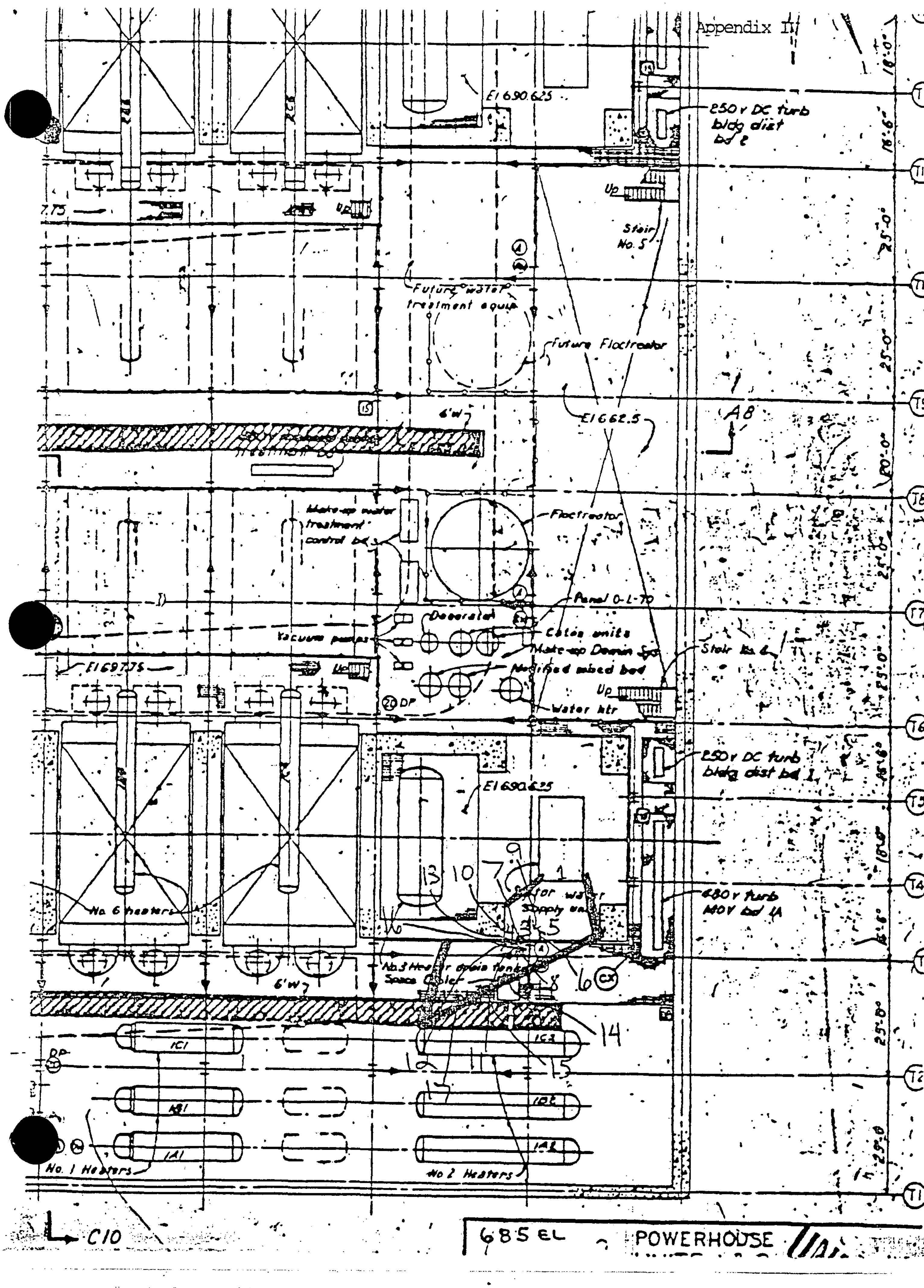
Date Collected	Sample Type and Number	Location	Concentration
1-30-82	W14'	Cement wall 15' NW of T-6-D line (CE)	8 $\mu g/ft^2$
	W15'	Steel upright by cable trays E of stairs (CE)	6 $\mu g/ft^2$
	W16'	Horizontal pipe 15' N of T-6-D line, 7.5' h (CE)	10 $\mu g/ft^2$

PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentration
1-30-82	W39[30]	Cement wall beside sample #38 (CE)	18 $\mu g/ft^2$
	W40[30]	Cement wall in back of den, E side (CE)	1.9 $\mu g/ft^2$
	W41[30]	Vertical pipe 25' SE xmfr back of den (CE)	68 $\mu g/ft^2$
	W42[30]	Piping system 1-24-568, 12'E of xfmr (CE)	23 $\mu g/ft^2$
	W43[30]	Top of hori. pipe, 9'h, 7' from back of den(CE)	7 $\mu g/ft^2$
	W44[30]	Top of conduit, 2'W of sample #43 (CE)	3.4 $\mu g/ft^2$
	W45[30]	10'S of sample #43, top of hori pipe (CE)	16 $\mu g/ft^2$
	W46[30]	Top of hori pipe, 9' h, 7'SE of xfmr (CE)	11 $\mu g/ft^2$
	W47[30]	Hori pipe, 7.5' h, 20'S of xfmr (CE)	<5 (3.4) $\mu g/ft^2$
	W48[30]	Cement wall facing E, 25'SE of xfmr (CE)	17 $\mu g/ft^2$
	W49[30]	Telescoping ladder 7' SW of xfmr (CE)	28 $\mu g/ft^2$
	W50[30]	Conduit 7.5' h, NE corner of den (CE)	<5 (ND)
	W51[30]	E cement wall in NE corner of den(CE)	<5 (3.3) $\mu g/ft^2$
2-1-82	W1'	5' N of xfmr on cement wall (CE)	450 $\mu g/ft^2$
	W2'	10' W of xfmr on cement wall (CE)	<5 (3) $\mu g/ft^2$
	W3'	Hori pipe 3'S of xfmr, 8' high (CE)	16,000 $\mu g/ft^2$
	W4'	Hori pipe 10'S of #3 (CE)	6 $\mu g/ft^2$
	W5'	Hori pipe 20' S of xfmr, 8' high (CE)	18 $\mu g/ft^2$
	W6'	Hori pipe 20' SW of xfmr, 8' high (CE)	N/A
	W7'	Vert pipe 20' SW of xfmr, 2' high (CE)	<5 (4) $\mu g/ft^2$
	W8'	Cement wall 7' NE of T-6-D line (CE)	7 $\mu g/ft^2$
	W9'	Beside phone on T-6-D line (CE)	10 $\mu g/ft^2$
	W10'	Hori piping 1' directly abv xfmr (CE)	65,000 $\mu g/ft^2$
	W11'	Cement wall 12'W of T-6-D line (CE)	8 $\mu g/ft^2$
	W12'	Side of DB air unit between T-6-D & T-7-D(CE)	10 $\mu g/ft^2$
	W13'	Pipe insulation 1.5' NW of T-6-D line (CE)	21 $\mu g/ft^2$

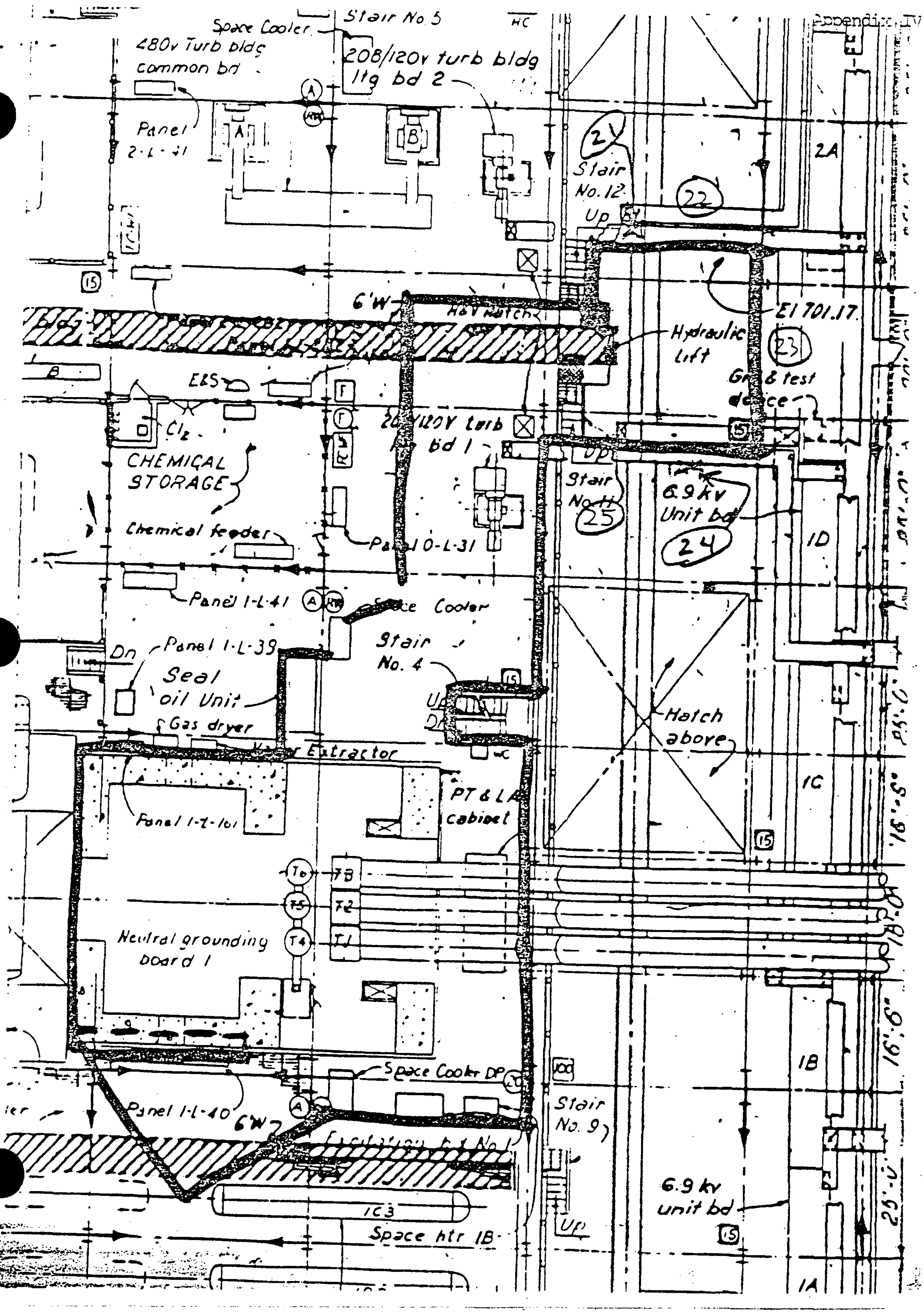
PCB Sampling
Elevation 706

Date Collected	Sample Type and Number	Location	Concentrat:
2/1/82	W14'	Cement wall 15' NW of T-6-D line (CE)	8 mg/ft^2
	W15'	Steel upright by cable trays E of stairs (CE)	6 mg/ft^2
	W16'	Horizontal pipe 15' N of T-6-D line, 7.5' h (CE)	10 mg/ft^2


El 690.625
250 v DC turb bldg dist bd 2
Up
Stair No. 5
Future water treatment equip
Future Floctreator
El 662.5
AB
6'W
Make-up water treatment control bd
Floctreator
Panel 0-L-70
Deaerator
Vacuum pumps
Cation units
Make-up Demin Sys
Modified mixed bed
El 697.75
Up
Water htr
Stair No. 6
20 DP
250 v DC turb bldg dist bd 1
El 690.625
480 v turb MOV bd 1A
No. 6 heaters
No. 3 Heater drain tank
Space Cooler
6'W
13 10 7 9 1 5 6 8 14 15 11 12
1C1
1C2
1B1
1B2
1A1
1A2
No. 1 Heaters
No 2 Heaters
T12 T11 T10 T9 T8 T7 T6 T5 T4 T2 T1
18'-0" 18'-6" 25'-0" 25'-0" 20'-0" 25'-0" 25'-0" 18'-6" 18'-6" 18'-6" 25'-0" 25'-0"
C10
685 EL
POWERHOUSE

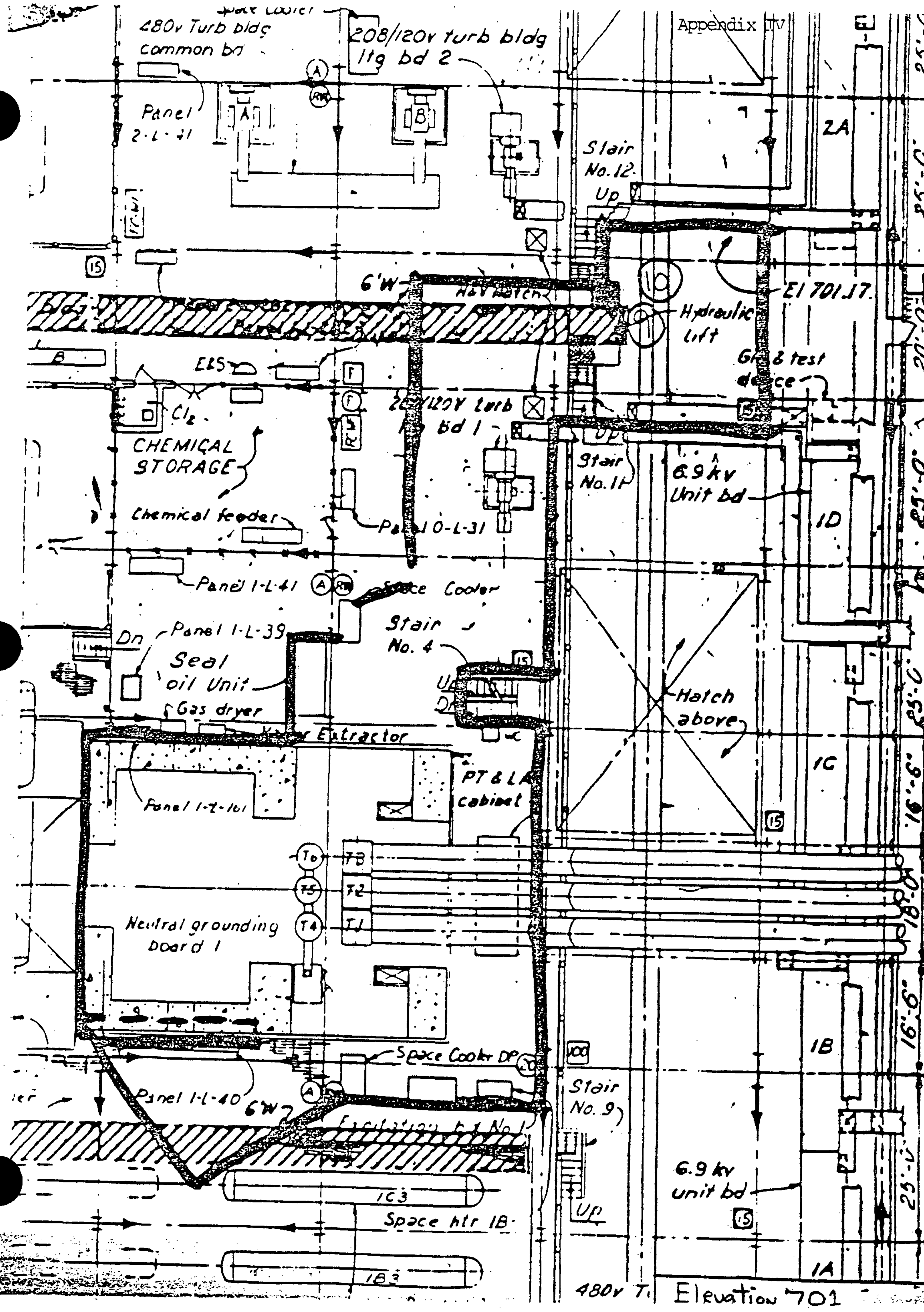
PCB Sampling
Elevation 701

Date Collected	Sample Type and Number	Location	Concentration
1-22-82	W21	6' W of S stairs in RR bay, 2' from boundry	<10 $\mu g/ft^2$
	W22	8' S of boundry, 3' W of tracks in RR bay	<10 $\mu g/ft^2$
	W23	3' W of boundry on W side of staging area	<10 $\mu g/ft^2$
	W24	3' N of boundry, 3' W of tracks in RR bay	<10 $\mu g/ft^2$
	W25	10' SW of T-7-C line in RR bay, 8' N of boundry	<10 $\mu g/ft^2$
1-31-82	W8[31]	On herculite (fork lift trucks) in staging area	<5 (3.4) $\mu g/ft^2$
	W9[31]	1' W of hydraulic lift in RR bay	10,000 $\mu g/ft^2$
	W10[31]	On herculite over tracks in RR bay	12 $\mu g/ft^2$
	W11[31]	In front of fire truck in RR bay	<5 (4.1) $\mu g/ft^2$
	W12[31]	Beside phone booth in RR bay	9 $\mu g/ft^2$



Space Cooler
Stair No. 5
480v Turb bldg common bd
208/120v turb bldg ltg bd 2
Panel 2-L-41
21
Stair No. 12 Up
22
2A
6'W
El 701.17
Hydraulic lift
23
Grd & test device
208/120V turb ltg bd 1
EBS
Cl_2
CHEMICAL STORAGE
Stair No. 11
25
6.9 kv Unit bd
24
1D
Chemical feeder
Panel 0-L-31
Panel 1-L-41
Space Cooler
Panel 1-L-39
Stair No. 4
Seal oil Unit
Gas dryer
Up
Dn
Hatch above
Panel 1-L-101
PT & LA cabinet
1C
Neutral grounding board 1
T6
T5
T4
T3
T2
T1
18'-0"
16'-6"
1B
Space Cooler DP
Panel 1-L-40
6'W
Stair No. 9
Excitation bd No 1
6.9 kv unit bd
1C3
Space htr 1B
Up
1A
25'-0"

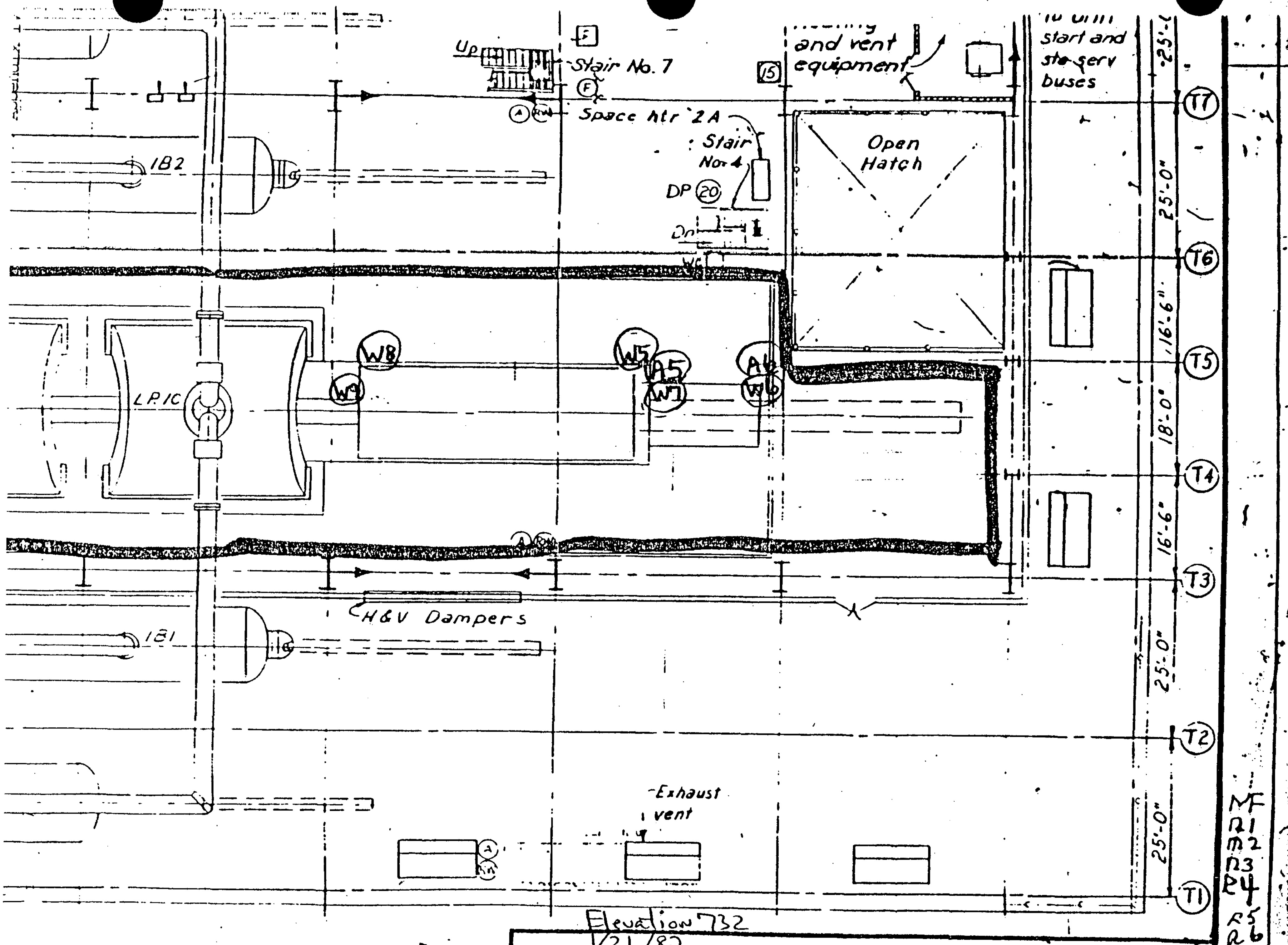
Appendix IV


480v Turb bldg common bd
208/120v turb bldg ltg bd 2
Panel 2-L-41
Stair No. 12 Up
2A
El 701.17
Hydraulic lift
Gnd & test device
6'W
CHEMICAL STORAGE
Chemical feeder
Panel 0-L-31
Stair No. 11
6.9 kv Unit bd
1D
Panel 1-L-41
Space Cooler
Panel 1-L-39
Seal oil Unit
Stair No. 4
Gas dryer
Hatch above
PT & LA cabinet
1C
Panel 1-L-101
Neutral grounding board 1
T6
T5
T4
T3
T2
T1
Space Cooler DP
Panel 1-L-40
6'W
Stair No. 9
1B
6.9 kv unit bd
1C3
Space htr 1B
Up
1B3
480v T
1A
Elevation 701
25'-0"
20'-0"
25'-0"
25'-0"
25'-0"
16'-6"
18'-0"
16'-6"
25'-0"

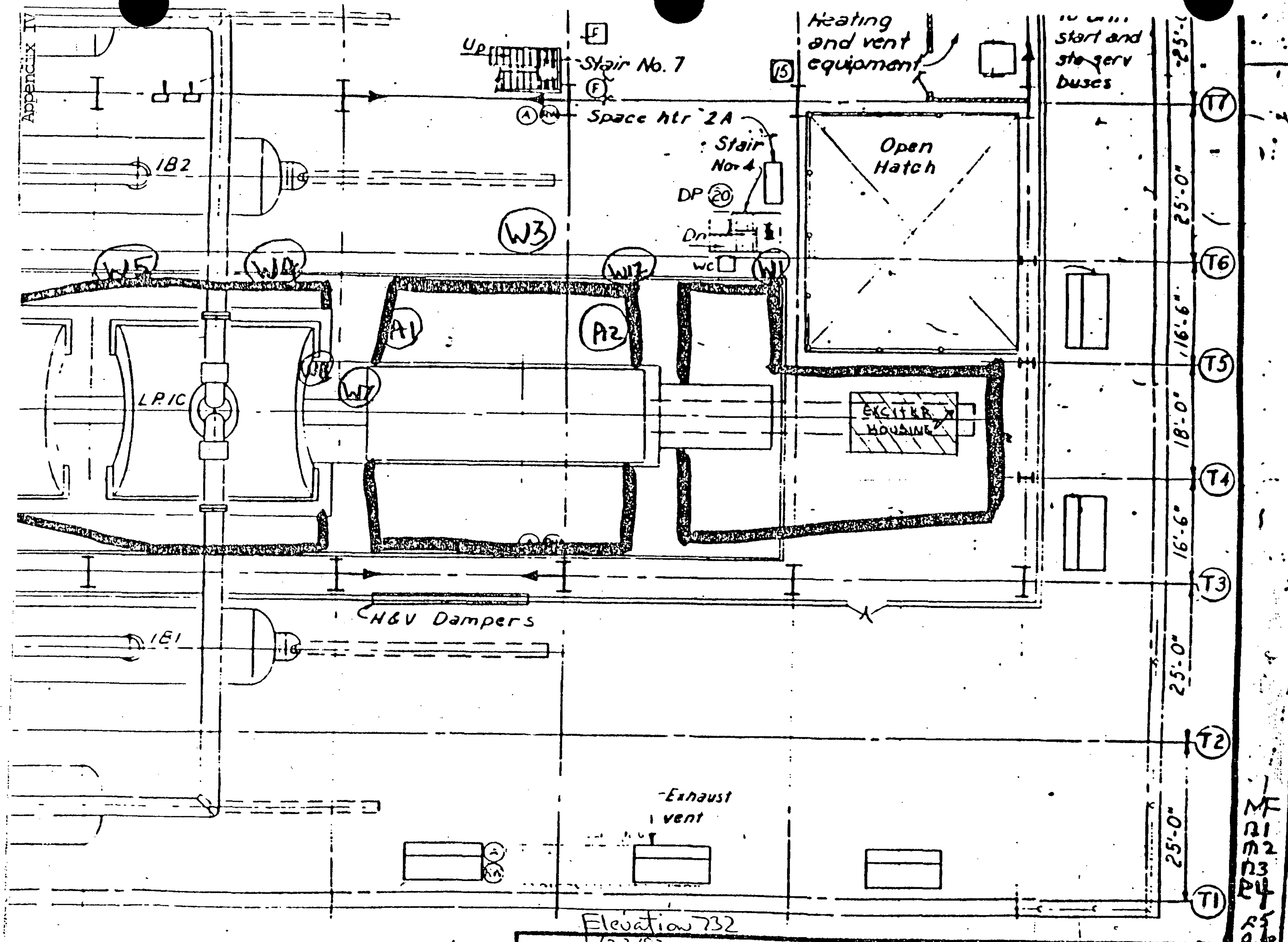
Appendix XIV

PCB Sampling
Elevation 706

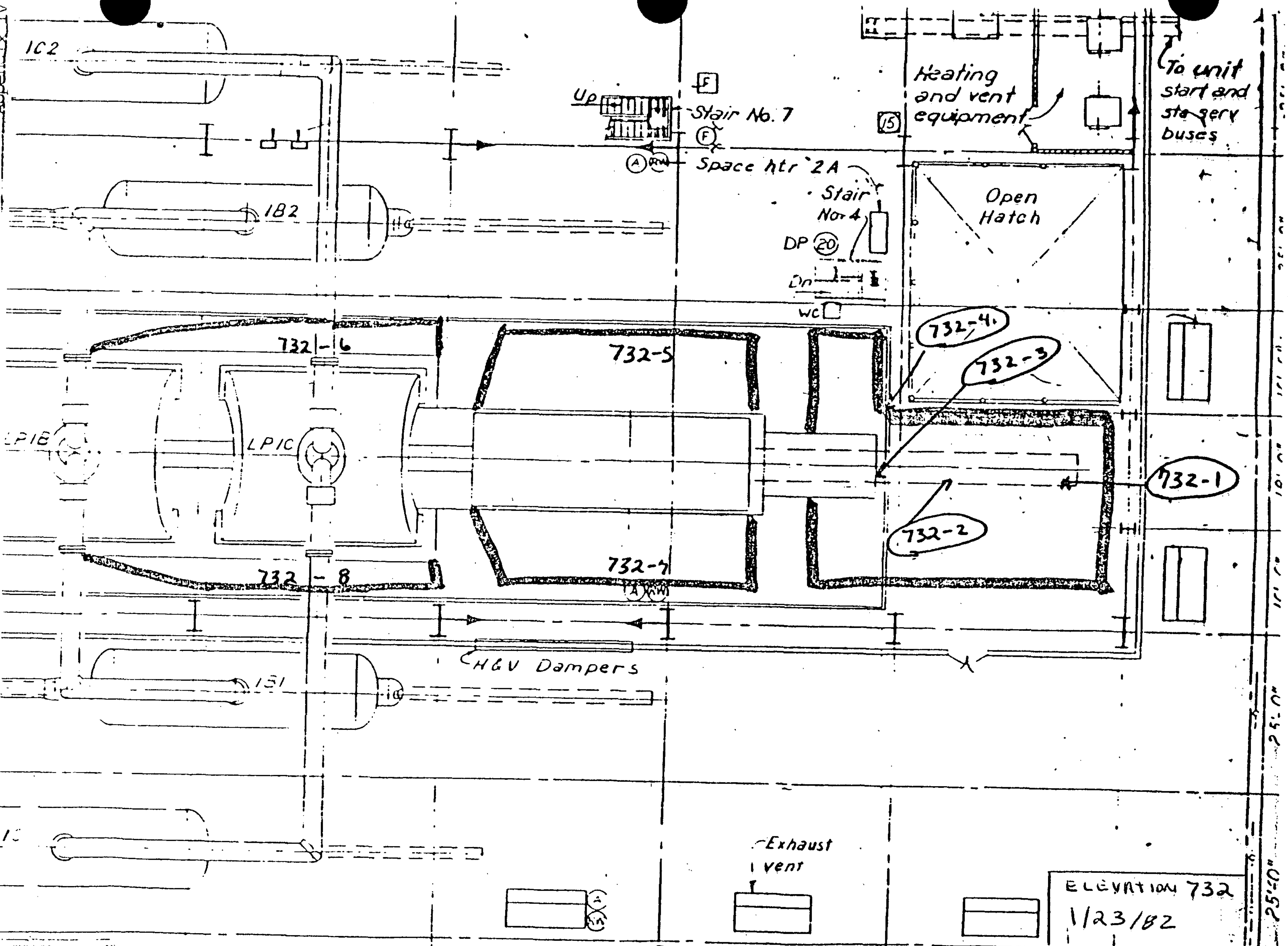
Date Collected	Sample Type and Number	Location	Concentration
1-20-82	W1	Half-way between T-7-D and T-6-D line, 3'W	220 $\mu g/ft^2$
	W2	T6 half-way between D and C lines	450 $\mu g/ft^2$
	W3	15' E of T-5-C line	300 $\mu g/ft^2$
	W4	15' E of T-4-C line	400 $\mu g/ft^2$
	W5	5' W of T-3-D line	470 $\mu g/ft^2$
	W6	E side of phone booth N of transformer	1100 $\mu g/ft^2$
	W11	On pipe 6' above floor, 15' S of transformer	700 $\mu g/ft^2$
	W12	On ladder 8' from transformer	6,400,000 $\mu g/ft^2$
	A1	8' from transformer, 5' high	.069 mg/m^3
	A4	On cart 5' E of transformer	.11 mg/m^3
	A5	On ladder 5' high, 15' SW of transformer	.052 mg/m^3
1-21-82	W3	On the unit 2 neutral transformer	3.2 $\mu g/ft^2$
	W4	On column 12' N of unit 2 neutral transformer	1.6 $\mu g/ft^2$
	A1	On ladder 8' SE of the transformer	.094 mg/m^3
	A2	On cart 5' W of the transformer	.053 mg/m^3
	A3	Same location as A1	.093 mg/m^3
	A4	Same location as A2	.107 mg/m^3
1-22-82	A3	On scaffold underneath the generator	.028 mg/m^3
	A4	At the drinking fountain	.013 mg/m^3
	W2	On plastic at the hydraulic lift	1600 $\mu g/ft^2$
	W3	On cement floor at the end of the plastic	2000 $\mu g/ft^2$
	W4	1-24-562 piping, S of transformer (cleaned)	2200 $\mu g/ft^2$
	W5	Cement wall SE of transformer (cleaned)	14 $\mu g/ft^2$
	W6	Cement wall N of transformer (cleaned)	33 $\mu g/ft^2$



and vent
equipment
start and
sta serv
buses
Up
Stair No. 7
Space Htr 2A
Stair
No. 4
DP 20
Dn
Open
Hatch
1B2
LPIC
W8
W9
W5
A5
W7
A6
W6
H&V Dampers
1B1
Exhaust
vent
T7
T6
T5
T4
T3
T2
T1
25'-0"
16'-6"
18'-0"
16'-6"
25'-0"
25'-0"
MF
R1
M2
R3
R4
R5
R6
Elevation 732
1/21/82



Elevation 732

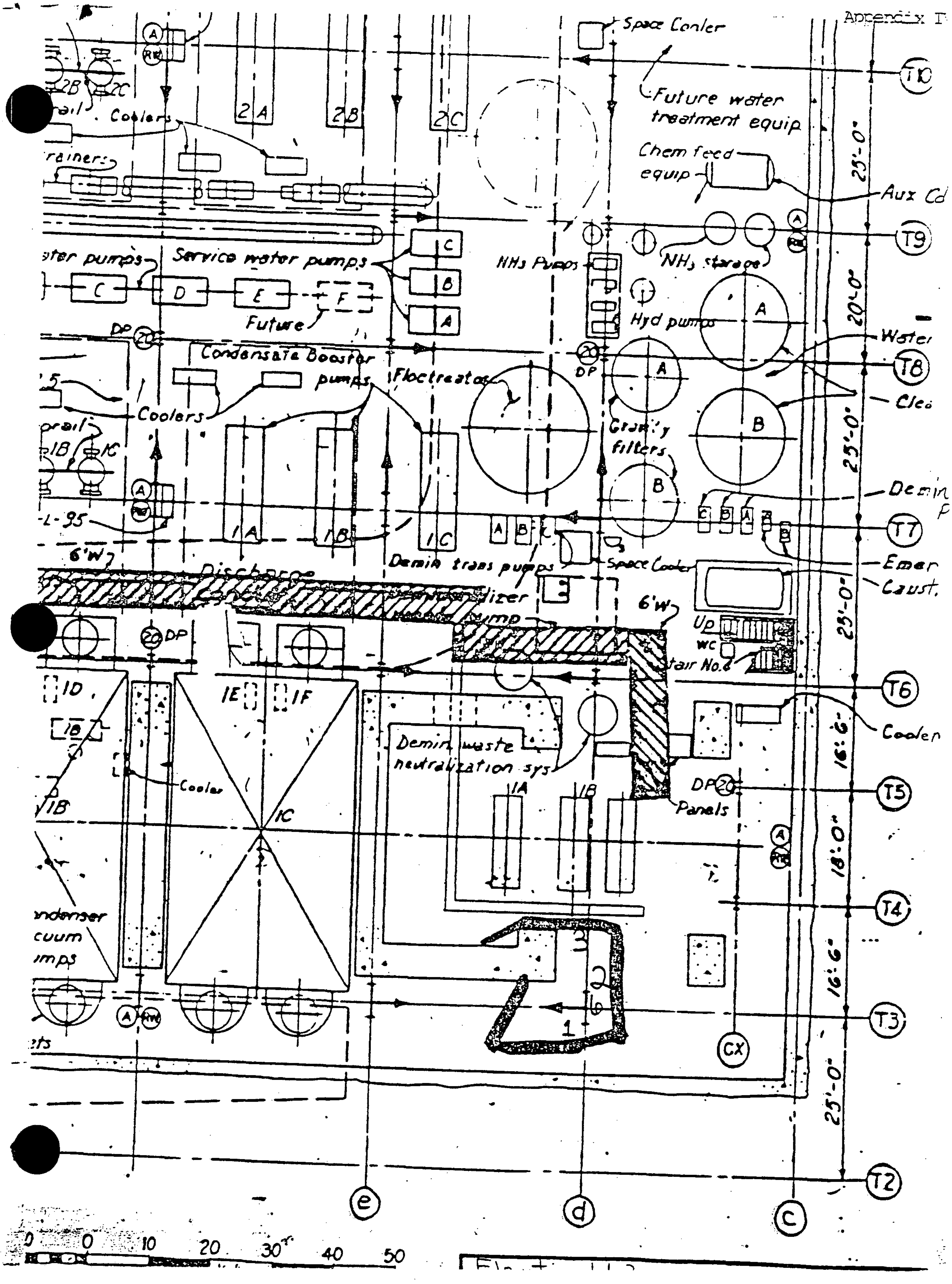


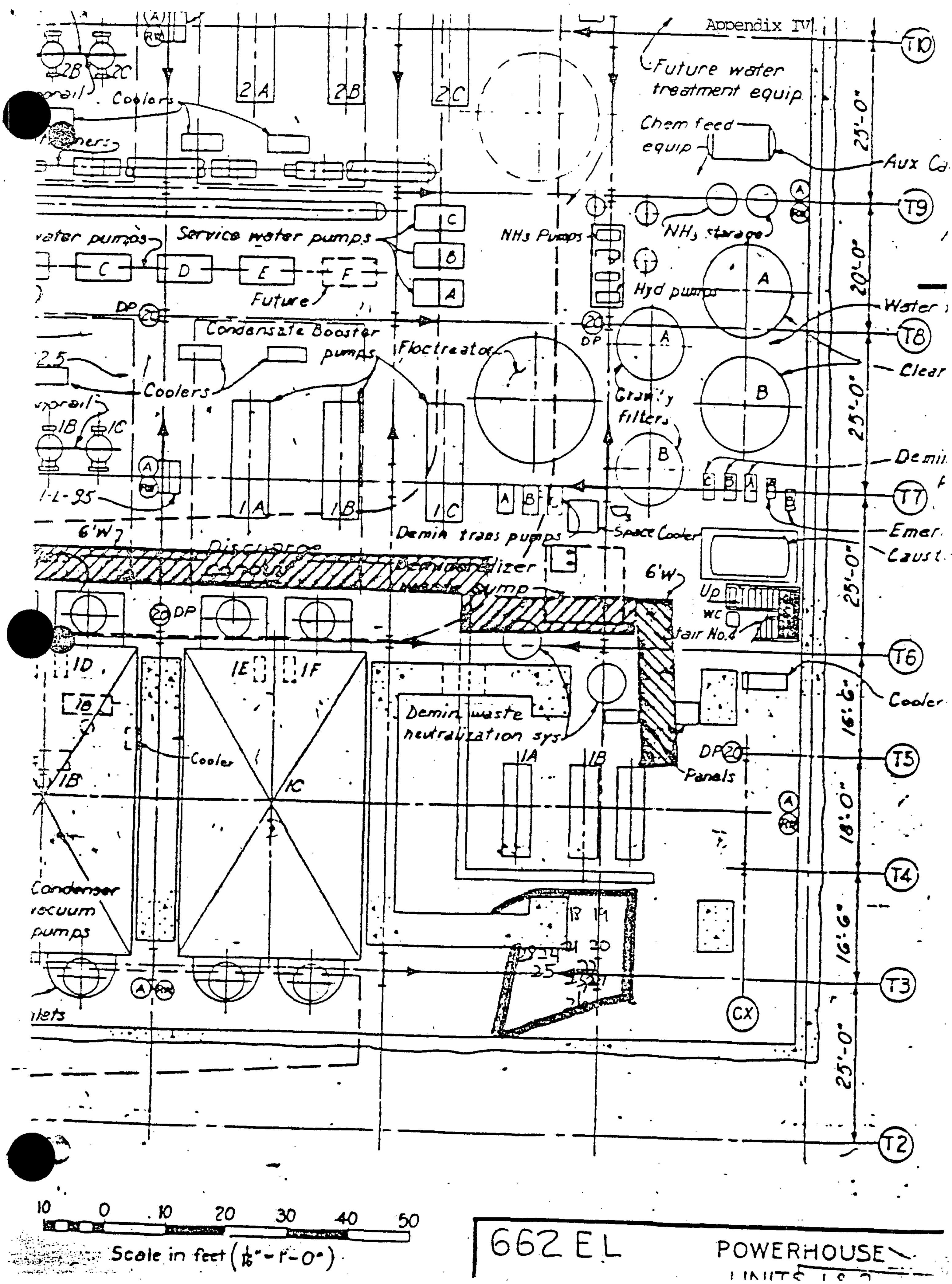
IC2
Up
F
Stair No. 7
F
A
RW
Space htr 2A
Stair No. 4
DP 20
Dn
WC
15
Heating and vent equipment
To unit start and sta gery buses
Open Hatch
1B2
732-4
732-3
732-5
732-6
LP1B
LP1C
732-1
732-2
732-4
732-8
A
RW
H&V Dampers
1B1
Exhaust vent
A
ELEVATION 732
1/23/82

Appendix XIV

PCB Sampling
Elevation 662

Date Collected	Sample Type and Number	Location	Concentration
1-22-82	A6	On scaffolding at column T-3-D line	.085 mg/m^3
	W1	5' NE of T-3-D line at boundry	33,000 mg/ft^2
	W2	2' SW of T-3-D line at boundry	1,200 mg/ft^2
	W3	10' S of T-3-D line at boundry	65 $\mu g/ft^2$
2-2-82	$W18^2$	Wall (cement) 8' SE of T-3-D line	< 5(3) $\mu g/ft^2$
	$W19^2$	Floor 8' S of T-3-D line	200 $\mu g/ft$
	$W20^2$	Floor 1' S of T-3-D line (in H_2O)	44,000 $\mu g/ft^2$
	$W21^2$	Corner of wall 4' SE of T-3-D line	130 $\mu g/ft^2$
	$W22^2$	Cement pad 1' E of T-3-D line	1,600 $\mu g/ft^2$
	$W23^2$	X-member 3' E of T-3-D line	60 $\mu g/ft^2$
	$W24^2$	Cement wall 4' E of T-3-D line	96 $\mu g/ft^2$
	$W25^2$	Floor 10' E of T-3-D line	8,000 $\mu g/ft^2$
	$W26^2$	Floor 5' NE of T-3-D line	7,800 $\mu g/ft^2$
	$W27^2$	E side of the column on the cement pad	16,000 $\mu g/ft^2$
	$W28^2$	Base of cement wall 10'E of T-3-D line (in H_2O)	13,000 $\mu g/ft^2$
	$W29^2$	On herculite by barrels at 706 drain	64 $\mu g/ft^2$
	$W30^2$	Off cement (in H_2O) at barrels by 706 drain	45 $\mu g/ft^2$


Space Cooler
Future water treatment equip
Chem feed equip
Aux Cd
Coolers
Strainers
2A
2B
2C
Service water pumps
C
D
E
F
Future
NH3 Pumps
NH3 storage
Hyd pumps
A
B
Water
Clea
Condensate Booster pumps
Floctreator
Gravity filters
Coolers
1A
1B
1C
Demin
Demin trans pumps
Space Cooler
Emer
Caust.
6'W
Discharge
Neutralizer pump
Up
WC
Stair No.
1D
1E
1F
1B
Cooler
Demin waste neutralization sys
Panels
Cooler
DP
T10
T9
T8
T7
T6
T5
T4
T3
T2
25'-0"
20'-0"
16'-6"
18'-0"
CX
e
d
c
Condenser vacuum pumps
0
10
20
30
40
50



Future water treatment equip
Chem feed equip
Aux Co
T10
T9
T8
T7
T6
T5
T4
T3
T2
25'-0"
20'-0"
25'-0"
25'-0"
16'-6"
18'-0"
16'-6"
25'-0"
Coolers
2B
2C
2A
2B
2C
NH3 Pumps
NH3 storage
Service water pumps
C
D
E
F
Future
A
B
C
Hyd pumps
DP
Condensate Booster pumps
Floctreator
Coolers
Gravity filters
Clear
1B
1C
1A
1B
1C
1-L-95
Demin
Demin trans pumps
Space Cooler
Emer
Caust
6'W
6'W
Up
WC
Stair No.4
Cooler
1D
1E
1F
1B
1B
1C
Demin waste neutralization sys
1A
1B
Panels
Cooler
Condenser vacuum pumps
CX
Scale in feet (1/16" = 1'-0")
10
0
10
20
30
40
50
662 EL
POWERHOUSE

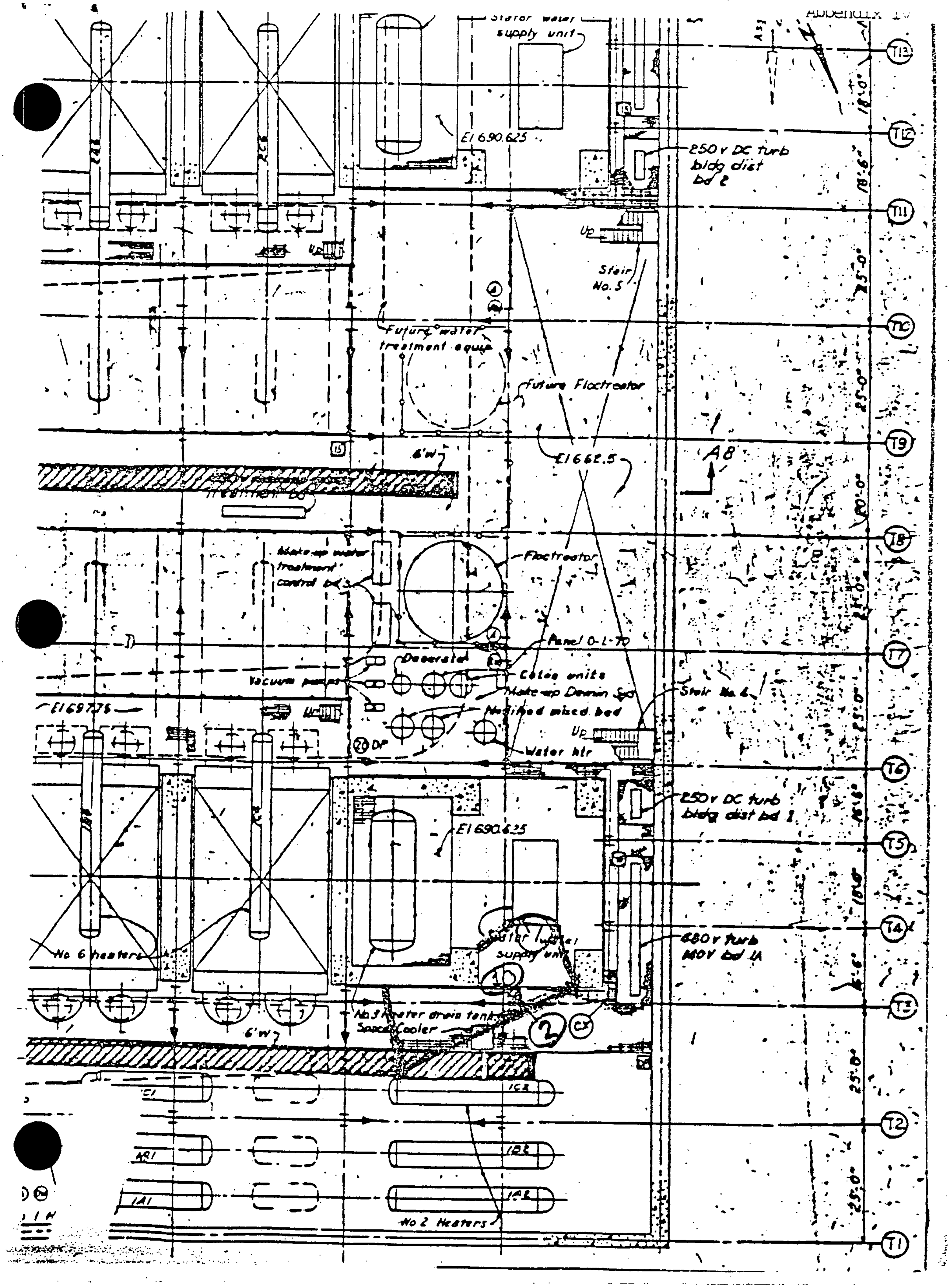
PCB Sampling
Elevation 685

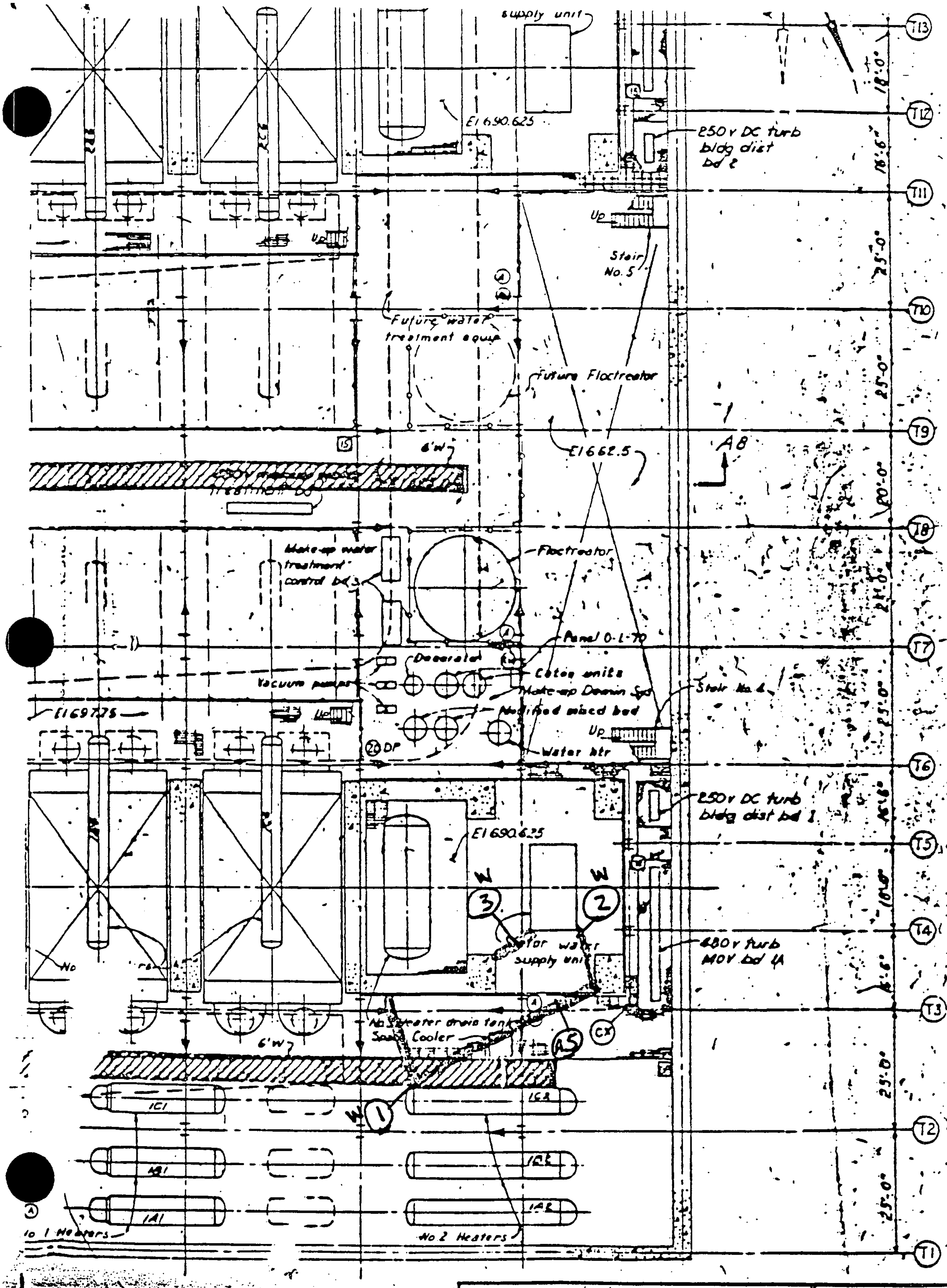
Date Collected	Sample Type and Number	Location	Concentration
1-20-82	W10	S. side of column T-3-D line	50,000 $\mu g/ft^2$
	A2	At T-3-D line	.22 mg/m^3
	A7	15' from T-3-D line on generator Stator Cooling System	.28 mg/m^3
1-22-82	A5	8' W of column T-3-D line, 6' high	.187 mg/m^3
	W1	20' NW of T-3-D line at boundry	12 $\mu g/ft^2$
	W2	5' E of T-4-C line at boundry	86 $\mu g/ft^2$
	W3	12' S of T-3-D line at boundry	800 $\mu g/ft^2$
1-28-82	W 685-3[28]	Electric board on W wall, T-3-D line	<10 (6) $\mu g/ft^2$
	W 685-4[28]	" " " " " "	<10 (3) $\mu g/ft^2$
2-2-82	W1[2]	On stator water supply unit 5' high	2.5 ND
	W2[2]	10' SW of T-3-D line on the floor	200 $\mu g/ft^3$
	W3[2]	Hori piping S. of T-3-D line	24 $\mu g/ft^3$
	W4[2]	Cement wall E. of T-3-D line, 3' off floor	190 $\mu g/ft^3$
	W5[2]	On floor 6' SW of T-3-D line (in water)	4,000 $\mu g/ft^3$
	W6[2]	Grating 1' SW of T-3-D line	52,000 $\mu g/ft^3$
	W7[2]	S side of column T-3-D, 1' from floor	180 $\mu g/ft^3$
	W8[2]	Cement support E of T-3-D line, 5' abv floor	19 $\mu g/ft^3$
	W9[2]	Overhead hori pipe S. of T-3-D line	3,600 $\mu g/ft^3$ --
	W10[2]	Cement wall E. of T-3-D line, 6' from floor	950 $\mu g/ft^3$
	W11[2]	Horizontal pipe E of T-3-D line	8,500 $\mu g/ft^3$
	W12[2]	X-member E of T-3-D line	38 $\mu g/ft^3$
	W13[2]	Grating E of T-3-D line	28,000 $\mu g/ft^3$

Appendix XIV

PCB Sampling
Elevation 685

Date Collected	Sample Type and Number	Location	Concentration
2-2-82	W14[2]	Top of air unit E of T-3-D line	540 $\mu g/ft^2$
	W15[2]	Floor 15' NE of T-3-D line	55 $\mu g/ft^2$
	W16[2]	Switchbox on E side of column T-3-D line	26 $\mu g/ft^2$
	W17[2]	Trench drain 13' NE of T-3-D line	41 $\mu g/ft^2$


Stator water supply unit
El 690.625
250 v DC turb bldg dist bd 2
Up
Stair No. 5
Future water treatment equip
Future Floctreator
El 662.5
A8
6'W
Make-up water treatment control bd
Floctreator
Panel 0-L-70
Deaerator
Cation units
Vacuum pumps
Make-up Demin Sys
Modified mixed bed
Stair No. 6
El 697.75
Up
20 DP
Water htr
250 v DC turb bldg dist bd 1
El 690.625
Stator water supply unit
480 v turb MOV bd 1A
No 6 heaters
No. 3 heater drain tank
Space Cooler
6'W
1C2
1B2
1A2
1B1
1A1
No 2 Heaters
T13
T12
T11
T10
T9
T8
T7
T6
T5
T4
T3
T2
T1
18'-0"
18'-6"
25'-0"
25'-0"
20'-0"
25'-0"
18'-6"
25'-0"
25'-0"

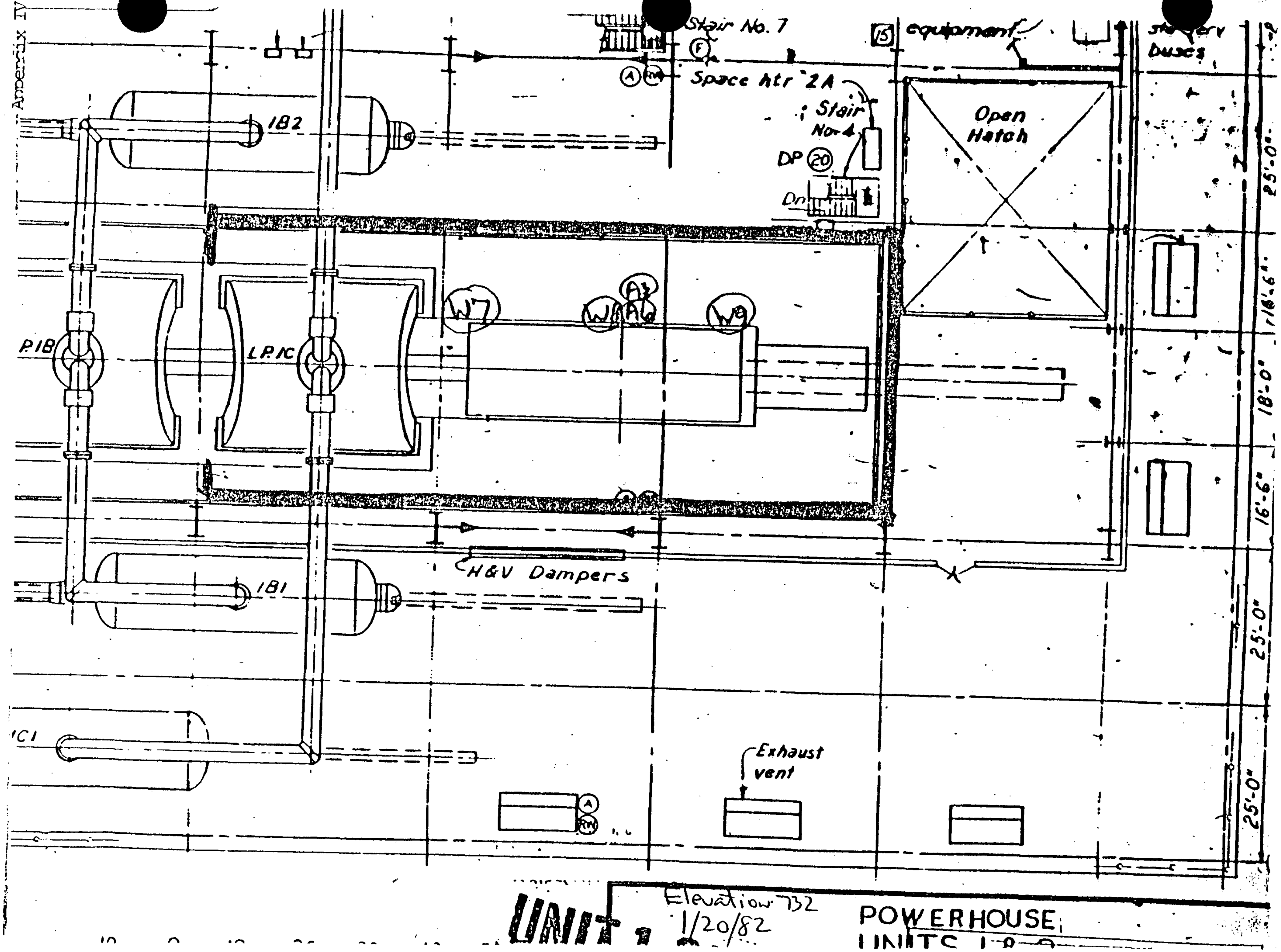


685 EL 1/22/82 POWERHOUSE Units 1&2

Appendix XIV

PCB Sampling
Elevation 732 (contd)

Date Collected	Sample Type and Number	Location	Concentration
1-23-82	W 732-1[23]	W. end of exciter housing	<10 $\mu g/ft^2$
	W 732-2[23]	E. end of exciter housing	<10 $\mu g/ft^2$
	W 732-3[23]	W. end of exciter on fins 1.5' off floor	<10 $\mu g/ft^2$
	W 732-4[23]	At S. boundry on floor at handrail	<10 $\mu g/ft^2$
	W 732-5[23]	Front of dressing area on floor at S. boundry	<10 $\mu g/ft^2$
	W 732-6[23]	On floor at S. boundry between E and F line	<10 $\mu g/ft^2$
	W 732-7[23]	At T-3-D line at N. boundry	<10 $\mu g/ft^2$
	W 732-8[23]	Between E and F line, N. boundry	<10 $\mu g/ft^2$


Stair No. 7
equipment
buses
Space htr 2A
Stair No. 4
DP 20
Dn
Open Hatch
1B2
P.1B
LP.1C
W7
W8
W9
H&V Dampers
1B1
1C1
Exhaust vent
25'-0"
18'-6"
18'-0"
16'-6"
25'-0"
25'-0"
Elevation 732
1/20/82
POWERHOUSE

Appendix XIV

PCB Sampling
Miscellaneous Locations

Date Collected	Sample Type and Number	Location	Concentration
1-22-82	O-crane	On steel support by stairs on crane elevation	<10 $\mu g/ft^2$
1-25-82	W-1[23]	MSA 401 cas # 02.15	<10 $\mu g/ft^2$
	W-2[23]	MSA 401 tank # 02.62	<10 $\mu g/ft^2$
	W-3[23]	MSA 401 tank # 02.30	<10 $\mu g/ft^2$
	W-4[23]	MSA 401 case # 02.79	<10 $\mu g/ft^2$
1-24-82	W-TBS-1	N. wall of TBS, 2" above water level	880 $\mu g/ft^2$
	W-TBS-2	S. wall of TBS, 4' above water level	30,000 $\mu g/ft^2$
	W-TBS-3	E. wall of TBS, 4' above water level	39,000 $\mu g/ft^2$
	W-TBS-4	W. wall of TBS, 4' above water level	12,000 $\mu g/ft^2$
1-25-82	W-TBS-1[25]	W. wall of the TBS after cleaning (H_2O lasing)	380 $\mu g/ft^2$
	W-TBS-2[25]	E. wall of the TBS after cleaning (H_2O lasing)	1600 $\mu g/ft^2$
	W-TBS-3[25]	N. wall of the TBS after cleaning (H_2O lasing)	390 $\mu g/ft^2$
	W-TBS-4[25]	S. wall of the TBS after cleaning (H_2O lasing)	700 $\mu g/ft^2$
	W-TDI-1[25]	South drain in the TDI building	3 $\mu g/ft^2$
	W-TDI-2[25]	Middle drain in the TDI building	4 $\mu g/ft^2$
	W-TDI-3[25]	North drain in the TDI building	1 $\mu g/ft^2$
1-26-82	W1-26	662, Rail around TBS	12 $\mu g/ft^2$
	W2-26	662, Floor by TBS	87 $\mu g/ft^2$
	W3-26	662, Floor beside TBS	98 $\mu g/ft^2$
1-26-82	W1-27	662, N. wall of TBS after 1st stearing	<5 $\mu g/ft^2$
	W2-27	662, W. wall of TBS after H_2O lasing	7 $\mu g/ft^2$
	W3-27	662, S. wall of TBS after 1st stearing	<5 $\mu g/ft^2$
	W4-27	662, E. wall of TBS after H_2O lasing	14 $\mu g/ft^2$
	W5-27	662, N. wall of TBS after H_2O lasing	13 $\mu g/ft^2$
	W6-27	662, S. wall of TBS after H_2O lasing	<5 $\mu g/ft^2$

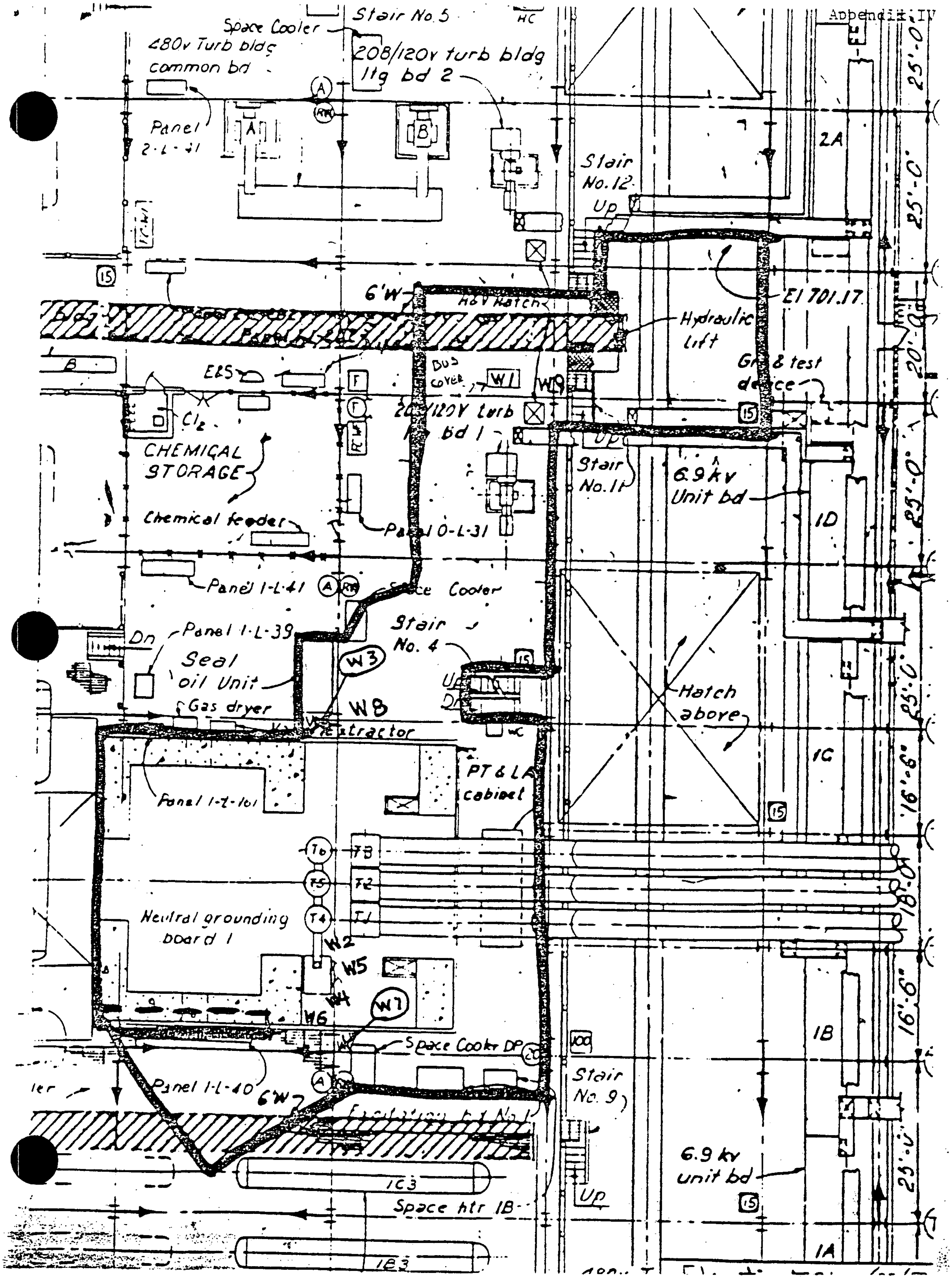
PCB Sampling
Elevation 732

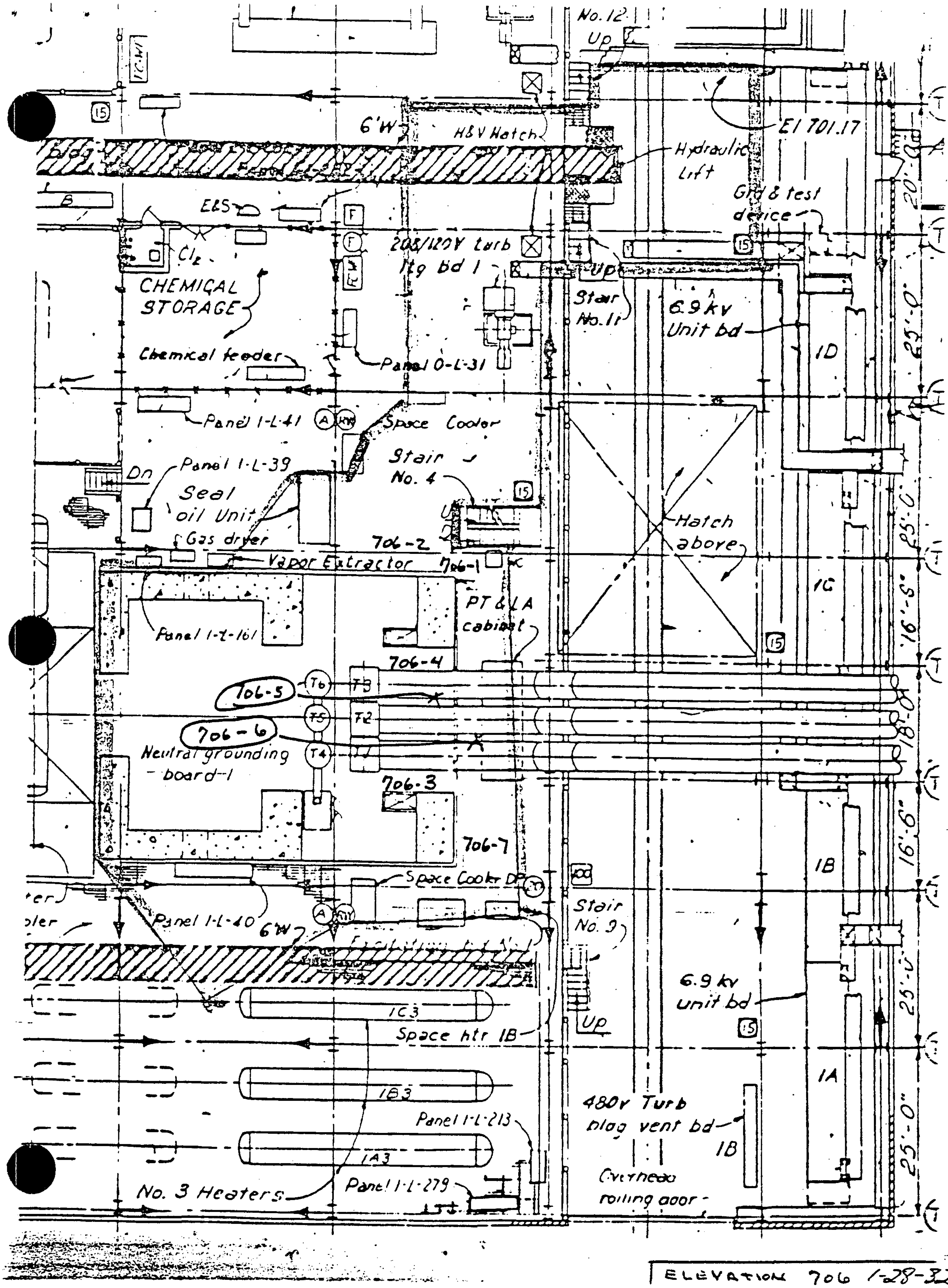
Date Collected	Sample Type and Number	Location	Concentration
1-20-82	W7	S. side, E. end of generator	700 $\mu g/ft^2$
	W8	S. side, middle of generator	480 $\mu g/ft^2$
	W9	S. side, W. end of generator	1700 $\mu g/ft^2$
	A3	On cart near generator name plate, S. side	.027 mg/m^3
	A6	S. side of generator near the name plate	.052 mg/m^3
1-21-82	W1	N. side of unit 2 generator near name plate	10 $\mu g/ft^2$
	W2	S. side of unit 2 generator near name plate	4.4 $\mu g/ft^2$
	W5	On the same location as sample 1-20, W9 (after cleaning)	10 $\mu g/ft^2$
	W6	W. corner of exciter (after cleaning)	12 $\mu g/ft^2$
	W7	On the exciter magnet	<10 $\mu g/ft^2$
	W8	On the same location as sample 1-20, W7 (after cleaning)	<10 $\mu g/ft^2$
	W9	End belt on E. end of the generator	1600 $\mu g/ft^2$
	A5	E. end of the exciter	.153 mg/m^3
	A6	W. end of the exciter	.026 mg/m^3
1-22-82	A1	Turbine end of the generator	.025 mg/m^3
	A2	Exciter end of the generator	.088 mg/m^3
	W1	15' S of the W end of the exciter at boundry	<10 $\mu g/ft^2$
	W2	15' S of the W end of the generator at boundry	<10 $\mu g/ft^2$
	W3	25' E of the W end of the gen, 8' from boundry	<10 $\mu g/ft^2$
	W4	W end of the MSR at the boundry	<10 $\mu g/ft^2$
	W5	Middle of the MSR at the boundry	<10 $\mu g/ft^2$
	W7	E end of the gen on the bell, already cleaned	<10 $\mu g/ft^2$
	W8	W end of the LPT on the housing	<10 $\mu g/ft^2$

PCB Sampling
Miscellaneous Locations (contd)

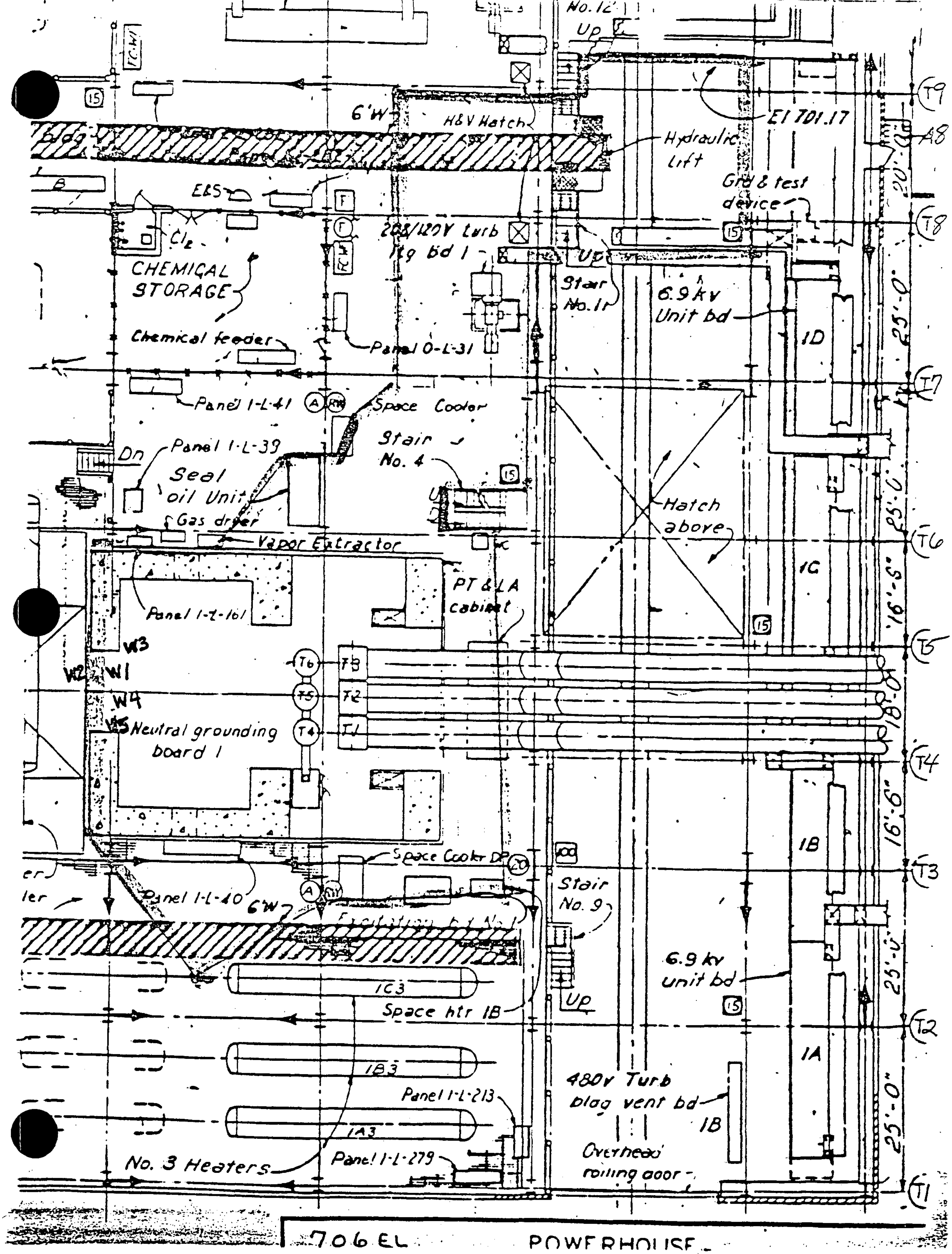
Date Collected	Sample Type and Number	Location	Concentration
1-28-82	W 662-1[28]	TBS wall after flushing with fire hose	<10 (4) μg/ft^2
	W 662-2[28]	TBS wall after flushing with fire hose	17 μg/ft^2
1-30-82	WBarrel-1[30]	Outside of PCB waste barrel (CE)	17 μg/ft^2
	WBarrel-2[30]	" " " " (CE)	<5 (1.8) μg/ft^2
	WBarrel-3[30]	" " " " (CE)	7 μg/ft^2
	WBarrel-4[30]	" " " " (CE)	<5 (1.2) μg/ft^2
	WBarrel-5[30]	" " " " (CE)	ND
	WBarrel-6[30]	" " " " (CE)	ND
	WBarrel-7[30]	" " " " (CE)	ND
	WBarrel-8[30]	" " " " (CE)	<5 (1.8) μg/ft^2
	WBarrel-9[30]	" " " " (CE)	7 μg/ft^2
	WBarrel-10[30]	" " " " (CE)	8 μg/ft^2
	W7[30]	Inside shipped bus link (CE)	<5 (3.6) μg/ft^2
	W8[30]	Outside of shipped bus link (CE)	<5 (<1) μg/ft^2
	W9[30]	Inside shipped bus link (CE)	<5 (2.4) μg/ft^2
1-31-82	W1[31]	Inside of black hose used as drain extension	<5 (3.9) μg/ft^2
	W2[31]	Outside of black hose used as drain extension	<5 (3.4) μg/ft^2
	W3[31]	Outside of wooden crate cntng PCB waste (CE)	<5 (2.0) μg/ft^2
	W4[31]	" " " " " " (CE)	76 μg/ft^2
	W5[31]	" " " " " " (CE)	7 μg/ft^2
	W6[31]	" " " " " " (CE)	<5 (3.4) μg/ft^2
	W7[31]	" " " " " " (CE)	11 μg/ft^2
2-1-82	WS'	Raincoat worn by V. Taylor in TBS	660 μg/ft^2

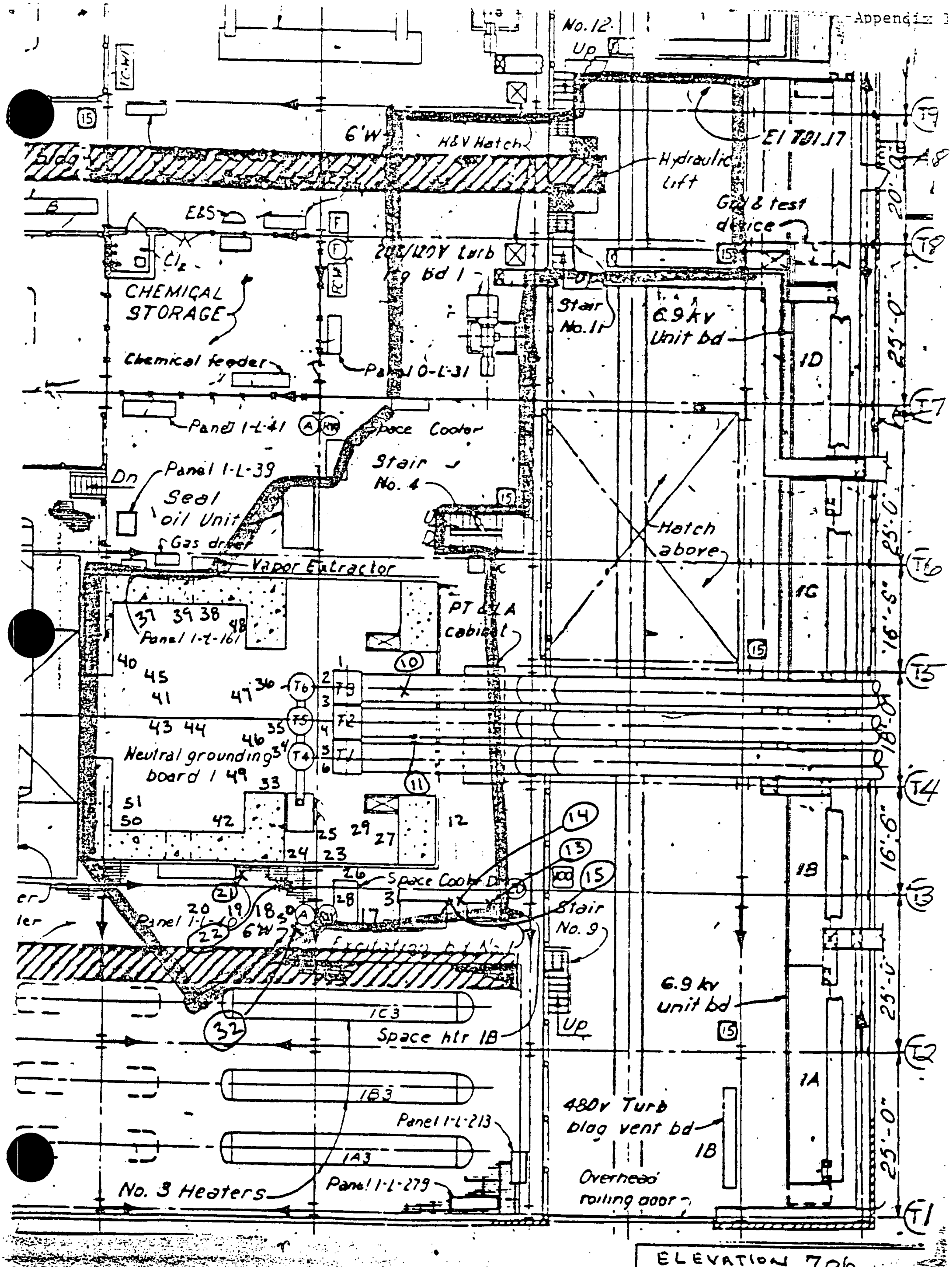
APPENDIX XVI


Stair No. 5
Space Cooler
480v Turb bldg common bd
208/120v turb bldg ltg bd 2
Panel 2-L-41
Stair No. 12
Up
2A
6'W
Hydraulic lift
El 701.17
Grd & test device
Bus cover
W1
W9
E&S
Cl_2
CHEMICAL STORAGE
208/120V turb ltg bd 1
Stair No. 11
6.9 kv Unit bd
1D
Chemical feeder
Panel 0-L-31
Panel 1-L-41
Space Cooler
Stair No. 4
Panel 1-L-39
Dn
Seal oil Unit
W3
Gas dryer
W8
Extractor
Hatch above
1C
Panel 1-L-101
PT & LA cabinet
T6
T5
T4
T3
T2
T1
Neutral grounding board 1
W2
W5
W4
W6
W7
1B
Space Cooler DP
Panel 1-L-40
6'W
Stair No. 9
1C3
Space htr 1B
6.9 kv unit bd
Up
1A
1B3
25'-0"
20'-0"
16'-6"
18'-0"

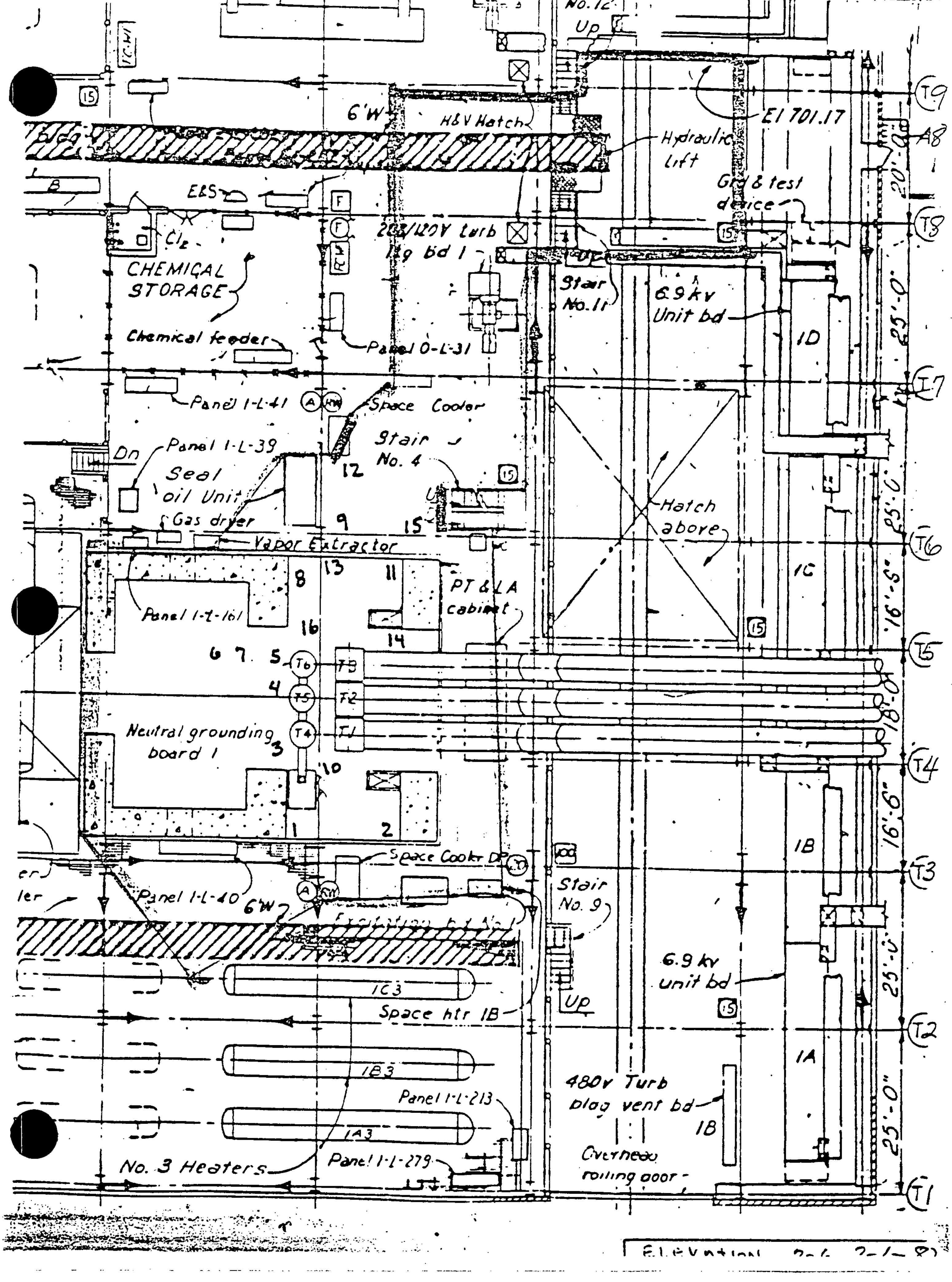


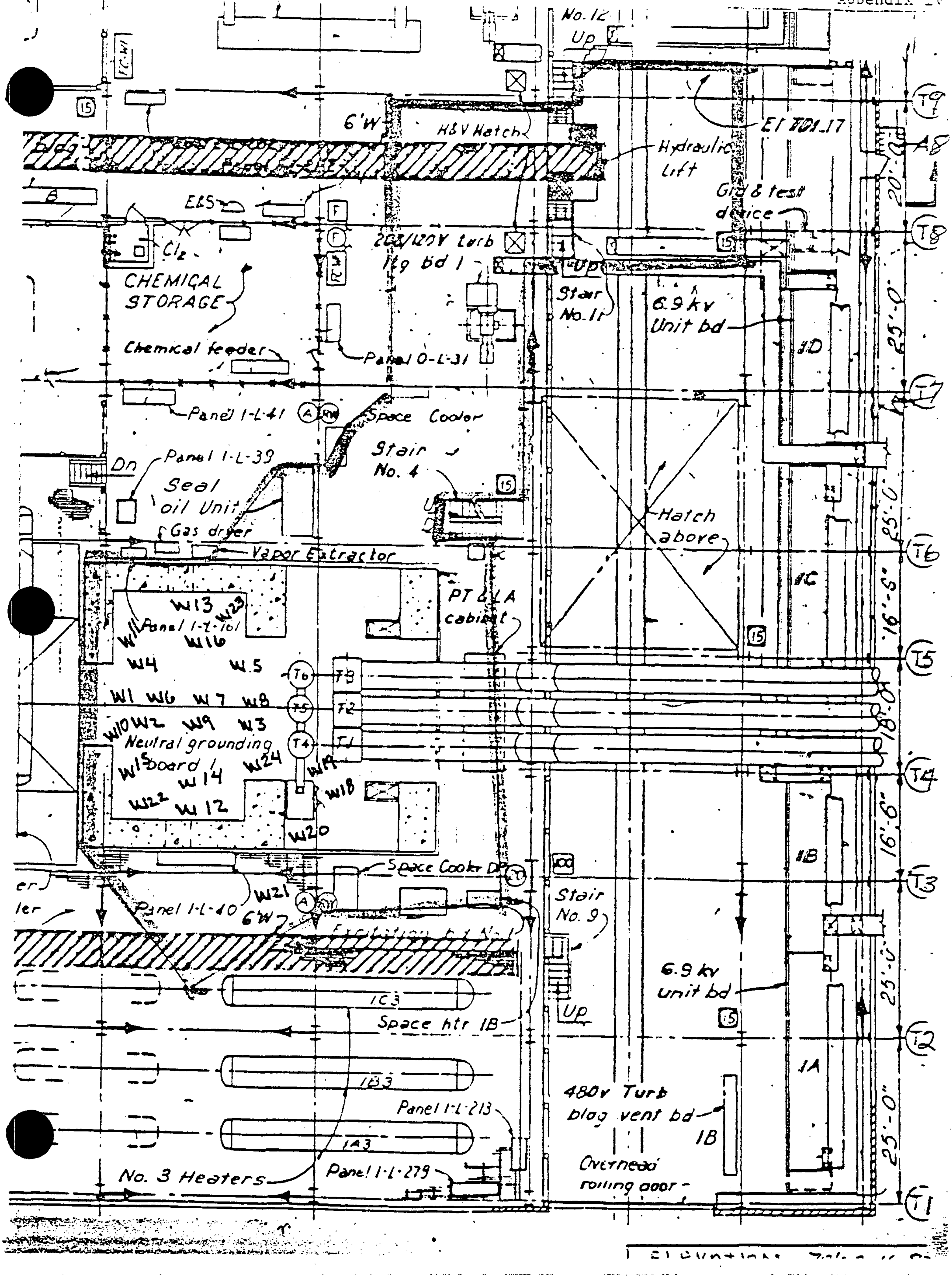
ELEVATION 706 1-28-82


No. 12
Up
H&V Hatch
6'W
El 701.17
Hydraulic lift
Grd & test device
T9
A8
T8
20'
E&S
Cl_2
CHEMICAL STORAGE
208/120V turb ltg bd 1
Up
Stair No. 11
6.9 kv Unit bd
1D
25'-0"
Chemical feeder
Panel 0-L-31
T7
Panel 1-L-41
Space Cooler
Stair No. 4
Dn
Panel 1-L-39
Seal oil Unit
Gas dryer
Hatch above
25'-0"
Vapor Extractor
T6
1C
16'-5"
PT & LA cabinet
Panel 1-L-161
T5
W3
W2
W1
W4
W5
T6
T3
T5
T2
18'-0"
T4
T1
Neutral grounding board 1
T4
16'-6"
1B
Space Cooler DP
T3
Stair No. 9
Panel 1-L-40
6'W
6.9 kv unit bd
25'-0"
1C3
Up
Space htr 1B
T2
1A
1B3
480v Turb bldg vent bd
25'-0"
Panel 1-L-213
1B
1A3
Overhead rolling door
No. 3 Heaters
Panel 1-L-279
T1
706 EL
POWERHOUSE

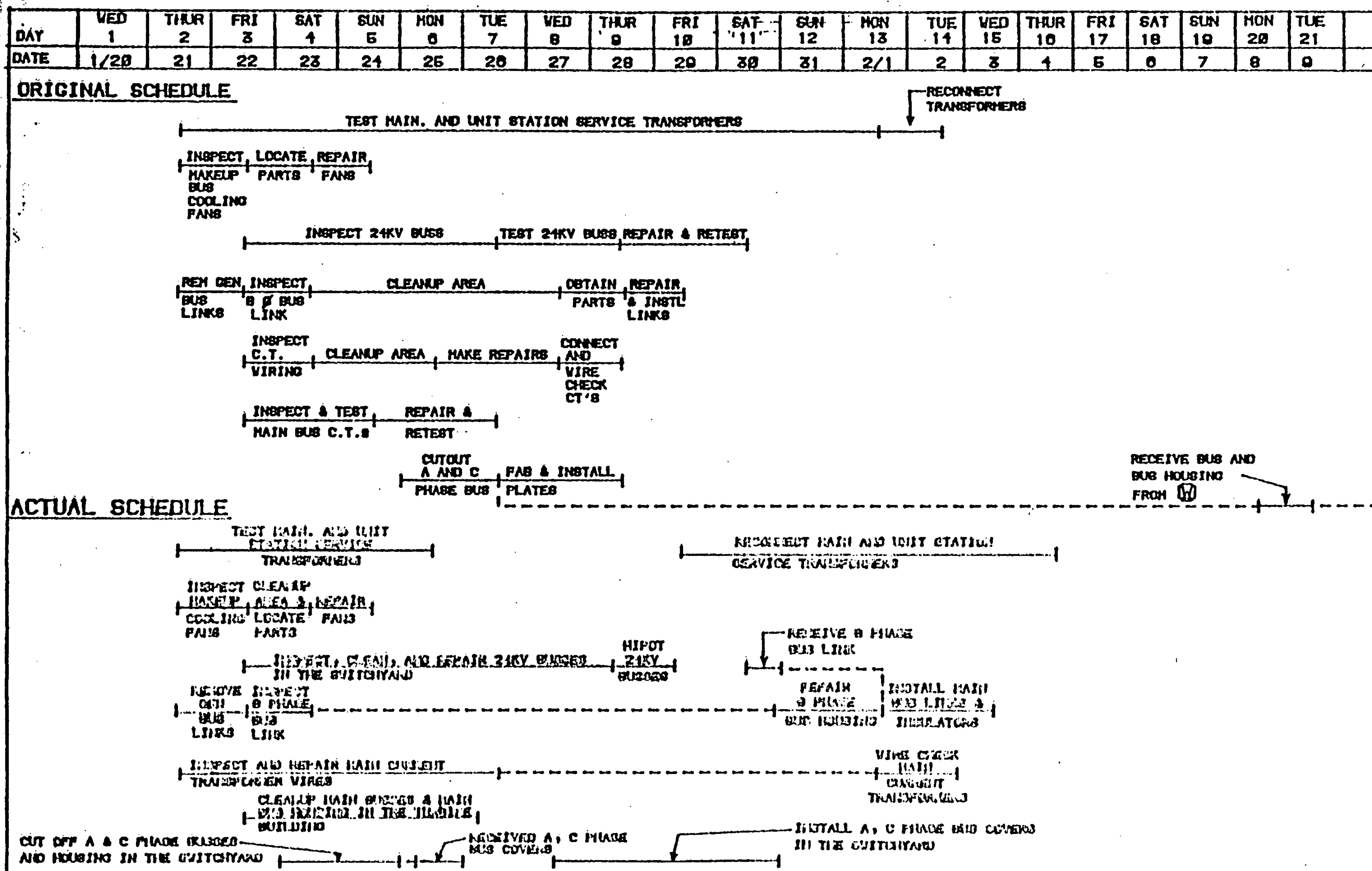


ELEVATION 706


No. 12
Up
6'W
HSV Hatch
El 701.17
Hydraulic lift
Grd & test device
E&S
Cl_2
CHEMICAL STORAGE
208/120V turb ltg bd 1
Stair No. 11
6.9 kv Unit bd
1D
Chemical feeder
Panel 0-L-31
Panel 1-L-41
Space Cooler
Stair No. 4
Panel 1-L-39
Dn
Seal oil Unit
Gas dryer
Vapor Extractor
Hatch above
1C
PT & LA cabinet
Panel 1-L-161
Neutral grounding board 1
T6
T5
T4
T3
T2
T1
T9
T8
T7
A8
1B
Space Cooler DP
Panel 1-L-40
6'W
Stair No. 9
6.9 kv unit bd
Up
1C3
Space htr 1B
1A
1B3
480v Turb bldg vent bd
Panel 1-L-213
1A3
No. 3 Heaters
Panel 1-L-279
Overhead rolling door
20'-0"
25'-0"
25'-0"
16'-5"
18'-0"
16'-6"
25'-0"
25'-0"
ELEVATION


No. 12
Up
6'W
H&V Hatch
El 701.17
Hydraulic lift
Grid & test device
E&S
Cl_2
CHEMICAL STORAGE
208/120V turb ltg bd 1
Up
Stair No. 11
6.9 kv Unit bd
1D
Chemical feeder
Panel 0-L-31
Panel 1-L-41
Space Cooler
Stair No. 4
Dn
Panel 1-L-39
Seal oil Unit
Gas dryer
Vapor Extractor
Hatch above
PT & LA cabinet
1C
Panel 1-?-101
Neutral grounding board 1
T1
T2
T3
T4
T5
T6
T7
T8
T9
A8
Space Cooler DP
Stair No. 9
Panel 1-L-40
6'W
1B
Excitation bd No. 1
1C3
6.9 kv unit bd
Space htr 1B
Up
1B3
1A
480v Turb bldg vent bd
Panel 1-L-213
1A3
1B
No. 3 Heaters
Panel 1-L-279
Overhead rolling door
20'-0"
25'-0"
25'-0"
16'-5"
18'-0"
16'-6"
25'-0"
25'-0"

APPENDIX XVII



BLACK - ESTIMATED SCHEDULE RED - ACTUAL SCHEDULE	**PLANT MAINTENANCE WORK**	DATE: 2/10/82

Appendix XVII

Appendix XVI

CHLORIDE TEST RESULTS

AREA	Cl (mg/dm^2)	DATE	DPM N75M3 CRITERIA	NOTE
Exciter Windings (Gen End)	2.6	1-27	1.0	1
Exciter Windings (Armature)	0.62	1-29	1.0	1
Exciter Housing	0.03	1-31	1.0	2
Excitation BD #1 Outside	5.3	1-27	1.0	1
Excitation BD #1 Inside	0.27	1-31	1.0	1
Excitation BD #1 Inside	0.39	1-31	1.0	1
Neutral Cubical	0.12	1-28	1.0	2
Neutral CT	0.21	1-28	1.0	2
Generator CT Leads	1.9	1-27	1.0	1
Generator CT Main AΦT3	0.29	1-29	1.0	2
Generator CT Main AΦT6	0.21	1-29	1.0	2
Generator PT	0.26	1-27	1.0	1
1-L-40 Panel	0.35	1-28	1.0	1
0-L-31 Panel	0.52	1-28	1.0	1
1-L-279 Panel	0.50	1-29	0.08	1
2-L-279 Panel	2.0	1-29	0.08	1, 3
Unit BD 1 B Side	0.12	1-28	1.0	1
Unit BD 1 B Top	0.25	1-29	1.0	1
Unit BD 2 B Top	0.16	1-28	1.0	1
Lighting BD # 2	0.56	1-27	1.0	1
Local Control Station	0.62	1-27	1.0	1
Unit 1 Seal Oil Cooler	0.11	1-29	1.0	2
Generator TC Studs (Old)	4.4	1-28	1.0	1, 3
Generator TC Studs (New)	4.8	1-28	1.0	3
Generator TC Studs (Cleaned)	1.45	1-31	1.0	2, 3
Generator TC Panel	0.28	1-31	1.0	2
S.S. Inst. Lines (Near Trans)	1.5	1-27	0.08	2
S.S. Inst. Lines (Unit 2)	0.90	1-28	0.08	1
S.S. Piping (Near Trans)	0.14	1-27	0.08	2
S.S. Inst. Lines (Near Trans)	0.33	2-2	0.08	2, 3
Generator TC Studs	0.33	2-2	1.0	2
S.S. Piping East of T-3D	0.175	2-25	0.08	2
S.S. Piping North of Metering PT	0.518	2-25	0.08	2
S.S. Electrical Line T-3D	0.240	2-25	0.08	2
S.S. Line Near Value 1-6-550	0.048	2-25	0.08	2
S.S. Line Above I-L-40B	0.162	2-25	0.08	2
S.S. Line Around Corner from Neutral Grnd Trans	0.048	2-25	0.08	2
S.S. Line Off Exciter Cooler at 1-24-314	0.318	2-25	0.08	2
S.S. Above Neutral Grnd Trans	0.024	2-25	0.08	2

1 - Not cleaned when sample was taken.
2 - Cleaned
3 - High reading appears to be from background contamination.

APPENDIX XXI

Tennessee Valley Authority
Sequoyah Nuclear Plant
Unit #1

Report by R. E. Wilson, Westinghouse, Atlanta PGSD.
Reported to Ray Pogue, Westinghouse Engineer, Chattanooga PGSD.

1. Generator 3 Phase 60 HZ 1800 RPM, Stator Volts -24,000
   Exciter Volts -525
   Serial 1S-77P-760: KVA-1, 356, 200: Stator Amp. 32, 625;
   Power Facot - 0.90;
   Liquid Cooled Stator Winding: Rotor Amp. -8778

Unit was placed in commercial service - May 1, 1981.

2. Purpose of trip was to inspect the generator and exciter for damages and supervise repair.

   Condition of Equipmentas found:

ISOLATED PHASE BUS@TRANSFORMER
Failure @ disconnect link between Phase A & Phase C. Length of disconnect bus air gap is 18 1/2 inches with aluminum barrier between phases. Closest point to ground aluminum barrier was 8 1/2" to Phase A flange.

Bus top inspection cover and bottom inspection cover (at point of failure) blew off bending and fracturing welds but showed no sign of arc or burning. Inside flanges, A & C Phases, at 12 to 6 o'clock melted lips having bolt holes and damaged porcelain support insulators where closest to failure. The aluminum barrier had melted except for the outside end and half of bottom. The lower quarter of the bus enclosure had burned away at closest point of failure.

FAILURE @ GENERATOR
Isophase B flashed to main lead enclosure melting aluminum but not completely through. Isophase Bus, Phase B, 90° Section, had a hole burned in aluminum metal and some flex . . . . .

Continued on Page 2

joints burned. This section of aluminum bus was returned to Cincinnati for repair. All other sections of the bus appears in good condition.

Neutral Lead Enclosure
A hole was burned in the right end (facing exciter) of enclosure and adjacent C.T. conduit. CT wiring was burned inside conduit mounted to foundation wall.

Grounding Transformer
Was completely destroyed blowing open from the side of the case.

Resistor bank and enclosed bus to neutral enclosure appeared intact but covered with carbon and PCB.

Generator
Exciter End - End Turn Inspection

a. A number of diamond spacers cord ties broken.
b. About one half of the end turn phase blocks (Z Blocks) loose.
c. Movement of several end turn core blocks.
d. Much lubricating oil was present.
e. Black and grey grease at end turn blocks.

Turbine End

a. A few bottom coil cord ties were broken.
b. Two bottom coils of outer binder tape were broken at end of coronox paint about 1 o'clock position.
c. One loose phase block at 11 o'clock.
d. Two top coil diamond spacers had come out and were laying in the bottom of the generator. One diamond spacer had come out half its length.
e. Some movement at core blocks.
f. Several thermocouple leads were found broken at the water header. This problem existed before this incident.

Excitation System
Appeared in good condition.

4b. Mr. Paul Vaughan of Westinghouse STGTOD made a generator crawl through inspection, also.

Work done as follows:
Loose phase blocks were tightened with dacron felt and YQ epoxy resin.
Loose diamond spacers were reinstalled with dacron felt and YR epoxy resin.
Broken binder tape was painted over with YQ epoxy resin.
A thorough tightening is recommended during the scheduled fall outage when the rotor is to be removed.

A 2500 V-DC test of each stator phase for 1 minute revealed resistance to ground to be 14 megohms, 14.5 megohms and 15 megohms on Phase T1, T2 and T3, respectively.

A 32 KV-AC potential was applied between each stator phase and ground for 1 minute with no evidence of breakdown.

Oil was wiped from baffles as accessible.

The customer conducted and recorded the excitation system tests. The system was meggered at 500 V-DC and had 1000+ megohms to the shaft.

Each diode was checked for a short and the resistor value checked on each fuse. No problem was found.

A 130V-AC pole drop test on exciter field poles revealed all drops to be within 6 to 7.5 V-AC except one at 2.5 V-AC. This coil should be replaced at next scheduled outage.

One current limiting resistor was grounded and was to be replaced by borrowed resistor from TVA Watts Bar Plant.

All work and supervision was done by TVA except for generator stator winding repair.

4c. <u>Material used from Atlanta stock:</u>
2 Rolls Dacron Felt, 0.125" x 2" 41475 BD

2 Rolls Glass Twine 41324AB40T

1 Coil Repair Kit 304P595 G01

4 Qt. 53841YR Epoxy

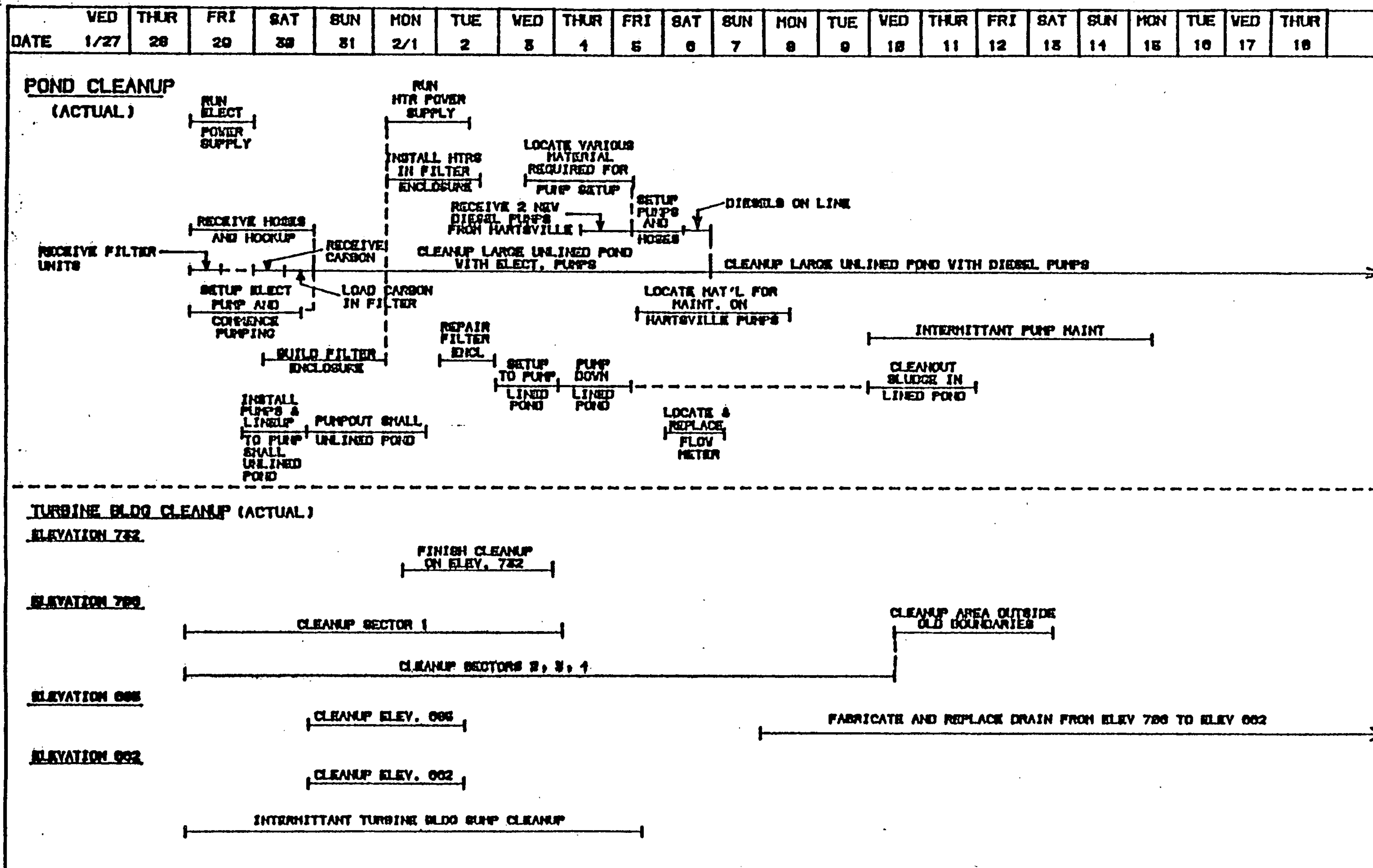
4 Pt. 53841YQ Epoxy

1 Gallon 32230 CP00Y Paint

5 Gallons 51500 CP00A Thinner

R. E. Wilson
Atlanta PGSD

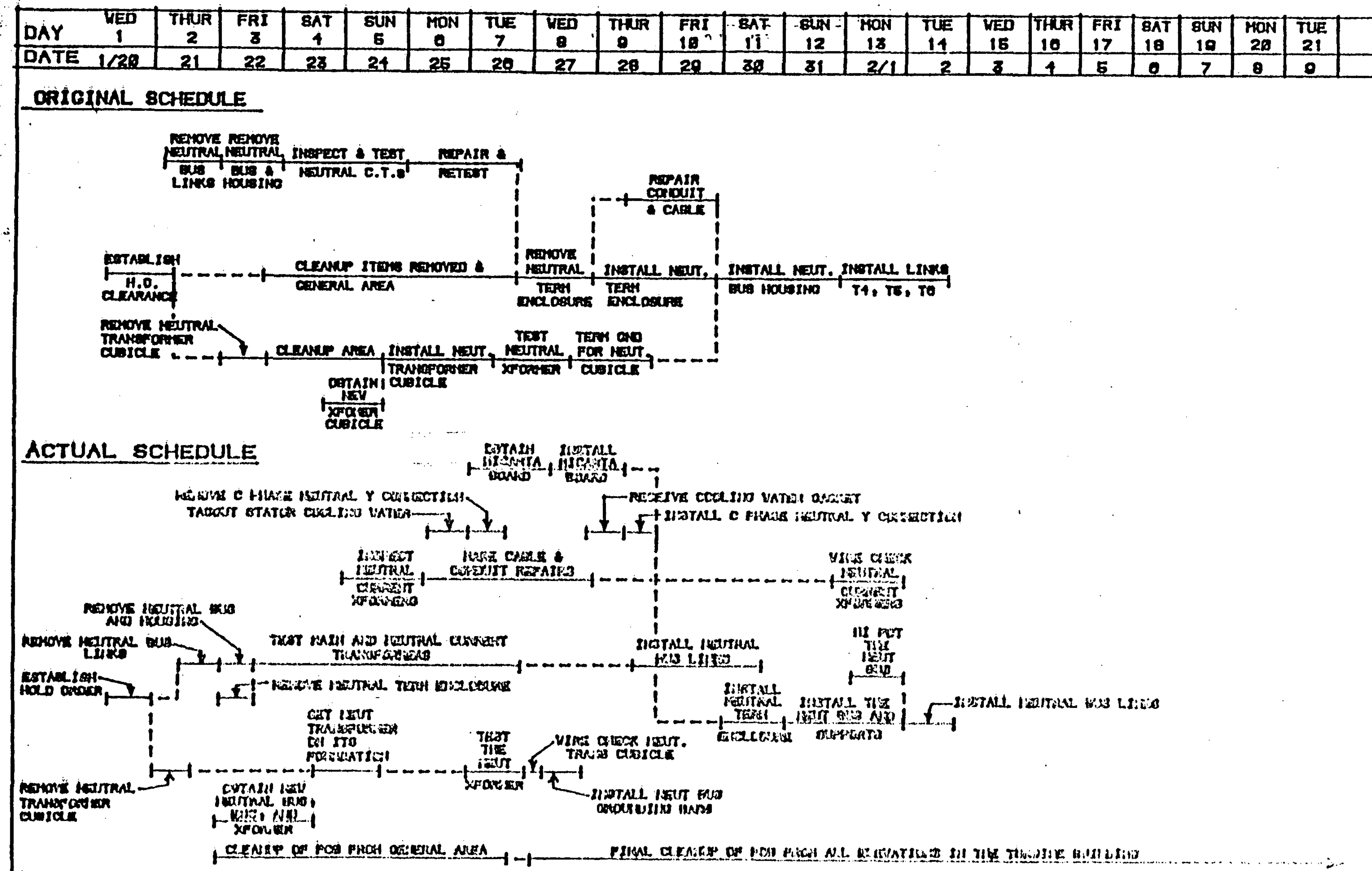
APPENDIX XX



P.C.B. CLEANUP SCHEDULES

DATE: 2/10/82

APPENDIX XVIII



BLACK - ESTIMATED SCHEDULE
RED - ACTUAL SCHEDULE

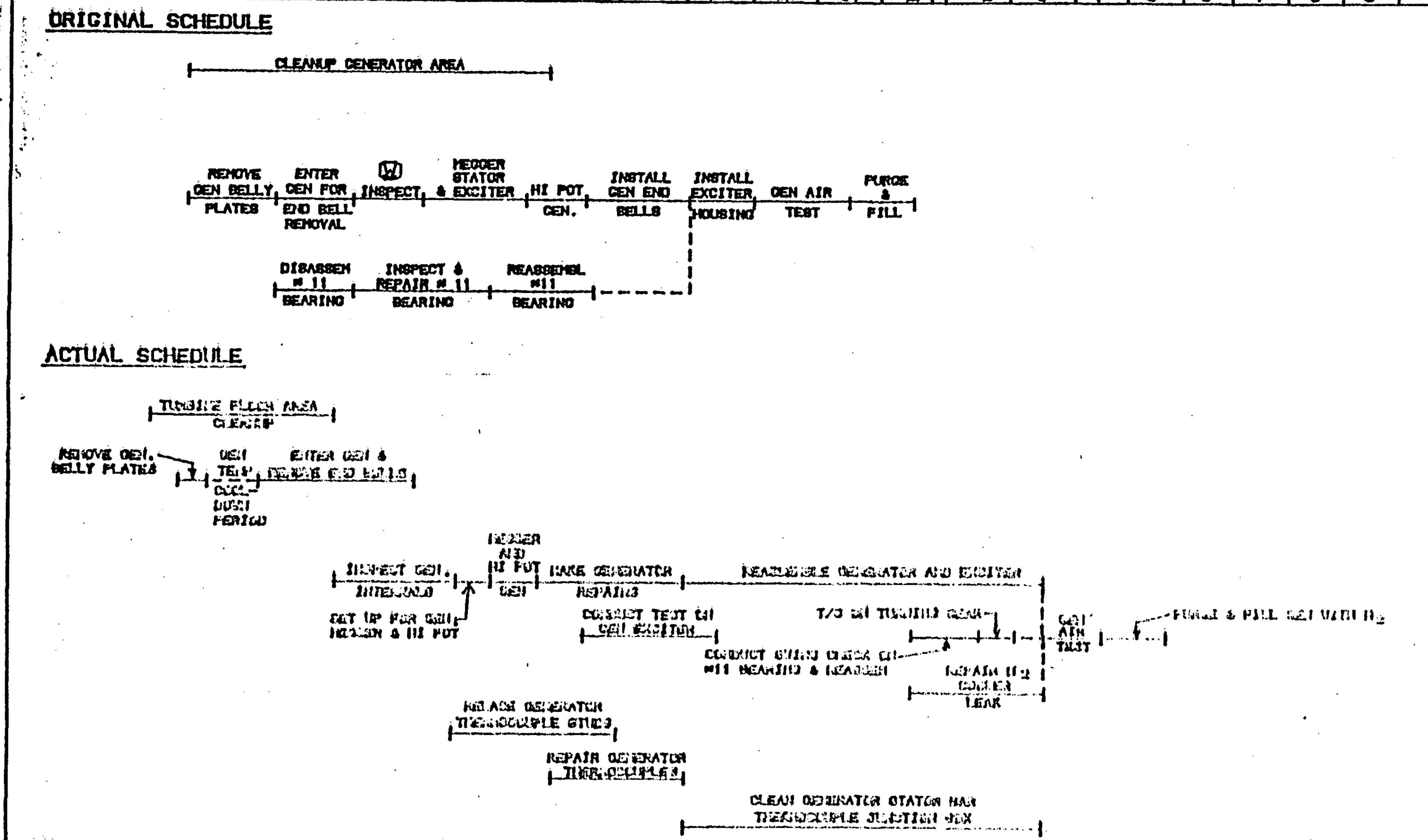
NEUTRAL BUS WORK

DATE: 2/10/82

Appendix XVIII

APPENDIX XIX

DAY	WED 1	THUR 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THUR 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THUR 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	
DATE	1/20	21	22	23	24	25	26	27	28	29	30	31	2/1	2	3	4	5	6	7	8	9	



BLACK - ESTIMATED SCHEDULE
RED - ACTUAL SCHEDULE

GENERATOR WORK

DATE: 2/10/82

Appendix XIX

APPENDIX XV

Appendix XV

Procedure For Packaging PCB
Contaminated Waste In Preparation
For Transit

1. All PCB waste (liquid or solid) shall be sealed in containers prior to transport. Sealable steel drums shall be used for all liquid waste. If solid waste will not fit into a sealable steel drum, plywood boxes lined with plastic shall be used. Any solid waste will be wiped clean of excess liquid prior to being packed.

2. Each sealed steel drum shall be wiped clean prior to transporting it from the PCB contaminated area to the staging area (area roped off in south end of turbine building, elevation 702). The staging area floor shall be protected by herculite. Lined plywood boxes will not be cleaned unless deemed necessary by the results of wipe samples.

3. Representative wipe samples shall be taken of the exterior of drums prior to transport. Twenty percent of the total number of drums per shipment shall have wipe samples taken. The exterior of each lined plywood box shall be checked for PCB contamination via wipe samples.

4. The minimum acceptable limit of PCB contamination on the exterior surfaces of shipping containers shall be 10 $\mu g/ft^2$ (micrograms per square foot) as determined by the wipe samples. If this level is not acceptable to any party involved in the transport, a mutually acceptable level shall be furnished in writing by the objecting party. Chemical goggles and coveralls shall be worn by employees handling the drums while loading and unloading the transport truck.

5. A final inspection shall be conducted of the exterior of each container prior to transport to identify and repair any leaking containers. A swipe test according to item 2 shall be performed on leaking drums following repairs and cleaning.

6. Each shipping container and the transport vehicle shall be labeled in accordance with SQ126 (attached).

7. During the unloading of the transport vehicle at its termination point, a visual inspection of each shipping container shall be conducted to ensure no damage in transport.

Edward Gill for
C. C. Mason

VMT:LAS
1/29/82