

NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-295/90024(DRP); 50-304/90026(DRP)

Docket Nos. 50-295; 50-304

Licenses No. DPR-39; DPR-48

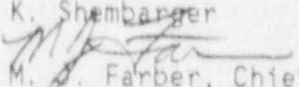
Licensee: Commonwealth Edison Company
Opus West III
1100 Opus Place
Downers Grove, IL 60515

Facility Name: Zion Nuclear Generating Station, Units 1 and 2

Inspection At: Zion, Illinois

Inspection Conducted: October 14 through December 11, 1990

Inspectors: J. D. Smith
R. J. Leemon
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Approved By:  M. J. Farber, Chief
Reactor Projects, Section 1A

1/4/91
Date

Inspection Summary

Inspection from October 14 through December 11, 1990 (Reports No. 50-295/9002 (DRP); No. 50-304/90026(DRP))

Areas Inspected: Routine, unannounced resident inspection of licensee action on previous inspection findings; summary of operations; operational safety verification and engineered safety feature (ESF) system walkdown; surveillance observation; maintenance observation; engineering and technical support; safety assessment and quality verification; overtime assessment; licensee event reports (LERs); and training.

Results: Of the 10 areas inspected, no violations or deviations were identified in 8 areas. One example of a previous violation for failure to post and barricade contaminated areas was identified (Paragraph 4.e), as was one deviation from a commitment to not exceed NRC and corporate overtime guidelines without prior management approval (Paragraph 9).

In the area of plant operations, licensee performance remains constant. The unit operator's response to the unit 2 reactor trip on November 11 was good. The licensee conservatively decided to take Unit 1 off-line prior to reaching the Technical Specification (TS) limit of 10 gpm identified leakage. The control room reorganization appears to be effective with some positive results observed. The Control Room Unit Supervisors allow for closer supervision of the units;

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however, excessive personnel and noise was observed during a Unit 1 load reduction and test. One crew maintained very good order and control of personnel during a Unit 2 return to service and the operators were very professional.

The licensee performed an extensive number of surveillances which involved outage related, startup and normal routine surveillances. Some problems occurred during a test of the OB diesel driven fire pump which resulted in damage to the pump, the rolling of an emergency diesel generator (EDG) after the completion of a surveillance, and the performance of a reactor trip breaker test. More management attention is warranted during the performance of surveillances.

One weakness was identified for work performed on two Anchor Darling check valves. These valves are inspected by the licensee during the March outage and developed leaks which were caused by inadequate work packages. Good work planning and maintenance performance to repair equipment which placed the units on tight limiting conditions for operation (LCO) time clocks were observed. No major concerns were noted during the performance of routine maintenance.

Engineering provided good support to the operations staff in the monitoring of the Unit 1 leakage to the pressurizer relief tank (PRT). The technical staff support to identify the root cause of the Unit 1 control rod slippage was considered a strength. The technical staff was also very involved in the determination of root causes of the multiple EDG problems. The technical staff has been proactive in responding to the NRC concerns and requests.

Communication between the licensee and the NRC was good during the failure of the Unit 2 station auxiliary transformer, the major oil leak on the 0 EDG, and the Unit 1 reactor coolant system leak. In contrast, routine control room tours by plant management are not frequent enough to effectively evaluate the operation of the plant.

DETAILS

1. Persons Contacted

- *T. Joyce, Station Manager
- *T. Rieck, Superintendent, Technical
- *W. Kurth, Superintendent, Production
- R. Budowle, Onsite Nuclear Safety
- T. Broccolo, Director, Services
- D. Karjara, Director, Performance Improvement
- W. Stone, Assistant to Technical Superintendent
- D. Redden, Assistant to Production Superintendent
- P. LeBlond, Assistant Superintendent, Operations
- R. Johnson, Assistant Superintendent, Maintenance
- J. LaFontaine, Assistant Superintendent, Work Planning
- D. Wozniak, Project Manager, ENC
- T. Vandervoort, Quality Assurance Supervisor
- *C. Schultz, Quality Control Supervisor
- *R. Chrzanowski, Regulatory Assurance Supervisor
- W. T'Niemi, Technical Staff Supervisor
- R. Smith, Security Administrator
- T. Saksefski, Regulatory Assurance
- N. Valos, Unit 2 Operating Engineer
- W. Demo, Unit 1 Operating Engineer
- M. Carnahan, Unit 0 Operating Engineer
- W. Mammoser, PWR Projects

NRC

- *M. Farber, Site Director, NRC

* Indicates persons present at the exit interview on December 11, 1990.

The inspectors also contacted other licensee personnel including members of the operating, maintenance, security, and engineering staff.

2. Licensee Actions on Previous Inspection Findings (92701, 92702)

Violations

(Closed) Violation (304/89002-07(DRP)): Taking the unit to mode 1 and 2 while relying on the action statement of TS 3.3.1.F. The event was the result of a misapplication of TS 3.0.4. The corrective actions, which include training of the senior reactor operators and revision of TS to reflect Generic Letter 87-09, have been completed. This violation is considered closed.

(Closed) Violation (304/89015-01(DRP)): Failure to follow procedures which resulted in an uncontrolled gas release. The review of corrective actions was only documented for Unit 1 in inspection report 295/90017, and the violation was considered closed. Correspondingly, this violation can be closed for Unit 2.

(Closed) Violation (304/89015-04(DRP)): The review of the licensee commitment to review all non-safety related instrument mechanic procedures was documented only for Unit 1 in inspection report 295/90017, and the violation was considered closed. Correspondingly, this violation can be closed for Unit 2.

(Closed) Violation (295/90003-1A(DRP)): Cavitation of the 1A auxiliary feedwater (AFW) pump due to an inadequate procedure and personnel error. The licensee revised the surveillance procedure and conducted an all-plant "Standdown" to address personnel errors. This violation is considered closed.

(Closed) Violation (295/90003-1B(DRP)): Improper alignment of the 1B AFW pump due to personnel error. The corrective actions as stated in the licensee response to the violation have been completed. This violation is considered closed.

(Closed) Violation (304/90003-01(DRP)): Failure to follow procedure. The mechanic involved was disciplined and discussions were held in each department on the importance of procedure adherence. Licensee actions appear to be adequate to consider the violation closed.

Unresolved Items

(Closed) Unresolved Item (304/88019-07(DRP)): Resolution of the identified environmental qualification deficiencies in DVR 1-88-109. Only the associated Unit 1 unresolved item was closed in a previous inspection report (295/90017(DRP)). Correspondingly this unresolved item can be closed for Unit 2.

(Closed) Unresolved Item (304/89013-01(DRP)): Review of the licensee's interim measures to improve work packages. The review of the licensee's interim measures to improve work packages was closed out in inspection report 295/90009; 304/90010 and only closure of the unresolved item for Unit 1 was documented in inspection report 295/90017. Correspondingly, this unresolved item can be closed for Unit 2.

(Closed) Unresolved Item (295/89034-04(DRP)): Senior reactor operator limited supervising a core off-load with an inactive license. An inspection of the licensed operator training program was conducted and was documented in inspection report (295/89040(DRS); 304/89026(DRS)). Enforcement action and a confirmatory action letter were issued and subsequently closed. This unresolved item is considered closed.

(Closed) Unresolved Item (295/90017-01(DRP); 304/90019-01(DRP)): Review of the licensee's overtime practices and corrective actions to meet Generic Letter 82-12, "Nuclear Power Plant Staff Working Hours." This issue is further discussed in Paragraph 9, and will be tracked as a Deviation (295)90024-01(DRP); 304/90026-01(DRP). This unresolved item is considered closed.

Open Items

(Closed) Open Item (304/88023-04(DRP)): Inconsistencies identified in the implementation of temporary procedure changes. The licensee revised the administrative procedure to provide guidance on implementation of temporary procedure changes and provided licensed operators additional training. This open item is considered closed.

(Closed) Open Item (304/89015-03(DRP)): Evidence of small tube fretting was found on the 1B EDG. Violation (295/89200-01F) was issued to address this issue. Closure of only the open item for Unit 1 was documented in inspection report 295/90017; 304/90019. Correspondingly, this open item can be considered closed for Unit 2.

(Closed) Open Item (295/89029-01(DRP); 304/89026-01(DRP)): Isolation valve seal water tank controllers found inoperable due to personnel error. The corrective actions implemented appear to be adequate to prevent recurrence. This open item is considered closed.

(Closed) Open Item (304/90003-04(DRP)): 2A AFW turbine tripped due to water slug in steam line. On March 6, 1990, the 2A AFW pump tripped on overspeed due to water which was trapped in the steam line. To prevent recurrence, Modification M22-2-90-502 was completed, which replaced the low point steam drain lines, traps and valves. In addition, Modification M22-2-87-28 was generated to provide a better drain path. The licensee actions appear to be adequate to consider this open item closed.

No violations or deviations were identified.

3. Summary of Operations

Unit 1

The unit operated at power levels up to 100% power until November 4, 1990, when power was reduced to recover the control bank D control rod H-08 which had slipped in twenty steps from the other rods in the bank. On November 6, an unusual event was declared when the unit was brought to hot shutdown due to the inoperability of the 0 and 1A EDGs. On November 9, the unusual event was terminated after repairs and successful operability tests were completed on both EDGs. During this forced outage, a body to bonnet leak on a safety injection accumulator check valve developed and was repaired. On November 12, the unit was synchronized to the grid. On November 17, increased leakage to the PRT from the reactor coolant system (RCS) was identified and monitored by the licensee.

On November 27, at 10:38 a.m. (CST), the unit was placed on a 5 hour LCO clock to be in hot shutdown in accordance with TS 3.15.2.H. due to the inoperability of both the 1B EDG (to replace the manual start valve) and the reserve power source (the Unit 2 system auxiliary transformer (SAT)). At 2:10 p.m., the unusual event was terminated when the 1B EDG was declared operable. Later on that day, at 8:50 p.m., another unusual event was declared when the unit was again placed on a five hour LCO clock to be in hot shutdown when the 0 EDG developed a severe lube oil leak. The

unusual event was terminated at 1:26 a.m. on November 28, when the O EDG was declared operable after the replacement of the lube oil flexitallic hose and a successful operability surveillance.

The unit resumed operation to full power until December 4, when the RCS leakage to the PRT increased to approximately 7 gpm. The licensee conservatively decided to take the unit off-line to investigate and repair the leakage. On December 4, a unit ramp down commenced and the reactor was manually tripped. On December 5, at 11:35 a.m., an unusual event was declared when the licensee determined that the RCS identified leak rate was greater than 10 gpm. In accordance with TS 3.3.3, the licensee commenced a slow cooldown toward cold shutdown. At 9:00 p.m., the unusual event was terminated when the leak rate was reduced to 0.6 gpm. On December 6, the licensee decided to continue the cooldown to cold shutdown to repair the loop A reactor bypass valve, which was determined to be the source of the leakage. On December 8, the licensee completed repairs to the valve and began repressurizing the system.

Unit 2

The unit entered this inspection period in hot shutdown in a forced outage due to the September 22, 1990, main transformer fire. On November 2, Unit 2 was taken critical and synchronized to the grid on November 3 after completion of the turbine overspeed test. On November 5 at 4:03 p.m., during an operability surveillance, the O EDG immediately tripped. In accordance with TS 3.8.2.D, the O EDG failure placed the unit on a 4 hour LCO clock to be in hot shutdown since the 2A safety injection (SI) pump was also inoperable. An unusual event was declared at 5:00 p.m. and a unit ramp down commenced. The unusual event was terminated at 6:17 p.m. when the 2A SI pump was successfully tested and declared operable. The unit had remained on line during this event and operated routinely for the following week.

On November 11, a leak in the diaphragm of the main turbine bearing oil pressure trip block developed which caused a low bearing oil turbine trip and subsequent reactor trip. On November 13, the unit was synchronized back onto the grid. On November 14, a high condenser differential pressure caused a degraded vacuum condition. The licensee reduced power to 50% to facilitate condenser tube sheet cleaning. On November 18, a leak in the heater drain tank rupture disc developed which caused the licensee to take the unit off-line for repair. The unit remained in mode 2, hot standby until November 19 when the unit was synchronized to the grid.

On November 27, at 10:00 a.m., the Unit 2 SAT experienced an external fault which placed the unit on a 48 hour LCO in accordance with TS 3.15.2.A. Later, at 8:50 p.m., the O EDG was declared inoperable; thus, placing the unit on a 5 hour LCO clock to hot shutdown in accordance with TS 3.15.2.H. An unusual event was declared and a unit ramp down was commenced. The unusual event was terminated at 1:26 a.m. when the repairs to the O EDG were completed. The SAT was returned to service during the day on November 28. The unit operated at power levels up to 100% power for the remainder of the inspection period.

No violations or deviations were identified.

4. Operational Safety Verification and Engineered Safety Features System Walkdown (71707 & 71710)

a. Operational Safety

During the inspection period between October 14 through December 8, 1990, the inspectors verified that the facility was being operated in conformance with the licenses and regulatory requirements and that the licensee's management control system was effectively carrying out its responsibilities for safe operation. This was done on a sampling basis through routine direct observation of activities and equipment, tours of the facility, interviews and discussions with licensee personnel, independent verification of safety system status and limiting conditions for operation action requirements (LCOARs), corrective action, and review of facility records.

On a sampling basis the inspectors daily verified proper control room staffing and access, operator behavior, and coordination of plant activities with ongoing control room operations; verified operator adherence with the latest revisions of procedures for ongoing activities; verified operation as required by TS; including compliance with LCOARs, with emphasis on ESF and ESF electrical alignment and valve positions; monitored instrumentation recorder traces and duplicate channels for understanding, off-normal condition, and corrective actions being taken; examined nuclear instrumentation and other protection channels for proper operability; reviewed radiation monitors and stack monitors for abnormal conditions; verified that onsite and offsite power was available as required; observed the frequency of plant/control room visits by the station manager, superintendents, assistant operations superintendent, and other managers; and observed the Safety Parameter Display System for operability [and general observations of control room, housekeeping, etc.]

The resident inspectors observed that on several occasions during the Unit 1 unloading and overspeed trip testing, the unit operator requested that extra personnel leave the control room to eliminate distractions. In contrast, during the startup of Unit 2, very good order and control of the personnel in the control room were maintained and the operators responded very professionally.

b. ESF Systems (71710)

During the inspection, the inspectors selected accessible portions of several ESF systems to verify status. Consideration was given to the plant mode, applicable TS LCOARs, and other applicable requirements.

Various observations, where applicable, were made of hangers and supports; housekeeping; whether freeze protection, if required, was installed and operational; valve position and conditions; potential ignition sources; major component labeling, lubrication, cooling, etc.; whether instrumentation was properly installed and functioning and significant process parameter values were consistent with expected values; whether instrumentation was calibrated; whether necessary

support systems were operational; and whether locally and remotely indicated breaker and valve positions agreed.

During the inspection, the accessible portions of the AC electrical power system; DC electrical power system; reactor protection system; residual heat removal system; containment and support system; safety injection systems; letdown and charging systems; accumulator systems; radiation monitoring system; service water system; component cooling water system; main and auxiliary steam system; condensate, feedwater system; process sampling system; circulating water system; main generator system; diesel generator and auxiliaries system; plant fire protection system; fuel handling system; and control room system were inspected to verify operability. The inspectors verified the operability of selected emergency systems, reviewed tagout records, and verified proper return to service of affected components. Tours of the auxiliary and turbine buildings were conducted to observe plant equipment conditions, including potential fire hazards, fluid leaks, and excessive vibrations and to verify the maintenance requests had been initiated for equipment in need of maintenance.

c. Onsite Event Follow-up (93702)

Unit 1 Events:

Outage Greater Than 72 Hours for Unit 1 Due to EDG Inoperability and RCS Leakage

On November 7, during a required surveillance, the 1A EDG immediately tripped due to a faulty control room control switch. The 1A EDG failure required the licensee to enter technical specification 3.0.3 which placed the unit in a 4 hour LCO clock to be in hot shutdown since the 0 EDG was also inoperable. An unusual event was declared at 2:15 p.m. and a unit ramp down commenced. At approximately 4:35 p.m., the control room operators manually tripped the reactor.

The 0 EDG was declared operable on November 8 after replacement of a leaking manual start valve. The 1A EDG was declared operable on November 9 after the replacement of a faulty start switch on the main control board. On November 12, Unit 1 was placed online after the completion of the main turbine overspeed test.

Unit 1 Excessive RCS Leakage

On November 16, Unit 1 was placed on 24 hour clock per TS 3.3.3.A. when the unidentified RCS leakage was confirmed to be greater than 1 gpm. The licensee determined that the leakage started to increase approximately 6 hours prior to this by reviewing the volume control tank level recorder. Further investigation showed an increase in the rate of PRT level change. The LCO was terminated when the technical staff identified the leakage and determined the total unidentified leakage to be 0.03 gpm. The technical staff continued to monitor the leakage for a possible trend.

On December 4, the licensee commenced a Unit 1 shutdown due to an increase in identified RCS leakage. The unit was operating at full power at the time shutdown commenced and the reactor was manually tripped at 7:16 p.m. The leakage was identified to be approximately 7 gpm into the PRT. The source of leakage was the RCS loop A reactor bypass motor operated valve stem leak-off. An information only emergency notification system (ENS) phone call was made at 4:42 p.m. due to the unit shutdown. The licensee attempted to stop the leakage by backseating and tightening the valve packing gland but were unsuccessful. During the maintenance activities, the leak rate increased to greater than 10 gpm. The unit was brought to cold shutdown to facilitate further maintenance on the valve.

Unit 1 Turbine Trip at less than 10% Power from Loss of Vacuum

On November 12, during performance of Unit 1's main turbine overspeed trip surveillance, loss of condensers vacuum resulted in a turbine trip. The reactor did not trip since the plant was less than 10% power at the time. Prior to the event, the unit was operating at 40% power for turbine conditioning. The moisture separator reheaters (MSRs) were preheated and ready to be placed in-service with the sealing steam isolated to the MSRs reliefs. Power was reduced to less than 10% to accommodate the overspeed test. The steps in the "Power Operation" (GOP 3) procedure that required removing the MSRs from service were incorrectly marked "not applicable" by the Unit 1 operation management since the substeps within this step required the sealing steam to be reapplied to the MSR relief valves. The lack of sealing steam to the relief valves caused a loss of condenser vacuum and a subsequent turbine trip when the unit was taken off-line. The licensee has classified this event as a "near miss." The resident staff will review the results of the "near miss" evaluation.

Unit 2 Events:

Unit 2 Startup from the September 22 Transformer Fire

On November 2, Unit 2 was taken critical and was synchronized to the grid on November 3 after completion of the overspeed test. The unit was returning from a trip which occurred on September 22 due to a catastrophic failure of the Unit 2 main transformer. The transformer was replaced and tested; portions of the 25 kV duct work were also replaced and inspected during the forced outage.

Unusual Event Due to 0 EDG and 2A SI Pump Inoperable

On November 5, the 0 emergency diesel generator (EDG) was started and then immediately tripped during a surveillance test. At the time of the event, the 2A SI pump had been declared inoperable due to low recirculation flow during its operability test; therefore, requiring operability testing to be performed on other safety systems. The 0 EDG failure placed the unit on a 4 hour LCO clock to be in hot shutdown if either the 0 EDG or 2A SI pump was not returned to service. An unusual event was declared at 5:00 p.m. and power was reduced from

50% to 30%. During the troubleshooting activities, the 0 EDG rolled when the emergency solenoid vent was covered by the maintenance personnel. The 0 EDG's manual start valve was found leaking air. The other EDG's were inspected for leakage, and a work request was written to replace the manual start valve on 1G EDG.

The licensee performed a subsequent surveillance on the 2A SI pump at which time the minimum recirculation flow acceptance criteria was met. The licensee terminated the unusual event at 6:17 p.m. This low recirculation flow for the 2A safety injection pump is considered an open item (304/90026-02(DRP)) pending further licensee evaluation.

Near Miss From Loss of Unit 2 Condenser Vacuum

On November 18, with Unit 2 at 45% power, the condenser vacuum decreased rapidly. The operator immediately started all three vacuum pumps on the Unit 2 condenser air removal header which failed to stop the decrease. A unit ramp down commenced at a rate of 2% per minute. Twenty minutes later, condenser vacuum was recovered and the unit was returned to 48% power. The loss of condenser vacuum coincided with the removal of a main condenser water box manway to repair the gasket and the manway's reinstallation. This event was considered a near miss by the licensee, and was evaluated. The circulating water system water box priming system was connected to the condenser off gas vacuum system through leaking valves which caused the vacuum to decrease. These valves will be evaluated for leakage by the technical staff. The resident inspectors will review the results of this evaluation.

Common Unit Events:

Unusual Events due to Inoperable Unit 2 SAT and EDG

On November 27, the Unit 2 SAT experienced an external fault for an unknown cause. All systems responded as expected with the exception of the 2B circulating water pump tripping and the flow control valve for instrument air to the Unit 2 containment isolating during the autobus transfer to the unit auxiliary transformer. The unit was at approximately 100% power at the time of the event. The failure of the SAT placed the unit on a 48 hour clock to be in hot shutdown in accordance with TS 3.15.2.A.

At the time of the unit 2 SAT failure, the 1B EDG was out of service due to replacement of the manual air start valve. With both the reserve power source (the unit 2 SAT), and the 1B EDG inoperable, unit 1 was placed on a 5 hour clock to be in hot shutdown in accordance with TS 3.15.2.H. At 10:38 a.m., an unusual event was declared due to the forced shutdown and a ramp down was established. At 2:10 p.m., the unusual event was terminated when the 1B EDG was declared operable. With the 1B EDG returned to service, the unit was returned to the 48 hour clock to be in hot shutdown in accordance with TS 3.15.2.A.

During the operability surveillance required by TS 3.15.2.A, the 0 EDG was declared inoperable due to a lube oil leak caused by a failed flexitallic coupling. The failure of the 0 EDG placed both units on a 5 hour clock to be in hot shutdown in accordance with TS 3.15.2.H. An unusual event was declared at 9:12 p.m. due to the required shutdowns. The consequences of the Unit 2 shutdown with the SAT inoperable is significant. With the SAT inoperable, the electrical loads for Unit 2 were being supplied by the unit auxiliary transformer. The shutdown would require a cool down through natural recirculation since the reactor coolant pumps are non-essential loads and would not have an electrical source if the unit was taken off-line. The licensee held the unit at approximately 50% power until the 0 EDG was declared operable. The unusual event was terminated on November 28 at 1:26 a.m. when the 0 EDG was declared operable after the replacement of the lube oil flexitallic coupling and a successful operability surveillance. The SAT was returned to service later that day and the unit resumed operation to 100% power.

d. Current Material Condition (71707)

The inspectors performed general plant as well as selected system and component walkdowns to assess the general and specific material condition of the plant, to verify that Nuclear Work Requests had been initiated for identified equipment problems, and to evaluate housekeeping. Walkdowns included an assessment of the buildings, components, and systems for proper identification and tagging, accessibility, fire and security door integrity, scaffolding, radiological controls, and any unusual conditions. Unusual conditions included but were not limited to water, oil, or other liquids on the floor or equipment; indications of leakage through ceiling, walls or floors; loose insulation; corrosion; excessive noise; unusual temperatures; and abnormal ventilation and lighting.

e. Radiological Controls (71707)

The inspectors verified that personnel were following health physics procedures for dosimetry, protective clothing, frisking, posting, etc., and randomly examined radiation protection instrumentation for use, operability, and calibration.

Due to the numerous problems with the radiation monitors, the licensee established a task force to address these issues. Periodic meetings are held to discuss the status of the work planned for radiation monitors that were on LCO clocks. Corporate management has shown a greater interest in this area, and they have provided an individual to monitor and ensure that the required resources are applied to this area.

On October 23, the inspector identified an unposted and unbarricaded contaminated area near the 2A AFW pump steam supply valve. Contaminated water with boric acid, apparently from the primary sample room above, had leaked down the floor piping penetration onto the valve diaphragm, valve handwheel and adjacent piping. Smears taken after the resident

inspector notified the licensee revealed contamination readings up to five times the licensee's administrative posting requirements. This condition had apparently existed for some time as evidenced by the boric acid crystals on the piping and valve actuator. A laundry tag dated October 10, 1990 indicated that calcium or boric acid crystals had formed from a leak on the valve; however, health physics personnel were not contacted to perform a survey for contamination.

A recent inspection (295/90022(DRSS)); 304/90024(DRSS)) identified several examples of failure to properly post and barricade contaminated areas in accordance with ZRP 1101-12, "Radiological Posting, Labels, Indicators and Their Use," which resulted in a violation (295/90022-06(DRSS); 304/90024-06(DRSS)). Corrective actions in this area are ongoing; thus this recent example of failure to identify, post and barricade a contaminated area is considered to be another example of the above violation. However, in their response to the violation, the licensee did not address actions regarding the identification of new contaminated areas such as those created by spills originating from the floors above. The residents were also concerned that this condition was not identified through the zone inspection program or by the laundry tag program which identified a buildup of calcium or boric acid crystals. The licensee indicated that the response to the violation would be revised to address these additional concerns.

f. Security (81064)

Each week during activities or tours, the inspector monitored the licensee's security program to ensure that observed actions were implemented in accordance with the approved security plan. The inspector noted that persons within the protected area displayed proper photo-identification badges and those individuals requiring escorts were properly escorted. The inspector also verified that checked vital areas were locked and alarmed. Additionally, the inspector also verified that observed personnel and packages entering the protected area were searched by appropriate equipment or by hand.

The licensee performed a complete and thorough investigation and maintained good communication with the NRC in response to a drug-related allegation received through the resident inspector's office.

g. Assessment of Plant Operations

In the area of plant operations, the licensee's performance remains constant. The unit operators response to the Unit 2 reactor trip on November 11 was good. The licensee conservatively decided to take Unit 1 off-line prior to reaching the TS limit of 10 gpm identified leakage when RCS leakage to the PRT had increased. The control room reorganization appears to be effective with some positive results observed. An example is the Control Room Unit Supervisors allow for closer supervision of the units. However, excessive personnel and noise was observed during a Unit 1 load reduction and test. One crew maintained very good order and control of personnel during a Unit 2 return to service and the operators were very professional.

One violation was identified in the radiation protection area; however, a similar violation was issued in a recent inspection report. The violation discussed above is considered to be another example of violation (295/90022-06(DRSS); J04/90024-06(DRSS)).

5. Monthly Surveillance Observation (61726)

The inspector observed TS required surveillance testing on the various systems and verified whether testing was performed in accordance with adequate procedures, whether test instrumentation was calibrated, whether LCOs were met, whether removal and restoration of the affected components were accomplished, whether test results conformed with TS and procedure requirements and were reviewed by personnel other than the individual directing the test, and whether any deficiencies identified during the testing were properly reviewed and resolved by appropriate management personnel.

The inspector also witnessed portions of the following test activities:

- PT-5 Reactor Protection Logic Test
- PT-10 Safeguard Logic Test
- PT-11 Diesel Generator Loading Test

The inspector found these tests to be performed in an acceptable manner.

a. Surveillance Events

Diesel Driven Fire Pump Failure

During PT-10, "Safeguards Actuation Testing," the OB diesel driven fire pump failed due to a total loss of oil pressure. Prior to the event, the OB fire pump was placed out of service for an oil and oil filter change. The pump was partially cleared to perform PT-10 after the completion of a maintenance run. During the surveillance test, control room alarms were received and an event operator was dispatched to investigate. No oil was found in the crankcase due to a leaking lube oil filter gasket causing significant damage to the diesel. Inspection revealed that the oil filter gasket was rolled over which resulted from improper installation of the filter. The diesel was returned to the manufacture for repair. A Human Performance Evaluation System Analysis is being conducted for the improper installation of the filter.

Inadvertently Tripped Reactor Trip Breaker - Unit 2

On November 21, with Unit 2 at 99% power an auxiliary operator inadvertently tripped the "B" reactor trip breaker while verifying it closed. No reactor trip occurred due to the bypass breaker "B" being closed at the time. The breaker tripped when returning the reactor trip and bypass breakers to normal after concluding the train "B" performance test. The breaker trip occurred when the operator lifted the latch lever to verify that the reactor trip breaker was closed.

The licensee investigation indicated that the breaker may not of been racked in properly. This event is considered an open item (304/90026-03(DRP)) pending review of the root cause analysis.

b. Assessment of Surveillances

The licensee performed an extensive number of surveillances which involved outage related, startup and normal routine surveillances. Some problems occurred during a test of the OB diesel driven fire pump which resulted in damage to the pump, and the performance of a reactor trip breaker test. More management attention is warranted during the performance of surveillances.

No violations or deviations were identified. One OPEN item on the inadvertent trip of the reactor trip breaker was identified.

6. Monthly Maintenance Observation (62703)

Station maintenance activities affecting the safety-related systems and components listed below were observed/reviewed to ascertain that they were conducted in accordance with approved procedures, regulatory guides and industry codes or standards, and in conformance with TS.

The following items were considered during this review: the LCO were met while components or systems were removed from and restored to service; approvals were obtained prior to initiating the work; activities were accomplished using approved procedures and were inspected as applicable; functional testing and/or calibrations were performed prior to returning components or systems to service, quality control records were maintained; activities were accomplished by qualified personnel; parts and materials used were properly certified; radiological controls were implemented; and fire protection controls were implemented. Work requests were reviewed to determine the status of outstanding jobs and to assure that priority is assigned to safety-related equipment maintenance which may affect system performance.

a. Maintenance Events

Forced Shutdown of Unit 2 for Equipment Repair

On November 18, a leak in the heater drain tank rupture disc developed. A forced shutdown was started with a slow ramp down, and the unit was taken off-line at 6:30 p.m. but the reactor was kept critical. On November 19, the rupture disc was replaced and Unit 2 was synchronized to the grid. A vendor representative of the disc was on site and inspected the rupture disc. The cause of the rupture disc failure is under investigation by the licensee.

Unit 2 Reactor Trip due to a Leaking Diaphragm

On November 11, Unit 2 had a turbine trip and a subsequent reactor trip. A leak in the diaphragm of the turbine bearing oil pressure

trip block caused a low bearing oil turbine trip. The licensee repaired the diaphragm and the unit was placed back on line on November 13. The cause of the diaphragm failure is believed to be from aging. Investigation indicated that the diaphragm last replaced was in 1986; however, the vendor recommends an inspection of the diaphragm every refueling outage. The licensee had not been inspecting these diaphragms. The licensee is considering adding the replacement of the diaphragm to their refueling outage preventative maintenance program.

Repair of Unit 1 Control Rod H-08

On at least three separate occasions, the Unit 1 control bank D control rod H-08 had slipped approximately 20 steps from the other rods in the bank. On November 6, while unit 1 was in hot shutdown, the connections for the control rod drive mechanism for rod H-08 on the reactor vessel head were inspected, found loose, and tightened. The licensee exercised and performed several drops of rod H-08 to verify operability. The rod has been moved greater than 7000 steps since the connector was tightened and has not experienced any slippage.

Leakage from the 1A Accumulator Check Valve

On November 8, during the containment rounds, an auxiliary operator identified a body to bonnet leak on the 1A accumulator check valve. Investigation indicated that the check valve was included in the population of Unit 1 Anchor Darling check valves inspected by the licensee during the March forced outage. Discussions with the vendor indicated that an increased torque value on the bolts would not affect the operability of the valve. The licensee performed an engineering evaluation to individually detension, clean, and torque the bolts to 2100 ft-lbs while the unit remained in hot shutdown. The maintenance was completed on November 9. The licensee visually inspected five Anchor Darling check valves and found no other problems.

A similar event occurred in July 1990, when the cold leg injection check valve, developed a body to bonnet leak due to improper torquing values and torquing method. The root cause of both leakages was inadequate work packages used during the March forced outage inspections which referenced three different torquing values for the bolts; one based on bolting material and two based on type and size of the valve. At this time, Unit 2 has not experienced leakage from the Anchor Darling check valves which were inspected during the March refueling outage.

Summary of EDG Problems

During this inspection period, the licensee experienced several EDGs maintenance problems which affected unit operations. The following problems occurred:

- (1) On October 23, the 1B east and west fuel oil transfer pumps failed their capacity tests. The 1B EDG was declared inoperable which required the remaining EDGs to be tested.

- (2) On November 5, the 0 EDG tripped during a surveillance due to a leaking manual start valve. Unit 2 was placed on a 5 hour LCO clock to be in hot shutdown. The LCO was cleared within the time limit when the 2A SI pump was returned to service.
- (3) On November 6, the 1A EDG tripped during an operability test. A malfunctioning start switch on the main control board caused the trip. Unit 1 was manually shut down due to the inoperability of two EDGs. On November 8, the 0 EDG was returned to service.
- (4) On November 15, the 2A EDG was declared inoperable when the 80 lb control air regulator valve was found broken. The 2A EDG was declared operable on November 16.
- (5) On November 23, the 1B EDG was declared inoperable due to a degraded condition on the 1B east starting air compressor. The 1B west starting air compressor was inoperable at the time.
- (6) On November 27, the licensee took the 1B EDG out of service to repair the manual starting valve. Later when the Unit 2 SAT failed, the unit was placed on a 5 hour LCO clock to be in hot shutdown. The 1B EDG was declared operable within the time period.
- (7) On November 27, the 0 EDG was declared inoperable due to a severe lube oil leak. Both units were placed on five hour LCO clocks to be in hot shutdown. The 0 EDG was returned to service within the time period.
- (8) On December 1, the 2B EDG was taken out of service to repair a leak in the 6 left jerk pump pipe. The leak, which was identified previously had increased. Unit 2 was placed on a 32 hour LCO clock to complete the repairs. The 2B EDG was declared operable on December 2. The licensee will perform an engineering evaluation to verify that the EDG would have remained operable with the fuel oil leak.
- (9) On December 8, an equipment operator reported water in the 2B EDG crankcase. The unit was placed on a 32 hour LCO clock when the EDG was placed out of service.

The licensee is evaluating the failures to determine if the lack of or poor maintenance contributed to the failures. When an EDG fails, the licensee inspects the other diesels to verify no commonality of the failure. The licensee is currently planning to systematically take the EDGs out of service to complete any outstanding work requests.

b. Assessment of Maintenance

One weakness was identified for work performed on two Anchor Darling check valves. These valves were inspected by the licensee during

the March outage and developed leaks which was caused by inadequate work packages. Good work planning and maintenance performance, to repair equipment which placed the units on tight LCD time clocks, were observed. No major concerns were noted during the performance of routine maintenance.

No violations or deviations were identified.

7. Engineering and Technical Support (37828)

The inspectors evaluated the extent to which engineering principles and evaluations were integrated into daily plant activities. This was accomplished by assessing the technical staff involvement in non-routine events, outage-related activities, and assigned TS surveillances; observing on-going maintenance work and troubleshooting; and reviewing deviation investigations and root cause determinations.

Assessment of Engineering and Technical Support

Engineering provided good support to the operations staff in the monitoring of the Unit 1 leakage to the PRT. The technical staff support to identify the root cause of the Unit 1 control rod slippage was considered a strength. The technical staff was also very involved in the determination of root causes of the multiple EDG problems. The technical staff has been proactive in responding to the NRC concerns and requests.

No violations or deviations were identified.

8. Safety Assessment and Quality Verification (SAQV)

The effectiveness of management controls, verification and oversight activities, in the conduct of job observed during this inspection were evaluated. Management and supervisory meetings involving plant status and plans were attended to observe the coordination between departments. The results of licensee corrective action programs were routinely monitored by attendance at meeting, discussions with the plant staff, review of deviation reports, and root cause evaluation reports.

Assessment of SAQV

Communication between the licensee and the NRC was good during the failure of the Unit 2 SAT, the major oil leak on the 0 EDG, and the Unit 1 RCS leak. On the negative side, routine control room tours by plant management are not frequent enough to effectively evaluate the operations of the plant.

No violations or deviations were identified.

9. Overtime Policy Implementation

In September 1990, an assessment of overtime worked by personnel at the Zion Station was conducted by members of the Human Factor Assessment Branch of the office of Nuclear Reactor Regulation. The specific objectives of the overtime assessment were to review the amount of overtime worked by plant

personnel with respect to the potential for personnel errors, and to identify the factors contributing to the excessive amounts of overtime. The inspection activities focused on overtime worked during the period of September 1989 to September 1990.

The assessment is included as an enclosure to this report. The team identified the following underlying causes for the excesses of overtime:

- a. Outage scheduling was unrealistic with respect to maintaining reasonable compliance with the NRC Policy and administrative procedures for the control of overtime;
- b. Staffing at minimum levels resulted from inadequate forecasting and support of personnel needs; and
- c. Collective bargaining agreements that allowed individuals to volunteer for excessive amounts of overtime and required the licensee to make overtime available to union members in excess of the overtime worked by contract personnel performing similar duties.

Due to increased NRC attention in this area, the licensee has committed to comply with their administrative procedure ZAP-09, "Overtime Guidance" and increase Zion management attention on the control of personnel hours. On July 31, 1990, at a meeting, Zion station management committed to the NRC Region III Deputy Director, Division of Reactor Projects that all overtime which would result in exceeding the NRC/Corporate guidelines as stated in ZAP-09, required pre-approval from the Operating Engineers, the Assistant Superintendent of Operations, or the Production Superintendent. Subsequent to this meeting and other discussions with NRC management, the Assistant Superintendent of Operations issued a September 4, 1990 memo to the Operating shift personnel stating that should a situation arise where a violation of NRC/Corporate guidelines would occur, prior approval will be obtained by station management. Also, during the September 17, 1990 monthly Performance Improvement Plan update meeting in Region III with A. Bert Davis, Regional Administrator, the licensee reiterated that pre-approval by station management for those instances where deviation from the guidelines was required.

During this inspection period, a few deviations from the guidelines occurred where required management approval was provided prior to the occurrence. However, three cases where pre-approval of overtime was not obtained prior to the individuals deviating from ZAP-09 occurred due to the inadequate management controls. Discussions with the licensee indicated that disciplinary actions were taken when a shift foreman worked greater than 24 hours within a 48 hours period during early November. On November 12 shift management granted four hours overtime to an equipment attendant and failed to recognize that with the additional four hours overtime, the individual had worked 78 hours within a 7 day period. In the third instance, an individual exceeded 24 hours within a 48 hour period due to the particular shifts worked and an unscheduled four hours of overtime.

Failure to obtain preauthorization from station management prior to violating the maximum overtime hours specified in ZAP-09 is considered a

Deviation (295/90024-01(DRP); 304/90026-01(DRP)) from the commitments made to the NRC on several occasions. In addition to responding to the Notice of Deviation, the licensee is also requested to address the contributing causes identified by the team.

10. LER Followup (92700)

Through direct observations, discussions with licensee personnel, and review of records, the following event reports were reviewed to determine that reportability requirements were fulfilled, immediate corrective action was accomplished, and corrective action to prevent recurrence had been accomplished in accordance with TS. The LERs listed below are considered closed:

Unit 1

<u>LER NO.</u>	<u>DESCRIPTION</u>
295/90006	1B AFW Pump Inadvertent Start

Regarding 295/90006, a violation (295/90003-1C(DRP)) was issued for failure to follow procedure. The procedure has been revised to warn the operator of the anticipated light indication. The completion of the corrective actions which include review of the remote shutdown panel layout will be tracked with the violation. This LER is considered closed.

Unit 2

<u>LER NO.</u>	<u>DESCRIPTION</u>
304/89008	Loss of Nuclear Steam Supply System (NSSS) Annunciation due to Blown Power Supply Fuses
304/90001	Manual Reactor Trip due to Electro-Hydraulic Control Oscillations

Regarding LER 304/89008, on June 24, 1989, a loss of the NSSS annunciation occurred due to blown power supply fuses. During the event, the loss of annunciation during ground checking was due to binding of the breaker mechanism. When the breaker was tested, the failure could not be repeated, and the testing results were found to be acceptable. Following the event, it was discovered that the polarity on the emergency DC feed was reversed, which was what caused the fuses to blow. The polarities of all DC emergency feeds were inspected and found to be acceptable. Licensee actions appear to be adequate to consider the issue closed.

Regarding LER 304/90001, the corrective actions which included revision of procedure TSSP 20-90 to change the order of the valve line-up to prevent a loss of vacuum during execution of the procedure and review of instruction SOI-33 to determine correct valve positions have been completed. The licensee actions appear to be adequate to consider the issue closed.

No violations or deviations were identified.

11. Training (41400)

During the inspection period, the inspectors reviewed abnormal events and unusual occurrences which may have resulted, in part, from training deficiencies. Selected events were evaluated to determine whether the classroom, simulator, or on-the-job training received before the event was sufficient to have either prevented the occurrence or to have mitigated its effects by recognition and proper operator action. Personnel qualifications were also evaluated. In addition, the inspectors determined whether lessons learned from the events were incorporated into the training program.

No violations or deviations were identified.

12. Open Items

Open Items are matters which have been discussed with the licensee which will be reviewed further by the inspector and which involve some action on the part of the NRC or licensee or both. Two Open Items disclosed during this inspection are discussed in paragraphs 4c and 5a.

13. Deviation

Notices of Deviation are written notices describing a licensee's failure to satisfy a commitment where the commitments involved had not been made a legally binding requirement. A notice of deviation requests a licensee to provide a written explanation or statement describing corrective steps taken (or planned), the results achieved, and the date when corrective action will be completed. One Notice of Deviation is discussed in paragraph 9.

14. Exit Interview (30703)

The inspectors met with licensee representatives (denoted in Paragraph 1) throughout the inspection period and at the conclusion of the inspection on December 11, 1990, to summarize the scope and findings of the inspection activities. The licensee acknowledged the inspectors' comments. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary.

ENCLOSURE

ASSESSMENT OF OVERTIME USE AT ZION NUCLEAR POWER STATION, UNITS 1 AND 2, FOR THE PERIOD JANUARY 1989 TO SEPTEMBER 1990

1. BACKGROUND

In mid-1990, the Office for Analysis and Evaluation of Operational Data (AEOD) conducted a diagnostic evaluation of the Zion Nuclear Power Station, Units 1 and 2 (Zion). The report from this investigation (August 1990) stated that both licensed and non-licensed operators had worked "excessive" overtime. These findings confirmed prior observations made by the Zion resident inspection staff, who had been tracking the use of overtime at Zion since February 1990.

Because of the close succession of the Unit 1 and 2 refueling outages and a series of unplanned outages for equipment repair, personnel at Zion have been working on an outage schedule for most of the September 1989 to September 1990 time period. The high amount of overtime worked by individuals at Zion on a weekly basis, coupled with the extended nature of the Zion outage schedule, was identified as creating the potential for personnel errors due to cumulative fatigue effects. In response to these concerns, the staff conducted an assessment of overtime worked by personnel at Zion. In this assessment, the team (1) reviewed the amount of overtime worked by plant personnel with respect to the potential for increased frequency of personnel errors, and (2) identified the factors contributing to the excessive amounts of overtime.

2. OVERVIEW OF ASSESSMENT ACTIVITIES

During the week of September 10 to 14, 1990, two NRR staff members, David R. Desaulniers and Isabel M. Herb, of the Human Factors Assessment Branch (LHFB) were assisted by Ann Marie Bongiovanni of the Zion resident inspection staff in conducting the onsite portion of the assessment of overtime. Inspection activities focused on overtime worked between January 1989 and September 1990. Because the licensee had frequently used outage schedules since September 1989, the team focused particularly on the last 12 months of this period. The team performed the following three primary activities to examine overtime use in the operations, maintenance (instrument, electrical, and mechanical), health physics, and chemistry departments:

- o A significant number of plant staff and management was interviewed. The interviews focused on their experiences and observations concerning overtime, fatigue-related errors, and the reasons that plant personnel had worked excessive amounts of overtime (see Appendix A for a complete list of persons interviewed);
- o Documentation of the licensee's policies and practices concerning the control of overtime was reviewed. These documents included: administrative procedures and union agreements, overtime records and tracking systems, and licensee self-assessments concerning work planning and overtime control (see Appendix B for a complete listing of documents reviewed); and

- o Events and general operating experience at Zion were examined with respect to the overtime worked by the personnel involved in the event. The team identified events involving human performance through a review of licensee event reports (LERS), the licensee's human performance evaluation system (HPES) reports, and personnel error evaluation program (PEEP) reports. The team reviewed the schedules worked by the individuals involved in these events for the 28 days before the event.

The results of the assessment are provided in the following sections:

3. ASSESSMENT OF ZION OVERTIME POLICY

The team reviewed the licensee's administrative procedures for controlling overtime and its agreement with the union for work scheduling. These documents were reviewed with respect to NRC "Policy on Factors Causing Fatigue of Operating Personnel at Nuclear Plants" (NRC Policy) as transmitted in NRC Generic Letter No. 82-12, "Nuclear Power Plant Staff Working Hours." During 1989 and 1990, the licensee changed its administrative procedures for controlling overtime and temporarily revised its agreement with the union for work scheduling. The specific changes in Zion's overtime procedure are discussed herein highlighting the differences from the NRC Policy. The team's findings concerning the licensee's implementation of the procedures to control overtime are also presented.

3.1 Zion Administrative Procedure - 0 "Conduct Of Operations"

Zion Administrative Procedure, "Conduct of Operations" (ZAP-0), was in effect during 1989 through April 26, 1990. This procedure is consistent with the NRC Policy with respect to the numerical limitations on working hours. However, the team noted that ZAP-0 was not consistent with the NRC Policy in that it did not include all positions held by individuals performing safety-related duties. Moreover, ZAP-0 was internally inconsistent and did not meet the intent of the NRC Policy. The procedure allowed personnel to exceed the guidelines to compensate for personnel shortages resulting from promotions, resignations, or extended illnesses, which conflicts with its stated objective "to maintain an adequate number of personnel . . . such that the use of overtime is not routinely required to compensate for inadequate staffing" (emphasis added).

3.2 Agreement Between Management and the Union for the Unit 2 1990 Outage Scheduling

On March 12, 1990, the licensee issued "Outage Schedule of Unit 2 1990" (Attachment A). This agreement between the union and management (local agreement) established new guidelines for the scheduling and the assignment of overtime in the operations department, for the duration of the Unit 2 1990 outage.

Before the local agreement was implemented, the "Collective Bargaining Agreement between Commonwealth Edison Company and Local Unions" (1988-1991) resulted in some individuals rarely volunteering for overtime while others

worked overtime whenever it was available. If properly implemented, the local agreement should have reduced the individual excesses of overtime which resulted. However, Zion management did not fully enforce the maximum working hour limits available to them in the agreement to reduce individual overtime. For example, in the operations department, four instances were identified in which individuals exceeded 100 hours per week and 16 instances were identified in which individuals exceeded 90 hours per week during the time this agreement was in effect. In addition to exceeding the guidelines in the NRC Policy, the individuals in these instances exceeded the objectives stated in the agreement, "a maximum of 72 hours, with an anticipated absolute maximum of 84 hours per week."

3.3 Zion Administrative Procedure - 09 "Overtime Guidelines"

In an August 4, 1989 inspection report, the NRC staff expressed a concern that the Commonwealth Edison Company (CECO) did not appear to have sufficient measures in place to ensure that safety-related work was not being jeopardized by personnel working too many hours. In response to this concern, CECO issued Nuclear Operations Directive (NOD) QA.13 (December 31, 1989) which established guidelines for working overtime at the utility's nuclear stations. Accordingly, the licensee developed Zion Administrative Procedure (ZAP) - 09, "Overtime Guidelines."

3.3.1 Implementation of ZAP-09

ZAP-09 expanded the scope of the overtime guidelines, as previously defined in ZAP-0, to include specific positions within the health physics, chemistry, and maintenance departments, contracted personnel performing safety-related work, and additional positions within the operations department (Appendix C provides a complete listing of positions to which the guidelines apply). To the extent that ZAP-09 has identified personnel performing safety-related duties, the scope of applicability of the procedure is consistent with the NRC Policy.

The team found the ZAP-09 limits on working hours were consistent with the NRC Policy guidelines. However, the licensee failed to control overtime to the limits stated in the procedure. Although ZAP-09 became effective on April 26, 1990, working hours were not maintained within ZAP-09 guidelines during the Unit 2 1990 outage (March 21 to August 30, 1990). Instead, the licensee continued to use the local union/management agreement, which permitted an absolute maximum of 84 hours per week, as the basis for work scheduling and the control of overtime.

During interviews with Zion management, the team discovered that the licensee had decided to adhere to the local agreement, as opposed to ZAP-09, partly because it believed that the local agreement provided an absolute maximum limit on overtime, which could be legally enforced in the context of labor law. In contrast, ZAP-09 was perceived as a guideline that was not legally defensible as a maximum limit on overtime. However, review of the overtime records showed that the licensee failed to use this "legal" agreement to maintain working hours below the 84-hour per week limit it established.

3.3.2 Approval of Deviations from ZAP-09

Section 2 of ZAP-09, "Approval of Guideline Deviations," is consistent with the NRC Policy with respect to approval of overtime. However, the licensee failed to fully implement the approval procedures. Furthermore, the licensee approved overtime despite written communication from the scheduler suggesting concern about decreasing personnel effectiveness as a result of the overtime requirements.

Review of overtime authorizations from April 29, 1990, to August 12, 1990, revealed that the licensee management did not normally complete the pre-authorization forms. This failure to obtain pre-authorization occurred during a period when deviations regularly occurred and, consequently, could have been anticipated. Furthermore, the licensee management did not complete post-authorization forms for overtime deviations for several dates and did not consistently complete these forms in a timely fashion.

The team identified a specific concern regarding three weeks of overtime that were pre-approved, despite the following statement shown on the pre-authorization form: "I can no longer (in good faith) state that personnel effectiveness or attitude will not be affected by overtime requirements." This statement was signed by the scheduler, the assistant superintendent of operations, and the production superintendent. Zion management, cognizant of the overtime authorizations, indicated that they had extended and modified the outage in response to these concerns. Nevertheless, the failure to adhere to the procedure and approve overtime, despite the scheduler's concern regarding personnel effectiveness, cannot be considered prudent with respect to ensuring public health and safety.

3.3.3 Tracking of Deviations

The tracking of deviations from ZAP-09 is not consistent across departments. For example, operations department deviations from ZAP-09 guidelines were compiled on a weekly basis. This system, however, did not use a seven-day rolling schedule. ZAP-09 states that individuals should not be permitted to work more than 16 hours in any 24-hour period, 24 hours in any 48-hour period, or 72 hours in any 7-day period. The practice of tracking deviations on a calendar week basis fails to identify instances in which the guidelines are exceeded when the 24-hour, 48-hour, or 7-day periods are divided across 2 calendar weeks.

The radiation protection and chemistry departments recently implemented a computer-based tracking system that included a rolling seven-day schedule for identifying deviations. Conversely, the maintenance departments had not yet instituted any formal tracking systems at the time of the inspection, although Zion's quality assurance department had noted in April and June 1990 that the maintenance departments were deficient in their ability to track overtime according to the ZAP-09 procedure.

3.3.4 Reporting of Deviations

ZAP-09 requires that a semiannual report be submitted to the Vice-President, Pressurized Water Reactor (PWR) Operations. The team examined an August 2,

1990, memorandum to the Vice President, PWR Operations, communicating deviations in the operations department during the period from January 1, 1990, to July 1, 1990. Although the memorandum referenced ZAP-09, the reporting requirements of ZAP-09 were not applied. The memorandum did not report deviations according to approval status (e.g., before the fact, after the fact, or not approved). ZAP-09 does not require a semi-annual report for radiation protection or chemistry technicians unless the duty technician positions exceeded the guidelines. This practice is a concern to the extent that management believes deviations have not occurred only because a report was not filed.

3.3.5 Potential Violation

The team believes that the numerous deviations from Zion administrative procedures with respect to approval, tracking and reporting of overtime as noted above, may constitute violations of 10 CFR 26.20 which requires the licensee to establish and implement policy and procedures that address, among other factors, fatigue, so that there is reasonable assurance that nuclear power plant personnel are not impaired in their ability to safely and competently perform their duties.

4. ANALYSIS OF ZION PERSONNEL OVERTIME

4.1 Description of Overtime by Department

The team examined the average number of hours worked per pay period for each position in the departments covered by ZAP-09. This review of overtime data revealed that several departments had exceeded the NRC Policy guidelines. The excessive overtime occurred primarily in the unit outages throughout the September 1989 to August 1990 time period. Consequently, the team examined levels of overtime according to plant conditions. Figures 1 through 7 provide the results of these analyses, as discussed in the following sections:

4.1.1 Operations

Figures 1, 2, and 3 show the average hours worked per pay period (14 days) by various positions in the operations department. The graphs in these figures reveal that shift supervisors, nuclear station operators, equipment operators, and equipment attendants began working significantly more hours when the units were in outage. However, the shift control room engineers and the shift engineers maintained a nominal 40-hour workweek, regardless of plant conditions.

For the pay periods from March through June of 1990, nuclear station operators averaged over 125 hours worked every two weeks (Figure 2), and non-licensed operations personnel averaged at least 130 hours every two weeks (Figure 3). The continuous nature of these long workdays raises a concern that the risk of human error may have increased because of the cumulative effects of fatigue.

The peak averages for the bargaining unit employees were also of particular concern, because the averages were high enough to suggest that individuals approached or exceeded the guidelines of the NRC Policy. Further investigation revealed that several employees had exceeded the guideline of 72 hours worked

in a 7-day period. The team expressed concern about the following data for the period from September 1989 to August 1990: in 44 instances, personnel worked over 90 hours in one week, and in 17 additional instances, personnel worked 100 or more hours in one week. The team also identified 5 instances in which individuals worked 200 or more hours in two weeks, and 5 additional instances in which individuals worked between 284 hours and 297 hours in a 3-week period.

4.1.2 Radiation Protection and Chemistry

Personnel in the radiation protection and chemistry technician positions experienced an increase in workload during the outage periods, but the overtime worked by radiation protection technicians was particularly high (Figure 4). During the 10th pay period of 1990, for example, 23 technicians worked an average of 150 hours in 14 days. With respect to the long term effects of continuous overtime, the radiation protection technicians continued to work excessive hours during both major outage periods. Individuals often worked 10 to 12 hours a day, 7 days a week for extended periods of time. From September through November of 1989, and from March through May of 1990, these technicians maintained work schedules of 130 or more hours worked every 2 weeks for 8 weeks and 12 weeks, respectively. However, not all personnel in these departments performed safety-related work. Following implementation of ZAP-09 on April 26, 1990, a "duty technician" was assigned to each shift to be responsible for safety-related duties. Each day, work schedules were reviewed to identify individuals that would qualify to work as the duty technician.

4.1.3 Mechanical Maintenance

Mechanical maintenance supervisors, A-men, and B-men all increased their overtime hours during the outages (Figure 5). The plot for the senior mechanic represents one employee, and thus exhibits more extreme fluctuations. The two major peaks in Figure 5 show averages of 130 to 140 hours per pay period.

4.1.4 Instrument Maintenance

Although overtime for personnel in instrument maintenance (Figure 6) increased significantly during the outages, the average number of hours, even during peak workload periods, remained at or less than 130 per pay period.

4.1.5 Electrical Maintenance

Electrical maintenance personnel (Figure 7) experienced an increase in workload during outages. During the first major outage (September through December of 1989), electrical maintenance supervisors worked an average of 120 to 140 hours every two weeks, and these same employees worked an average of 120 to 130 hours every two weeks during most of the second major outage (February through August, 1990). Other electrical maintenance personnel also worked more overtime during these two time periods, although the difference was not as significant.

4.1.6 Summary of Overtime by Department

The significant quantities of overtime worked by the personnel in these departments indicate that Zion may be particularly vulnerable to human

performance decrements. The team was particularly concerned about the unusually high amounts of overtime in the operations department. Information concerning individual excesses in overtime was not readily available from other departments. Consequently, the team did not evaluate the frequency of these occurrences.

Studies indicate that individuals who vary from a normal 8-hour workday/40-hour workweek suffer from degraded cognitive and motor skills (see "Applicable Research," Section 4.4). Personnel working excessive overtime may successfully perform routine tasks even when less alert, thus not revealing reduced abilities. However, such personnel may find that their ability to respond quickly to an emergency situation is significantly affected.

4.2 Relationship between Personnel Errors and Overtime

The team reviewed work schedules of personnel involved in plant events to identify instances in which fatigue may have contributed to degraded performance. The team reviewed plant events involving human performance included in licensee event reports (LERs), human performance evaluation system (HPES) reports, and personnel error evaluation program (PEEP) reports and examined the applicable personnel overtime records.

4.2.1 Findings

Thirty LERs, 12 HPES reports, and 6 PEEP reports were reviewed, but there was insufficient data to determine a direct link between hours worked and the errors made by the personnel involved.

4.3 Conclusions Regarding Overtime Use and Personnel Errors

Individuals in the operations department frequently exceeded the working hour guidelines of the NRC Policy. According to the policy, personnel performing safety-related work should not work more than 72 hours in any 7-day period. Overtime data were not readily available for individuals from other departments to determine similar circumstances.

In general, the team found that there was insufficient data to determine if overtime practices at Zion resulted in safety-related errors at the plant. The data available did not support a sufficient analysis to determine causal relationships between work scheduling and human errors. Reporting procedures, particularly for LERs, are not sensitive to concerns of performance decrement due to fatigue. However, research on extended working hours (see Section 4.4) indicates that that amount of overtime worked by personnel at Zion is a concern because it may degrade their ability to perform routine safety-related duties. More importantly, fatigue may degrade an operator's ability to rapidly process the complex pattern of information that is presented in an offnormal plant condition. Consequently, the ability to respond in a timely fashion may be jeopardized, and errors in responding are more likely to occur as a result of lapses in short-term memory.

In the review of Zion's internal assessments, the team discovered inadequacies in the licensee's evaluation and reporting of these events with respect to the potential for fatigue to have been a contributing factor. HPES reports in

which the individuals involved had been working overtime did not reflect the work schedules. Several of the HPES reports involved personnel whose overtime in the days or weeks leading to the event had exceeded the guidelines of the NRC Policy. However, as a rule, the report either designated the work scheduling section "Not Applicable" or omitted the section entirely.

The staff's review also revealed weaknesses in the licensee's current capabilities to track overtime. The licensee had difficulty in providing cumulative summaries of overtime in departments other than operations. The unavailability of these records at the site indicates that management continues to lack the tools necessary to adequately control overtime.

4.4 Applicable Research

The amount of overtime worked by personnel at Zion exceeds amounts at which research indicates human performance begins to degrade. Studies on the effects of overtime have found that human performance degrades as the number of hours worked in a day increases. Significant decrements in both cognitive and motor skills occur with a departure from the 8-hour workday/40-hour workweek. Alertness declines after increasing shift length by 50 percent. The ability to sustain one's attention declines with increasing fatigue, as does short-term memory. Performance on tasks which require sets of rules to be applied, such as diagnostic tasks, can be expected to degrade.

Because the majority of the research literature focuses on studying the effects of merely compressing the work schedule (i.e., working longer hours and having a shorter workweek), the results of these studies are a conservative estimate of the effects of the Zion work schedules on human performance. At Zion the workdays were frequently increased in length without the benefit of shortening the workweek.

An analysis of work schedules by seven experts in chronobiology, fatigue, and shift scheduling, indicated that schedules similar to those observed at Zion were "unsatisfactory" with respect to maintaining performance over a period of more than four weeks. Furthermore, the literature suggests that 20 hours of overtime every two weeks may actually double human error rates. Figures 1 through 7 reveal that Zion personnel frequently worked 20 to 50 hours of overtime in a two-week period.

In a study investigating Swedish nuclear power plant operators, it was found that many of those involved in an incident had worked a considerable amount of prior overtime. Studies have shown that fatigue due to long work hours or highly concentrated work results in less attention to certain types of signals; people develop their own subjective standards of what is important, and as they become more fatigued, they ignore more signals. Frequently, workers may not even be aware that their performance is impaired. In a study specific to the nuclear industry, control-room operator alertness was examined on an "alertness continuum", with one end representing focused wakefulness, and the other end representing the point of sleep onset. A well-rested individual can usually move rapidly (within seconds) to more alert and vigilant stages from lower stages. In contrast, a tired (sleep-deprived) individual would have the tendency to drift back to the lower end of the continuum in a few minutes. According to expert opinion, the transition to full alertness and peak ability

to cognitively process information, such as the determination of the precise meaning of an alarm signal and necessary corrective actions, may require minutes rather than seconds.

Although the team did not identify specific events at Zion that clearly resulted from personnel fatigue, numerous studies have indicated that the types of tasks performed at nuclear power plants are susceptible to fatigue-related degradation. Not realizing that their own performance has been degraded, fatigued workers may become less effective in their tasks. The evidence found in the literature suggests that, at the very least, the potential for human error at Zion has increased with the increase in the overtime worked by the individuals.

5. PERSONNEL PERCEPTIONS OF OVERTIME AND PERFORMANCE

The team interviewed several individuals from each department in which overtime was being assessed. The team selected individuals representing a range of responsibilities and positions (e.g., technicians, operators, supervisors, and schedulers) within each department. In the interviews, the team collected the experiences and observations of Zion personnel concerning the effect of outage work schedules on personnel performance.

5.1 Zion Staff's Perceptions Regarding Fatigue and Errors

None of the individuals interviewed indicated that they knew of an error that was directly attributable to fatigue. Members of Zion's quality control and quality assurance departments indicated that they had not observed errors that appeared to be fatigue-related. There were only a few cases reported of difficulty staying awake on the job or when driving home.

The majority of those interviewed did not believe that fatigue has had a significant effect on performance. However, many of the staff indicated that while the schedules had resulted in fatigued workers, the workers "do not allow" fatigue to affect their performance, or "the procedures and verifications do not allow us to make a mistake." In contrast, several individuals expressed concern about the amount of overtime that was being worked in the operations department and indicated that "some people do not know their own limits."

5.2 Zion Staff's Observations Regarding Overtime and Fatigue

Plant personnel observed that fatigue had affected personalities or attitudes rather than performance. The interviewees believed that the overtime had strained interactions between the operations and instrument maintenance departments. Workers were described as becoming more irritable, and instances of strained relationships at home were reported. Several interviewees noted a decline in worker morale as the outage progressed.

In general, there was a consensus that "forced" overtime was the most difficult to work, particularly when the overtime was required on the 11 pm to 7 am shift. This view was consistent with the opinion that people coped with the long working hours by preparing themselves (e.g., resting) for it. When "forced" to work overtime without much advance notice, individuals did not have time to prepare.

The desire to work overtime varied considerably between individuals. One individual indicated that working over 100 hours in a week was "no problem" and wished for more available overtime hours. However, the majority of the people interviewed expressed that they were tired of working the overtime. This disparity in the workers' attitudes toward working overtime enabled individuals to accumulate excessive overtime as a result of consistently volunteering to work hours that others had refused.

6. ASSESSMENT OF FACTORS CONTRIBUTING TO EXCESSIVE OVERTIME

In addition to expressing the concerns presented in Section 3.3.4 pertaining to the inadequacies in the overtime tracking capabilities at Zion, the team made the following observations and conclusions regarding the factors contributing to the excessive use of overtime. These findings are based upon interviews with members of Zion's management and staff, and reviews of the licensee's procedures, practices, and self assessments concerning work scheduling.

6.1 Staffing

The team and members of Zion management identified a lack of adequate staffing as one of the primary contributors to the use of overtime. Members of the chemistry and radiation protection departments indicated that they were understaffed, but the lack of qualified personnel was most evident in the operations department. Recent shortages in licensed positions were in part attributed to cancellation of a license class several years ago and the subsequent postponement of a class in progress, which resulted in high attrition in the class.

Many of the individuals interviewed, including members of Zion's management, perceived that the minimal staffing levels in first line management positions had resulted from failure of the corporate management to approve requested increases in staffing. Interviewees believed the corporate management had "set" staffing levels according to a corporate assessment of staffing needs. Some interviewees believed that the corporate assessment had relied too heavily on historical data and had underestimated inadequate future workloads and staffing needs. Other interviewees stated that low staffing levels resulted from austerity measures imposed by the corporate management.

Interviewees were also critical of hiring and training practices, indicating that there was a failure to adequately consider attrition in classes and reductions in department staffs because of reassignments, promotions, and resignations. The team has similar concerns for the licensee's current plans to address personnel shortages in the operations department and meet the intent of the NRC Policy which is to have operating personnel work a 40-hour workweek when either unit is operating. The licensee has based staffing projections for January 1992 on a plan that does not adequately address attrition in training programs and the loss of personnel to other departments. Interviewees stated that Zion management wants to encourage nuclear station operators (NSOs) to enter supervisory positions. However, the staffing plan does not address this source of attrition in the NSO position.

6.2 Plant Availability Goals

Several interviewees stated that Zion has a goal of limiting each scheduled outage to a period of 70 days. The NRC Policy recognizes that outages result in an increased need for overtime. However, the overtime worked during the refueling outages for Unit 1 in 1989 and Unit 2 in 1990 is indicative that the schedules were unrealistic with respect to meeting the intent of the NRC Policy and Zion administrative procedures. The licensee has allowed numerous deviations from its procedures for overtime control.

6.3 Collective Bargaining Agreement

The staff reviewed the collective bargaining agreement (1988-1991) between CECO and local unions of the International Brotherhood of Electrical Workers and conducted interviews with plant staff. As a result, the staff concluded that Zion's adherence to the union agreement resulted in some of the observed excesses in overtime.

The agreement to make overtime available on the basis of the cumulative overtime list enabled individuals to work excessive amounts of overtime. Interviewees also stated that the union agreement required the licensee to make overtime available to union members in excess of the overtime worked by contract personnel performing similar duties. Finally, some of the overtime worked by radiation protection personnel resulted from a union agreement requiring that only union technicians act as timekeepers for union employees. This requirement eliminated the possibility of reducing the overtime burden by distributing some of the workload among non-union contract personnel.

6.4 Work Planning

Many interviewees made complaints concerning work planning. There was a consensus among the employees interviewed that much of the overtime was unnecessary or unproductive because of inadequate work planning. Interviewees commonly cited a lack of coordination among work groups which resulted in individuals waiting for parts, equipment, or personnel support. Interviewees reported that operations personnel commonly worked overtime to support tests that were delayed excessively or not performed. Some individuals indicated that scheduling was not receiving adequate support (e.g., personnel did not receive advance notice of jobs to be scheduled and work groups did not commit to meet scheduled objectives).

The licensee has identified the need to improve daily work planning and has instituted programs to address this issue. In addition, members of the licensee management stated that they are attempting to improve outage scheduling. The licensee expanded the department responsible for outage planning from 1 to over 12 individuals in the past 2 years. The team did not attempt to assess the adequacy of the licensee's efforts to enhance its work planning activities.

7. CONCLUSIONS

The event and overtime information reviewed did not provide sufficient data to determine if personnel errors occurred or increased in frequency because of

the effects of cumulative fatigue. However, the team did confirm observations by the regional staff and the DET that plant personnel had worked excessive overtime. Within the departments examined, individuals in the following positions worked the most overtime: nuclear station operators; equipment operators and attendants; and radiation protection technicians.

In over 60 instances, individuals in the operations department worked more than 90 hours in a week and regularly exceeded the working hour guidelines transmitted in the NRC Policy and contained in Zion's administrative procedures. Studies of extended working hours indicate that the performance of individuals working such hours can be expected to degrade. Because individuals in these positions perform safety-related duties, and may be required to respond to a plant emergency, the practice of allowing excess overtime cannot be considered prudent with respect to protecting public health and safety. Excessive working hours result in operator fatigue and consequently, the ability to respond appropriately and in a timely fashion is likely to be degraded.

The team identified the following underlying causes for the excesses of overtime:

- (1) Outage scheduling was unrealistic with respect to maintaining reasonable compliance with the NRC Policy and administrative procedures for the control of overtime;
- (2) Staffing at minimum levels resulted from inadequate forecasting and support of personnel needs; and
- (3) Collective bargaining agreements that:
 - (a) allow individuals to volunteer for excessive amounts of overtime; and
 - (b) require the licensee to make overtime available to union members in excess of the overtime worked by contract personnel performing similar duties.

In addition, the team identified the following factors that contribute to the inadequate control of overtime: (1) inadequate work planning resulting in inefficient use of man-hours, and (2) inadequate ability to track overtime and identify deviations.

The licensee management has verbally committed to strict enforcement of the NRC Policy in the future and plans to increase staff resources and improve work planning to alleviate the need for excessive amounts of overtime. Some members of plant management also stated that they intend to maintain levels of overtime below those stated in the guidelines, regardless of plant conditions. It is recommended that the resident staff continue to monitor the extent to which the licensee management's commitments are met, specifically, (1) the control and tracking of overtime in accordance with the NRC Policy and ZAP-09, (2) efforts to improve work and outage planning, and (3) progress in attaining adequate staffing levels in the operations department.

APPENDIX A

Management:

Thomas Joyce	Plant Manager
William Kurth	Production Superintendent
Peter LeBlond	Assistant Superintendent, Operations
Robert Johnson	Assistant Superintendent, Maintenance
James LaFontaine	Assistant Superintendent, Work Planning
Thomas Flowers	Unit Outage Planner
Eugene Broccolo	Performance Improvement Director

Operations:

Ralph Dietz	Operating Scheduler
Dan Giernoth	Unit Supervisor
Jerry Marsh	Shift Foreman
John McSorley	Nuclear Station Operator
Fred Cook	Nuclear Station Operator
Patrick Comerford	Equipment Operator
Lee Danson	Equipment Operator
Wayne Gerdes	Equipment Attendant

Chemistry:

Brent Schramer	Chemistry Supervisor
Rich Winiarski	Chemistry Technician A
James Cope	Chemistry Technician B

Radiation Protection:

Randall Mika	HP Services Supervisor
Michael Finney	Rad-Chem Scheduler (previously)
Robert Pratt	Radiation Protection Scheduler
Kevin McEvoy	Contamination Control Coordinator
Craig Wepprecht	Health Physicist
Oscar Fick	Radiation Protection Technician
Robert Lindquist	Radiation Protection Technician

Maintenance, Electrical:

Ben Higginbottom	Electrical Maintenance Supervisor
John Parker	Electrical Maintenance Supervisor
Mark Rottman	Electrical Maintenance A-Man

Maintenance, Instrument:

David Stachon	Instrument Maintenance Supervisor
Steven Zander	Instrument Maintenance Supervisor
Michael Braim	Instrument Maintenance A-Man
Robert Cole	Instrument Maintenance A-Man

Maintenance, Mechanical:

Bernard Radman	Mechanical Maintenance Supervisor
Charles Nelson	Mechanical Maintenance A-Man

Human Performance Evaluation System:

Richard Flessner	Corporate HPES Coordinator
Dennis Sheehan	HPES Coordinator

Quality Programs:

Carl Schultz	Quality Control Supervisor
Thomas Van De Voort	Quality Programs Superintendent
Annette Dennenberg	Quality Programs Operations Group Leader
Donald Felz	Quality Programs Maintenance Group Leader

APPENDIX B

- A. Zion Administrative Procedure - 0 "Conduct of Operations"
- B. Zion Administrative Procedure - 09 "Overtime Guidelines" f*
- C. Zion Licensee Event Reports
- D. Zion Deviation Reports
- E. Human Performance Evaluation System Reports
- F. Personnel Error Evaluation Program Reports
- G. Quality Programs Monthly Reports
- H. Quality Assurance Surveillance Reports
- I. Outage Schedule of Unit 2 1990
- J. Projected Staffing Levels
- K. Collective Bargaining Agreement between Commonwealth Edison Company and Local Unions of the International Brotherhood of Electrical Workers (1988-1991)
- L. Diagnostic Evaluation Report for the Zion Nuclear Power Station, Units 1 and 2 (NRC/AEOD) August, 1990
- M. NRC Resident Staff Inspection Reports

APPENDIX B

- A. Zion Administrative Procedure - 0 "Conduct of Operations"
- B. Zion Administrative Procedure - 09 "Overline Guidelines" *
:
- C. Zion Licensee Event Reports
- D. Zion Deviation Reports
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- F. Personnel Error Evaluation Program Reports
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APPENDIX C

(Applicability of ZAF-09)

Within the Operating Department:

Shift Engineer (SRO)
Shift Supervisor (SRO)
Station Control Room Engineer (SRO)
Nuclear Station Operator (RO)
Equipment Operator A
Equipment Attendant (only when performing safety-related work
or scheduled as part of the plant's safety shutdown
response team)
Auxiliary Operator (only when performing safety-related work
or scheduled as part of the plant's safety shutdown
response team)

When moving fuel or performing core operations:

Fuel Handling Supervisor (SROL)
Shift Supervisor (SROL)
Nuclear Fuel Handler A
Nuclear Fuel Handler B

Within the Health Physics Services Department (on each shift):

Duty Radiation Protection Technician

Within the Chemistry Department (on each shift):

Duty Chemistry Technician

Within the Maintenance Department, when performing safety-related work:

Maintenance Supervisor (EM, IM, MM)
Control System Technician (IM)
Senior Mechanic (EM, MM)
A Mechanic (EM, IM, MM)
B Mechanic (EM, IM, MM)

Any contracted personnel performing safety-related work

OUTAGE SCHEDULE OF UNIT 2 1990

A Union/Management agreement has been reached regarding scheduling for the Unit 2 outage. Key elements of this agreement include:

- Mandatory 12 hour shifts (Optional 4 hrs early or 4 hrs over)
- Possible force to a maximum of 12 hours on first RDO with 48 hours notice
- RDOs will have first choice of O.T. to a MAX of 12 hours per calendar day and chosen to cover MINIMUM SHIFT COVERAGE according to O.T. list.

Managements desire is to eliminate, if possible, 16 hour shifts and approach compliance with NRC guidelines. Towards this end, we have established a target maximum of 72 hours, with an anticipated absolute maximum of 84 hours per week.

There will be three shifts per day:

- 1) Night Shift (1st) hours will be 7 pm to 7 am.
2 NSOs, 1 A man, and 2 B men will be allowed 11 pm to 11 am.
- 2) Day Shift (2nd) hours will be 7 am to 7 pm.
2 NSOs, 1 A man, and 2 B men will be allowed 3 am to 3 pm.
- 3) Middle Shift (3rd) will be 3 pm to 3 am.
2 NSOs, 1 A man, and 2 B men will be allowed 11 am to 11 pm.
- 4) Hours for personnel during their training week (i.e., not mandatory 12s) will be 7 am to 3 pm. 3 am to 3 pm optional to meet MAXIMUM SHIFT COVERAGE.

There will be 48 hours notice of forcing of the first RDO, following the Thursday deadline described below.

If forced for 16 hours, there will be an 11 hour off period until next scheduled start time, providing it does not result in another force.

RDOs will be requested by Thursday, of the week before schedule's start.

Request for O.T. starting time change will be for the entire week, i.e., early or over, as per the shift rules, described above.

Only Shift Supervisors may release employees from O.T. hours once the schedule has been posted.

MINIMUM/MAXIMUM Shift Coverage for terms of the agreement as a follows:

<u>NSO</u>	<u>A Men</u>	<u>B Men</u>
5/8	3/5	8/11

In the event maximum coverage would be exceeded the highest person on early or over O.T., according to the O.T. list, would be refused the opportunity to work.

TED HOLDEN
Chief Steward

Ted Holden
3-12-90

RALPH DIETZ
Scheduler

Ralph Dietz
3/12/90

PETE LEBLOND
Asst. Supt. Operating

Peter LeBlond
3/12/90

FIGURE 1. OPERATIONS

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

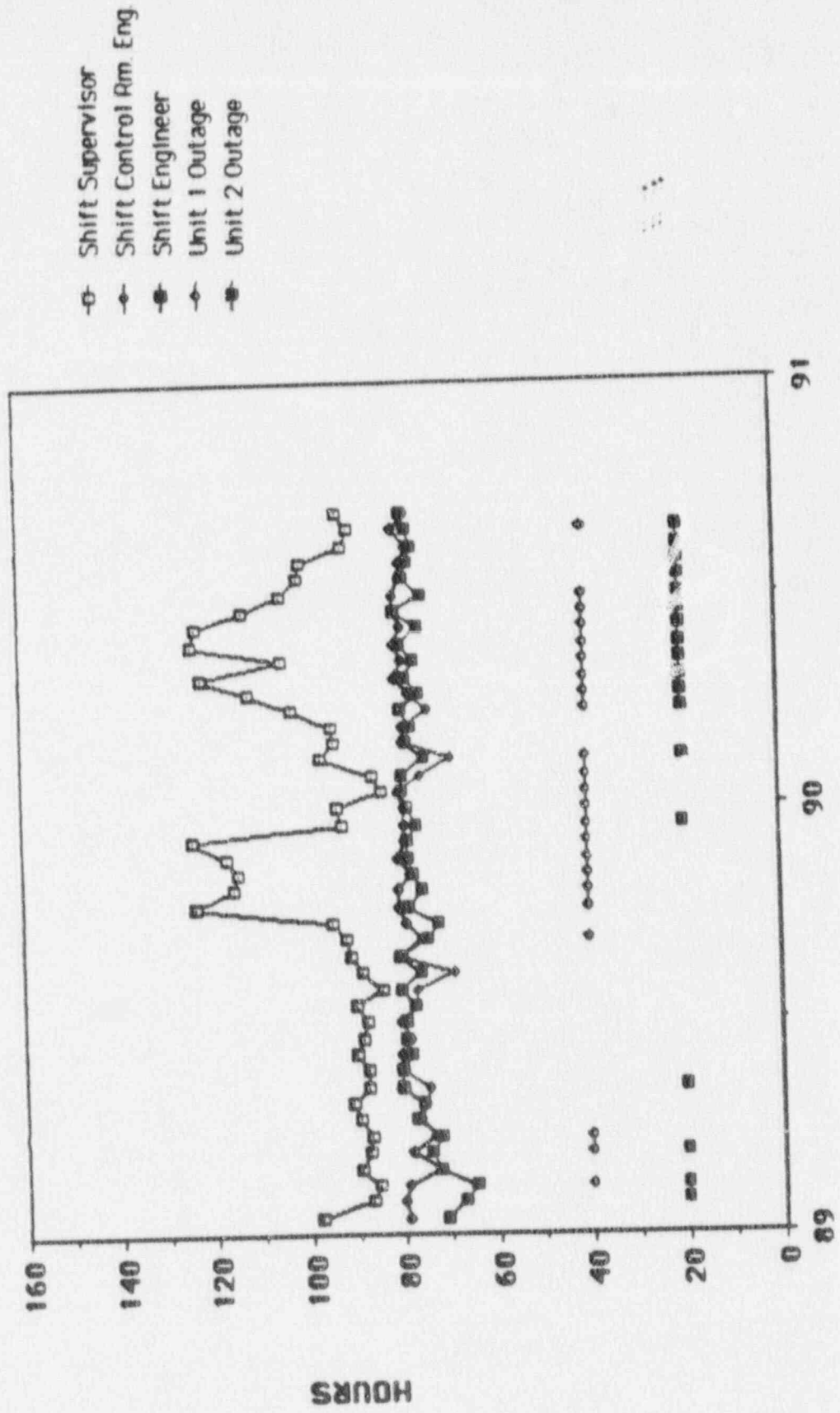
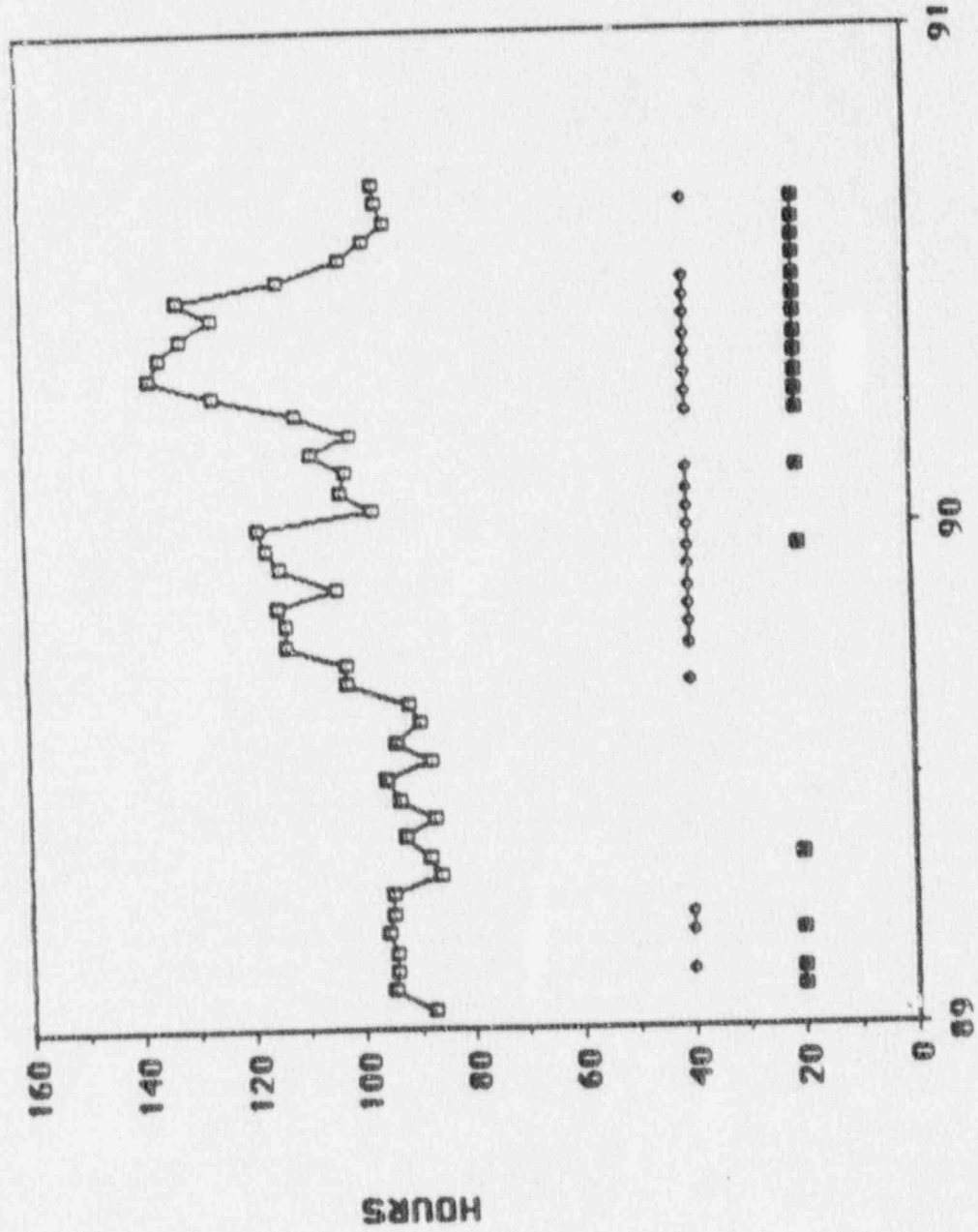


FIGURE 2. OPERATIONS

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)



- Nuclear Station Operator
- ◇- Unit 1 Outage
- Unit 2 Outage

FIGURE 3. OPERATIONS

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

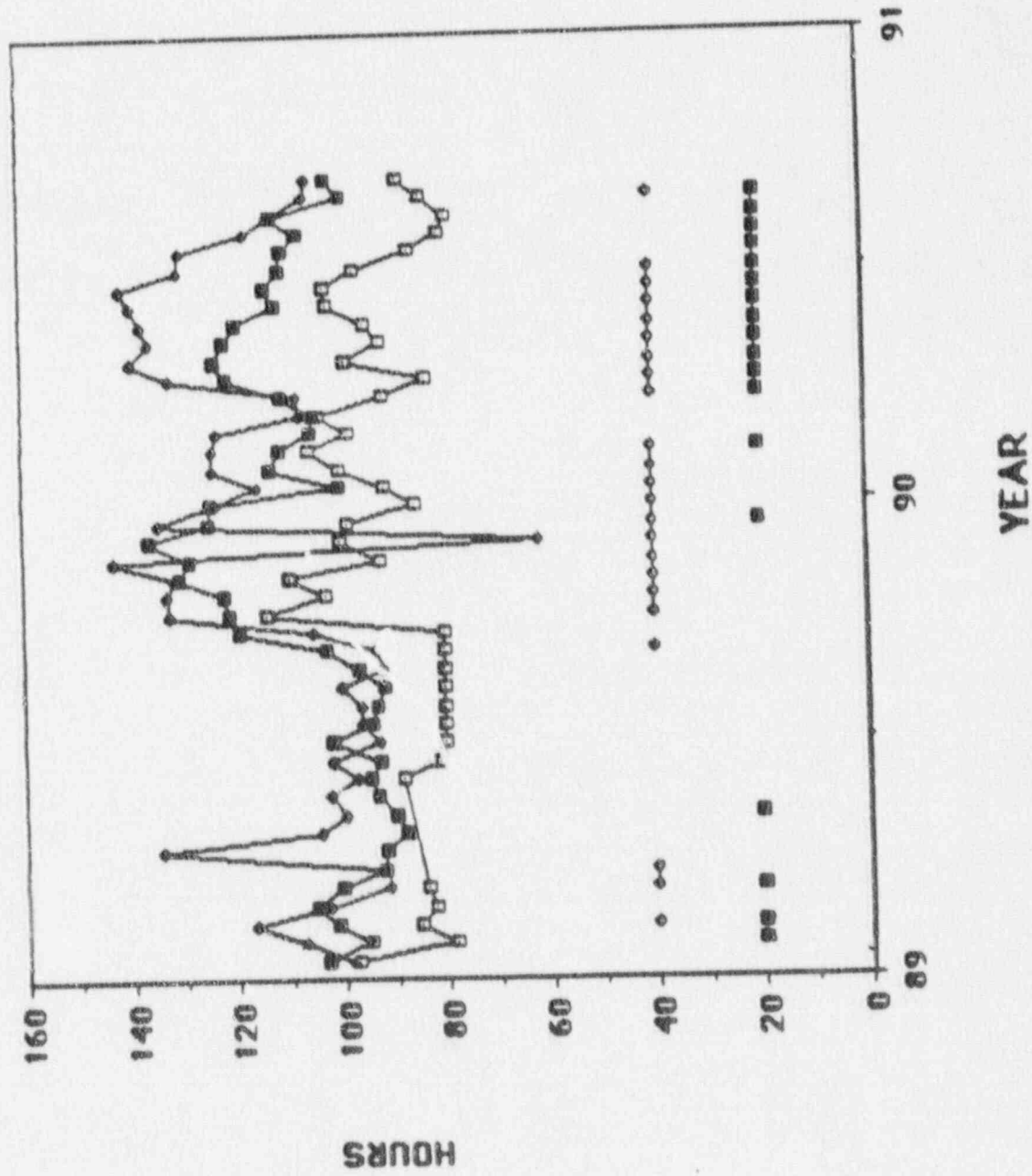


FIGURE 4. RADIATION PROTECTION AND CHEMISTRY
 (AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

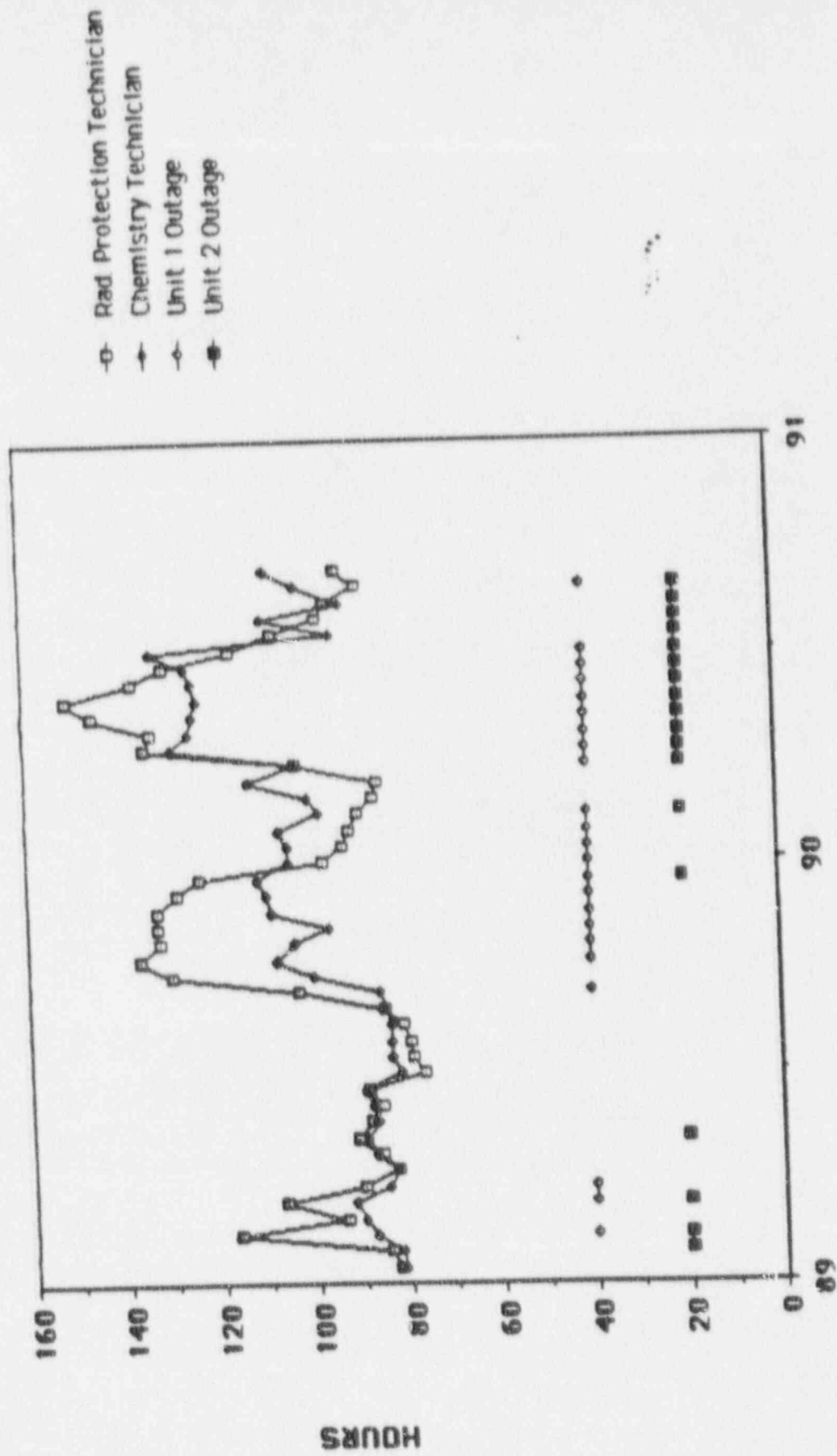


FIGURE 5. MECHANICAL MAINTENANCE

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

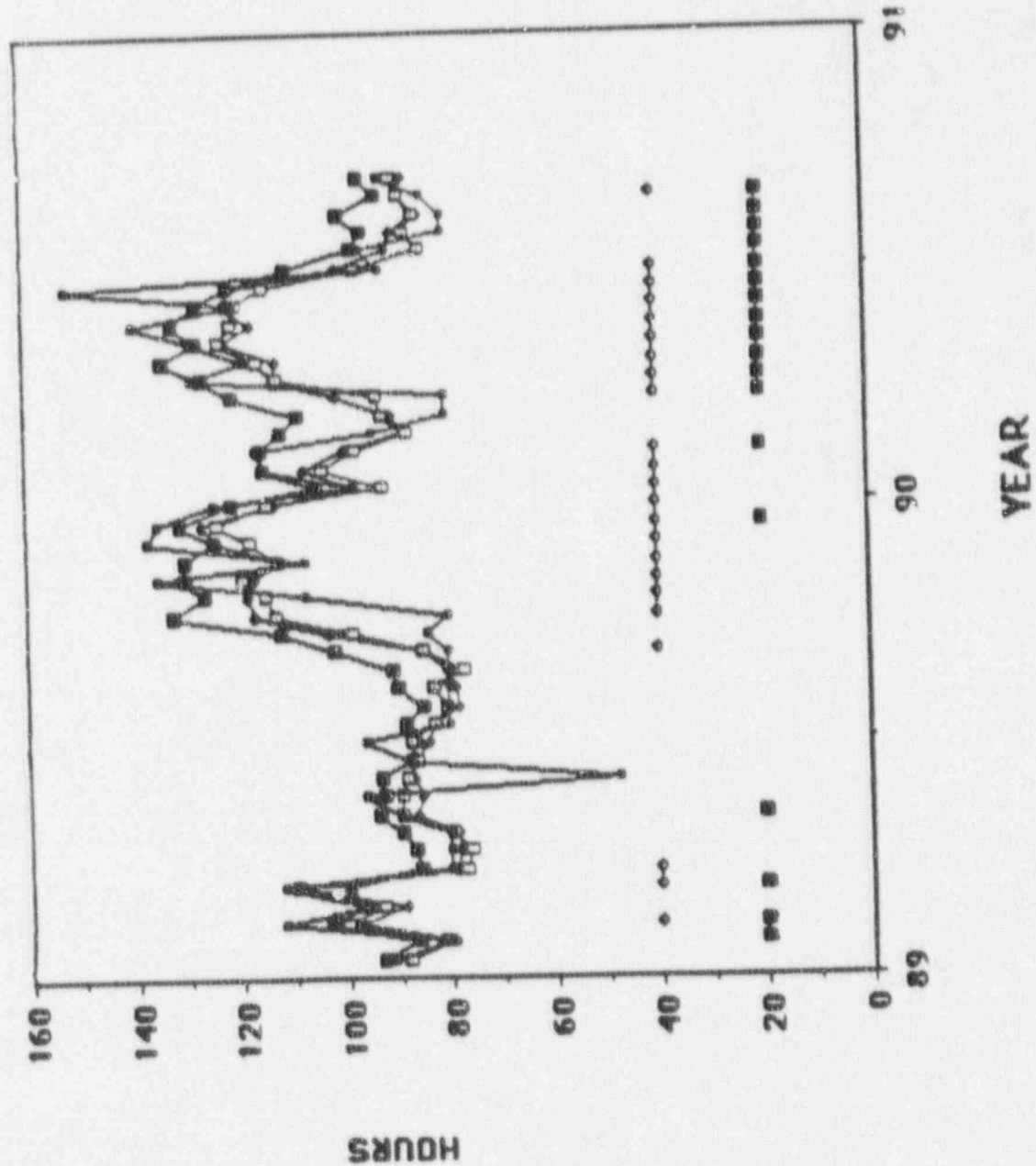


FIGURE 6. INSTRUMENT MAINTENANCE

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

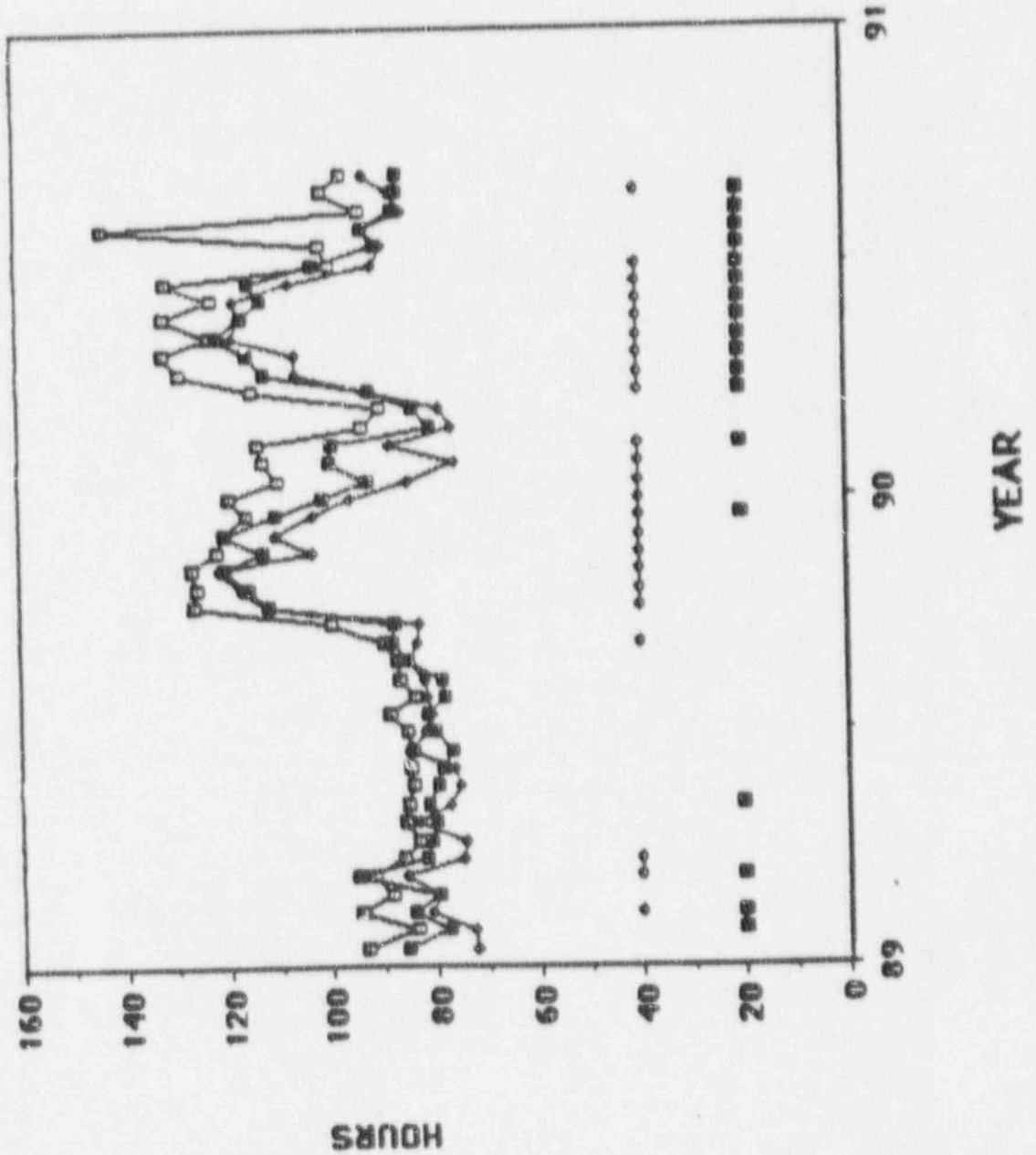


FIGURE 7. ELECTRICAL MAINTENANCE

(AVERAGE HOURS WORKED PER TWO WEEK PAY PERIOD)

