

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-530/87-08

Docket No. 50-530

License No. CPPR-143

Licensee: Arizona Nuclear Power Project
P. O. Box 52034
Phoenix, AZ 85072-2034

Facility Name: Palo Verde Nuclear Generating Station Unit 3

Inspection Conducted: February 9 - March 6, 1987

Inspector: Clifford A. Clark 3/23/87
C. Clark, Reactor Inspector Date Signed

Approved by: S. Richards 3/23/87
S. Richards, Chief, Engineering Section Date Signed

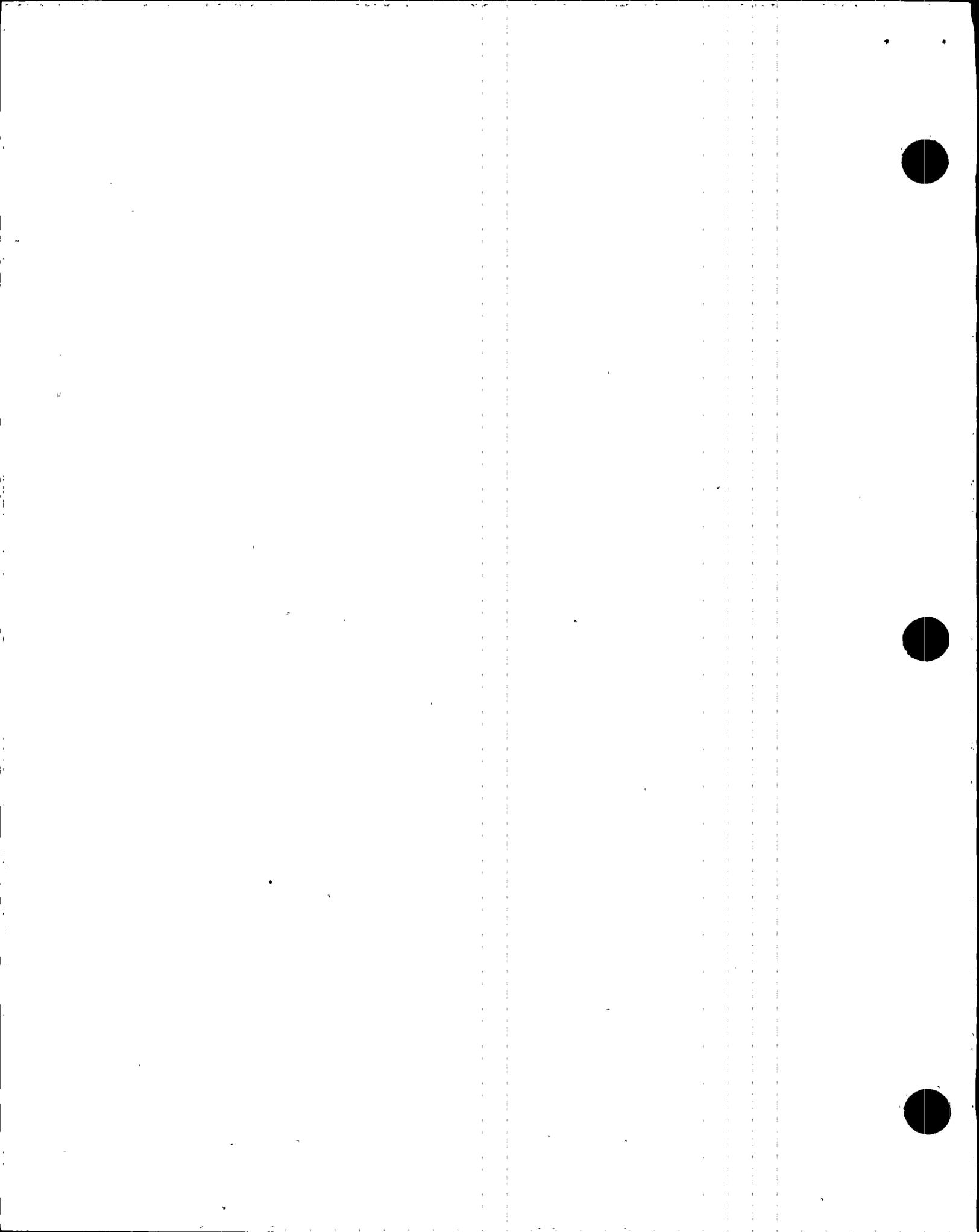
Summary:

Inspection During the Period February 9 - March 6, 1987 (Report No. 50-530/87-08)

Areas Inspected: Routine unannounced inspection of Unit 3. Areas examined included licensee action on inspector identified items, deficiency evaluation reports, and an inoffice review of the PVNGS Unit 3 Reactor Containment Building Integrated Leak Rate Test Summary Technical Report (File: 86-G-056-026). Inspection Procedures 30703, 92700, 92701, 92702, and 70323 were covered during this inspection.

Results: In the areas inspected, no violations of NRC requirements were identified.

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DETAILS

1. Persons Contacted

- *J. Kirby, Project Manager
- *C. Russo, Manager of Quality Audits and Monitoring
- *T. Shriver, Compliance Manager
- *T. Bradish, Compliance Supervisor
- *R. Baron, Compliance Supervisor
- *S. Penick, QA Supervisor
- D. Le Boeuf, Corporate QA/QC Transition Representative

*Denotes those personnel in attendance at the exit meeting on January 30, 1987.

The inspector also held discussions with other licensee and contractor personnel during the course of the inspection.

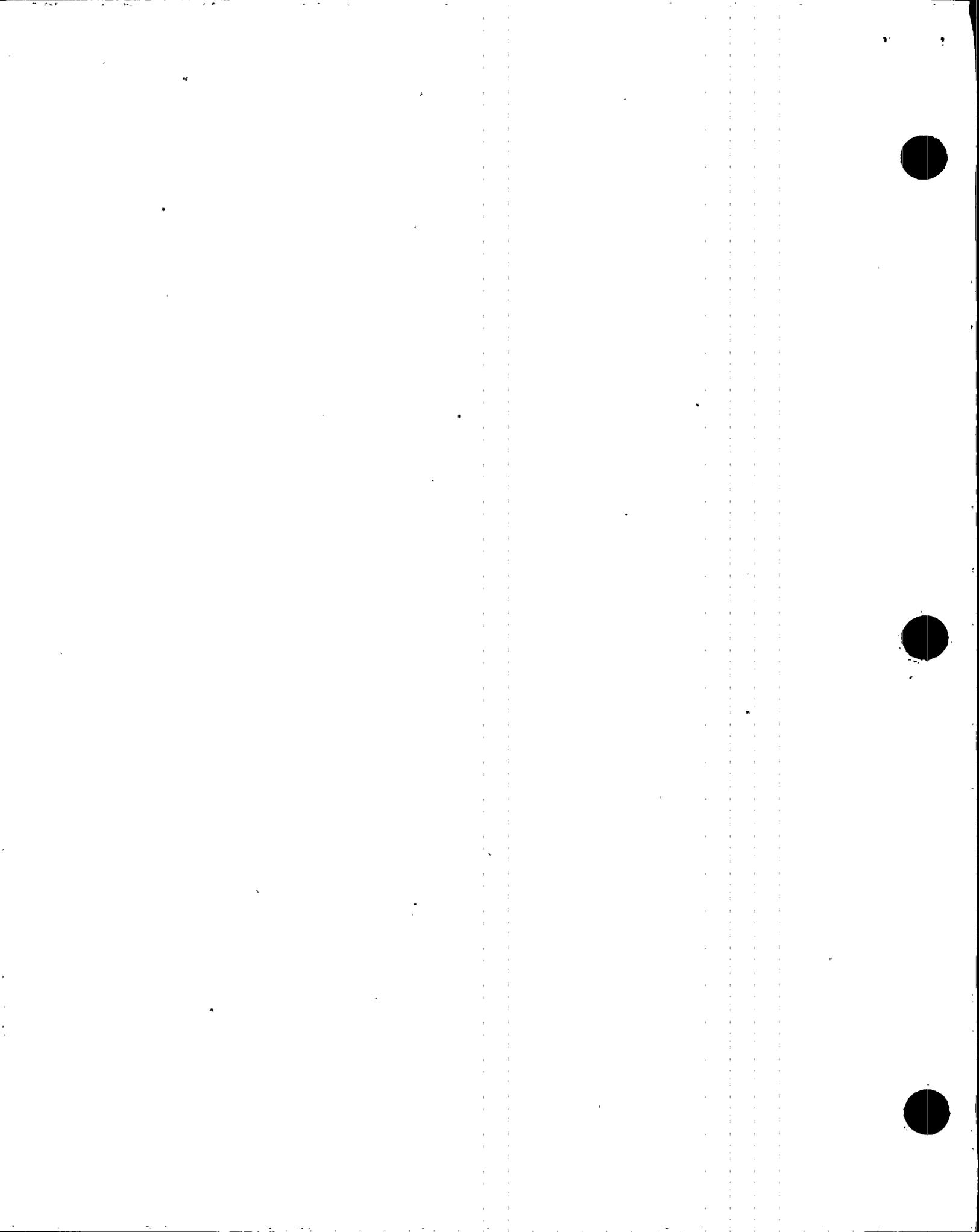
2. Licensee Action on Previously Inspector Identified Items

A. (Closed) Followup Item No. 50-530/86-03-16: PT Weld Examination Accuracy - Unit 3

In Section IV.B.3., "Preservice Examination (PSE)," of the NRC Construction Appraisal Team (CAT) Inspection Report No. 86-03, the NRC CAT inspectors identified that based on the "for information" PT inspection results observed during their inspection, that an additional review of the original baseline PT examinations may be required by the licensee to assess the adequacy of the PT examinations so that an accurate preservice baseline can be established.

During this inspection, the inspector identified the following information:

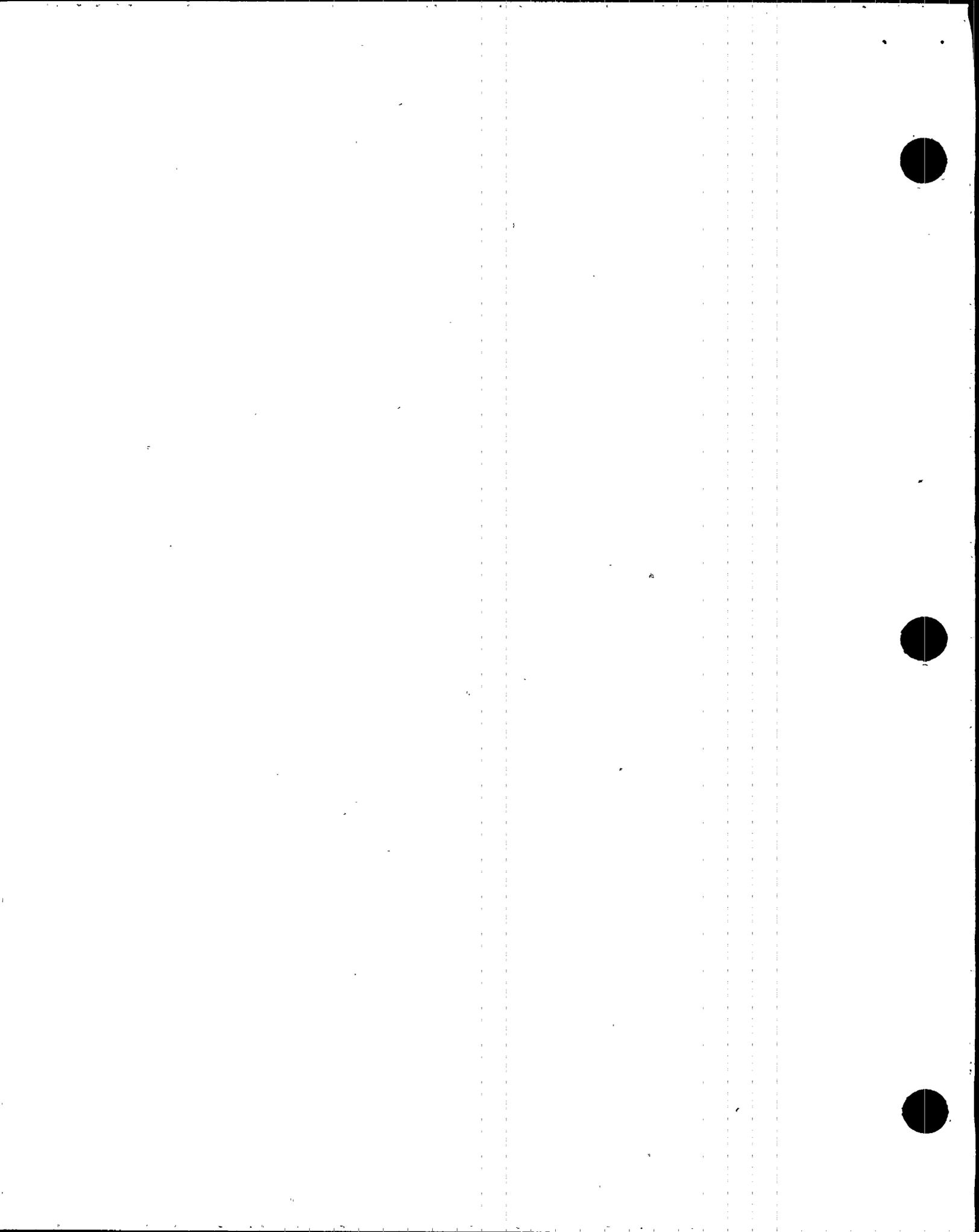
- (1) On January 30, 1986, the licensee issued Corrective Action Report (CAR) No. CA-86-008 to investigate why welds 03-031-006 and 03-085-003 revealed PT indications when reexamined, which were acceptable, but not recorded on the original PSE reports.
- (2) On March 3, 1986, the licensee identified CAR No. CA-86-008 invalid for the following reasons:
 - a. The indications identified were well within the acceptance criteria of ASME Section XI and CE procedure 9778-ISI-040.
 - b. It is possible the indications identified occurred after the PSE.
 - c. The welds with the identified indications will be reexamined within the normally scheduled ISI program, with any indications evaluated as new indications.



- (3) The licensee stated that the initial PT inspections observed by the CAT NRC inspectors prior to January 27, 1986, were information only PT inspections and did not require official documentation of results by the licensee. The licensee also stated that information only PT inspections performed by a licensee contractor on January 27, 1986, revealed that a majority of the original PT indications observed in weld 03-085-003 by the CAT NRC inspectors prior to January 27, 1986, were the result of undercleaning at the toe of the weld during this first information only PT inspection. The licensee PT Report No. UST-PT-56716 (dated January 27, 1986) states that for CE weld No. PSE03-085-003, only two (2) rounded indications (1/32 inch in diameter) at 39 on the pipe side were observed during a later followup PT inspection. One other licensee followup PT Report No. UST-PT-56717 (dated January 27, 1986) for weld PSE 03-031-006 revealed that five (5) rounded indications less than 3/64 inch in diameter and one (1) linear indication 1/64 inch long were observed during a later followup PT inspection. The licensee also stated other information only PT inspections had been performed but not documented.
- (4) The licensee has taken the following position on additional review of PSE baseline PT inspections.
- a. All PT indications found during these later information only PT inspections were acceptable, per the acceptance criteria of ASME Section XI and CE PT examination procedure 9778-ISI-040. Therefore, there were no welds found rejectable per PT inspections.
 - b. It is possible that any PT indications found during these information PT inspections were the result of material surface condition changes in the last twenty-one (21) months since the PSE baseline inspections were performed.
 - c. All PSE baseline PT inspections were performed by acceptable personnel, using an acceptable procedure and the results were officially documented. The licensee is not planning on repeating these PSE baseline inspections.
 - d. All welds with identified indications will be reexamined during the future ISI examinations and any indications found will be evaluated as new indications at that time.

After reviewing the licensee available documents and discussions with licensee personnel, the inspector agreed with the licensee position, that there is no requirement for additional review of the PSE PT examinations.

The inspector was concerned that during the review of this item, the licensee stated that they had perform information only PT inspections and investigations, but could provide little written documentation of the work they performed to resolve this item. The inspector stated that actions taken to resolve issues should be



adequately documented in an acceptable form for audit/review. This area requires additional management attention for future items.

This item is closed.

B. (Closed) Unresolved Item No. 50-530/86-03-19: Radiograph Adequacy Due to Poor Quality - Unit 3

Section IV.B.11, "Vendors and Shop Fabricators Other Than Those Previously Addressed," of the NRC CAT Inspection Report No. 86-03 identified that during the review of radiographs supplied by various vendors and contractors, the NRC CAT inspectors identified several deficiencies associated with two vendors, involving film artifacts which could mask the area of interest, missing identification marks, one set of radiographs available instead of the required 2 sets, low density and misfiled reader sheets.

These items were also referenced in Section 2.C of violation 50-530/86-03.

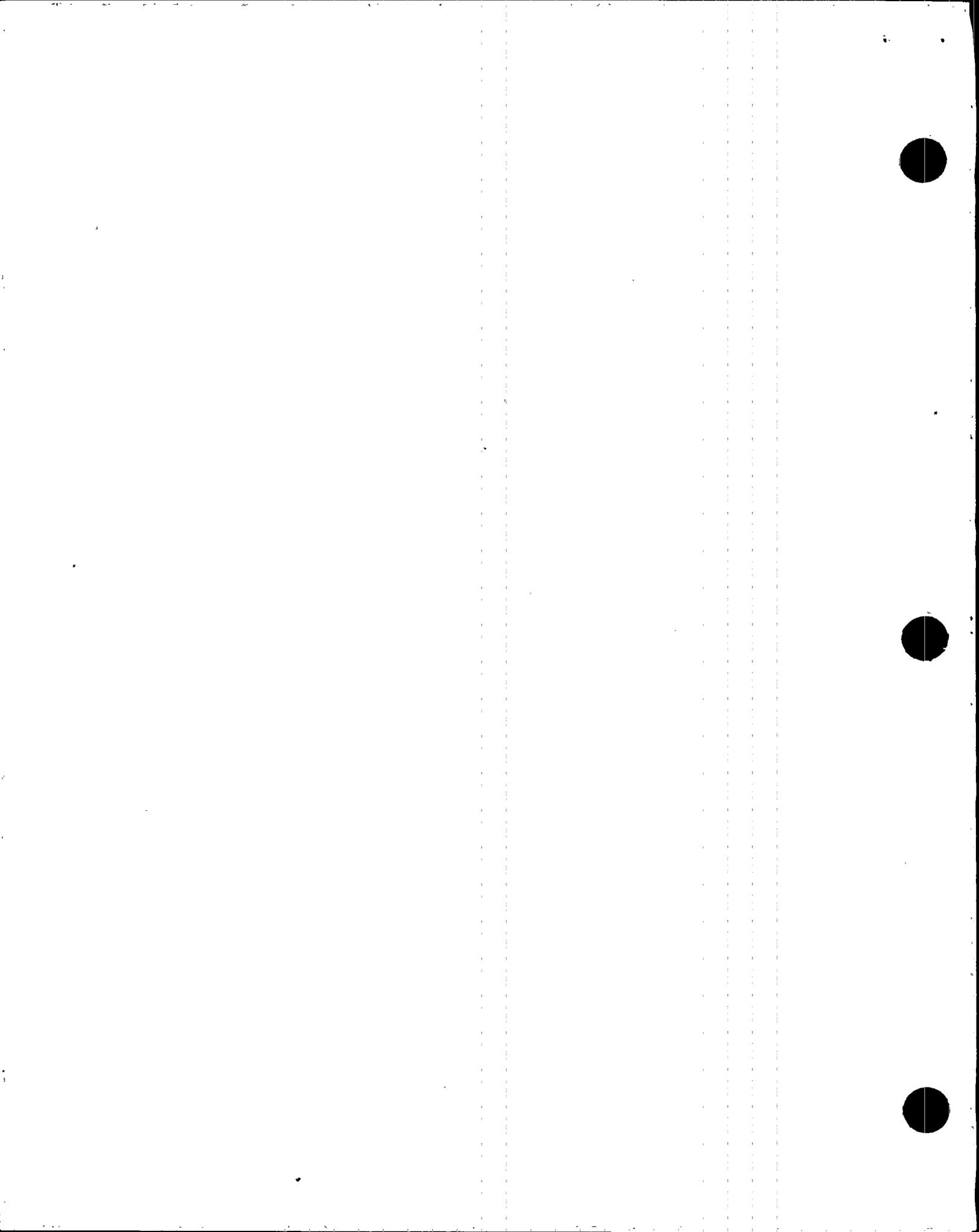
The licensee issued letter ANPP-37490-EEVB/SGP of July 25, 1986, in response to Notice of Violation 50-530/86-03, which stated in Section 2.C, "Some vendor supplied radiographs did not have the required film quality." In Section 2.C of the licensee's letter (on page 9) the licensee stated:

"The identified deficiencies were documented on Bechtel NCR's WA-1713 (EFCO) and WF-1714 (PX Engineering Co.). NCR WA-1713 was dispositioned "use-as-is" since there were no actual weld defects noted and has been closed. NCR WF-1714 was invalidated and superseded by EER 86-PC-010. The EER was dispositioned "use-as-is", since it has been demonstrated acceptable by passing several independent pressure tests, and has been closed.

"Due to the variety of deficiencies identified for EFCO film, ANPP/QA issued CAR CP86-0022. This report was issued against Combustion Engineering (CE), to whom the material was furnished. The corrective actions accomplished by CE included a CE Level III 100% review of existing EFCO film for the shutdown heat exchangers for all 3 units. Further project actions included a Bechtel NDE Level II and ANPP QAE overview of CE efforts.

"The NRC CAT discrepancies dealt totally with the quality of the radiographs and not with the quality of weldments. CE's 100% review did not reveal any weld defects, which confirmed original findings that the heat exchangers for all 3 units are acceptable. CE did undertake additional corrective action in retraining and reexamining NDE personnel in RT methods to improve their second level surveillance program.

"As a result of the deficiencies noted by the NRC, and in order to ensure that the radiograph deficiencies were not a generic



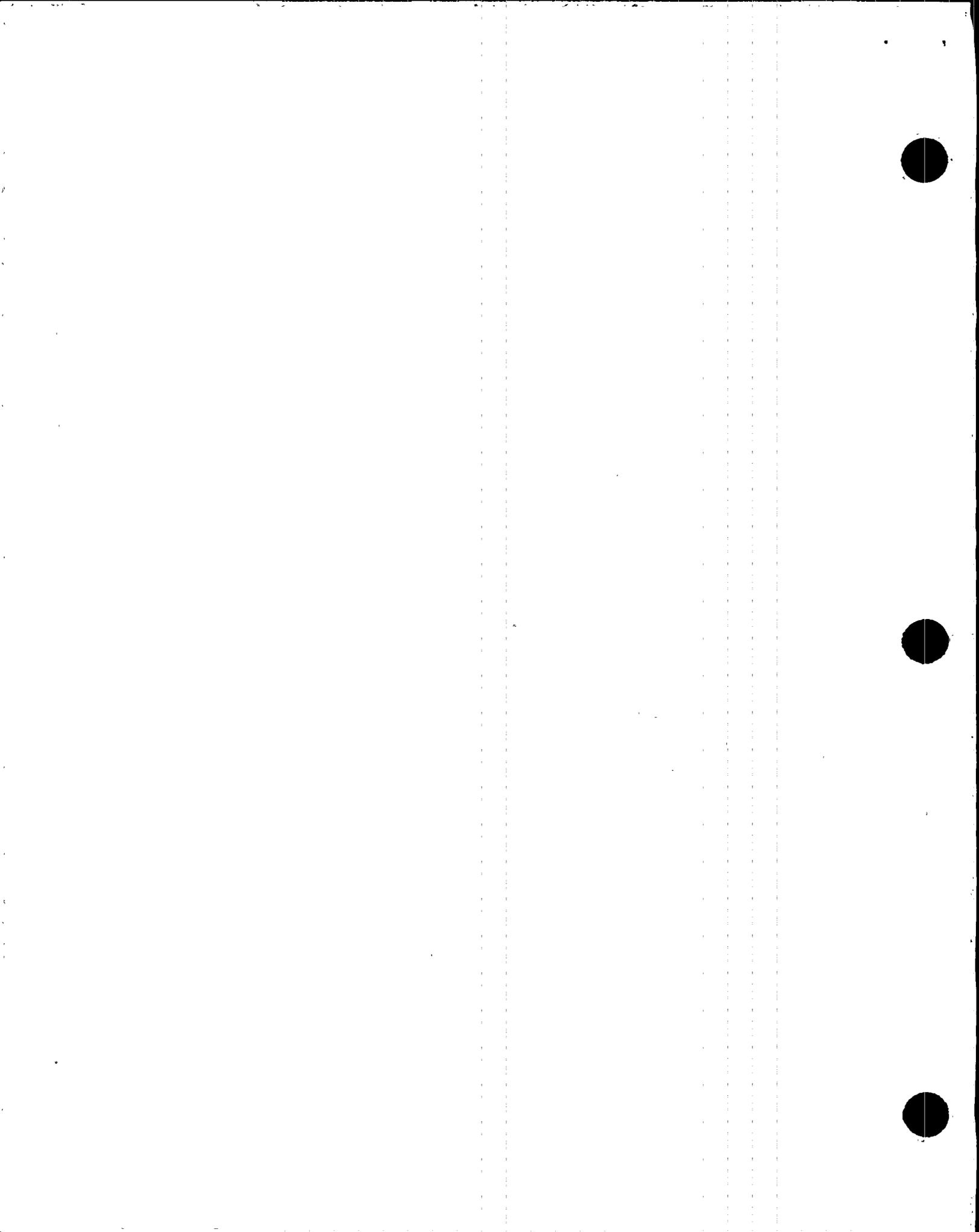
concern, Bechtel performed an additional overview evaluation of vendor film from Engineering Fabricators (EFCO), Struthers Wells, PX Engineering, AMETEK Straza, Control Components and CE Avery. This review started during the CAT inspection and concluded after the inspection. The following summarizes the results of film reevaluated by a Bechtel Level II reviewer and the discrepancies found.

- "EFCO - Deficiencies were addressed by CE in response to ANPP CAR CP86-0022, as previously described.
- "STRUTHERS WELLS - No discrepancies noted for film reviewed.
- "PX ENGINEERING - Deficiencies identified on NCR WF-1714/EER 86-PC-010.
- "AMETEK STRAZA - No discrepancies noted for film reviewed.
- "CONTROL COMPONENTS - No discrepancies noted for film reviewed.
- "CE-AVERY - One discrepancy was identified on NCR WC-1712 and was subsequently dispositioned "use-as-is."
- "SOUTHERN BOILER - One discrepancy was identified on NCR WC-1745 and was subsequently dispositioned "use-as-is."

"No safety significant deficiencies were identified during the review, and therefore no further reviews were conducted."

After reviewing the available information, the inspector reached the following conclusions:

- o While the initial quality acceptability of some of the original EFCO RT film was found unacceptable, with additional review effort such as high intensity viewers, a second set of film (when available), etc., reportedly the presence of the film irregularities did not interfere with the acceptable interpretation of the weld quality during the latest CE review of available EFCO RT film. All of the subject welds have undergone additional licensee acceptance testing in the past, and has been evaluated as acceptable. Applicable welds will also be routinely retested during the life of the unit.
- o The initial quality acceptability of some of the PX engineering RT film was found unacceptable. But again, all the subject welds were originally accepted by qualified RT examiners and have undergone additional licensee acceptance testing in the past and have been evaluated as acceptable. These welds have



passed all pressure tests and will be routinely retested during the life of the unit.

- ° The NRC CAT report did not question the quality of the welds they reviewed the applicable RT film for, but only the quality of the RT film as it existed several years after the initial official review and acceptance of the subject welds.
- ° It appears the licensee has taken adequate actions required to address the RT film quality concerns identified in the NRC CAT report.
- ° The licensee needs to direct additional attention to the RT film surveillance programs established by their contractors for acceptance of RT film, to improve the quality of RT film used during evaluation of applicable welds.

This item is closed.

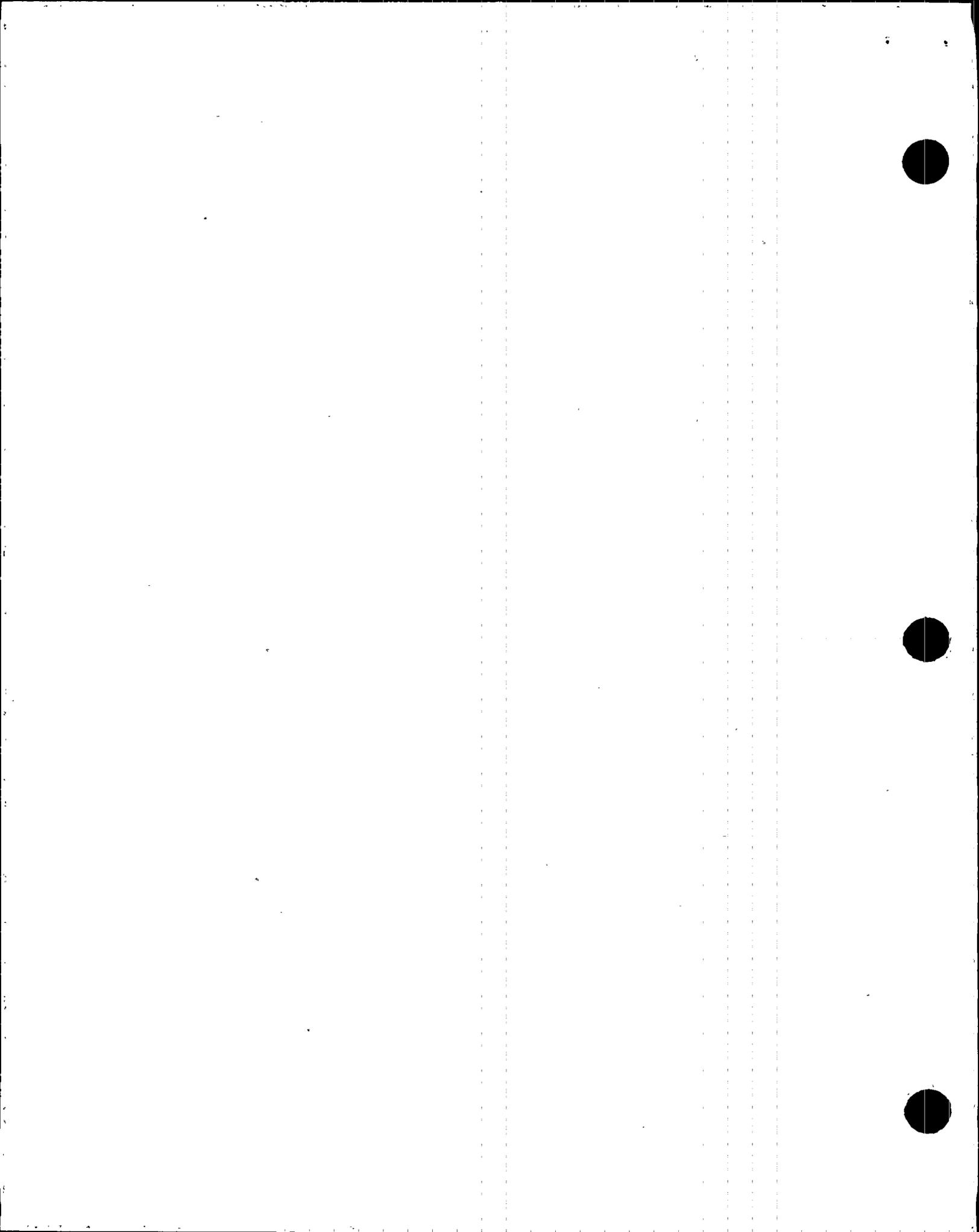
3. Licensee Action on Deficiency Evaluation Reports (DER)

A. (Closed) DER 86-04, Revision 1, "Supports for BISCO Penetration Seals" - Unit 3

On January 8, 1986, a floor penetration seal in Heat Exchanger Room A 106, in the Unit 2 Auxiliary Building, was observed to have moved approximately 9 inches in a downward direction. This indicated a lack of adhesion between the sealing material and the penetration sleeve and a potential for the 1,875 pound seal to drop completely out of the sleeve. If not corrected, this condition could have occurred on other similar seal configurations in the future due to aging of the material, building vibration, or a seismic event.

The above occurrence indicates that under certain circumstances, the adhesion of the seal material to the penetration seal sleeve may not be adequate to support the weight of the seal material without the use of structural supports. The supports are required to ensure that the fire barrier and radiation shielding function of the seals is maintained.

The subcontract required the subcontractor to provide miscellaneous support steel as required to sustain the weight of the seal and to maintain the sealing material in the penetration. At the time of this occurrence, four hundred and thirty-nine (439) seals utilizing Brand Industrial Services (BISCO) high density sealant material (150 or 250 pounds per cubic foot) were identified for installation in Units 2 and 3. The Unit 3 seals had not been installed yet. The initial Unit 1 seals were installed by a different subcontractor and were properly supported. However, thirty seven seals were installed later in Unit 1 by BISCO. Per Bechtel, the BISCO installations without supports were based on the BISCO position that the bonding characteristics of the seal material to the penetration sleeve were adequate to support the weight of the seal. This was also based on experience on other nuclear plants with similar conditions.



Since penetration seals are composed primarily of proprietary materials, Bechtel stated that the subcontractor must make the evaluation and determination of the need for structural supports. In BISCO letter No. 90, dated March 15, 1984, BISCO stated that, based on physical characteristics of their high density sealants, the bond between the sealant and the penetration sleeve was adequate to support the weight of the seal and thus structural supports were not required.

As a result of the penetration seal slippage, Bechtel performed calculation 13-CC-ZA-140 to establish criteria for determining which high density penetration seals required support. A total of forty three (43) seals each in Units 2 and 3 were identified as requiring support and scheduled to have supports installed. In addition, twelve (12) seals in Unit 2 were scheduled to have supports added as a conservative design improvement, and the design of these same twelve (12) seals in Unit 3 has been changed to utilize grout as an alternate sealing material. In Unit 1, six (6) BISCO seals will have supports added.

In this DER Bechtel stated, "The root cause of the failure is attributed to inadequate subcontractor design and installation." During this DER review, the inspector noted the following information:

(1) BISCO letter No. 0387, dated May 7, 1986, stated the following:

- a. "Based on calculations resulting from BISCO tests, a conservative value for the bonding strength of SF-150 NH and/or SF-250L to the inner surface area of an opening was determined to be 12 PSI. In comparison, by calculating the weight of the seal in penetration number 435/49 (1,535 lbs.) and dividing by the total surface area of its sleeve (3,056 sq. in.), the bond value required in order to support the seal is approximately .5 PSI.
- b. "The DER identifies a concern over the effect on the high density seals from building vibration or seismic event. These conditions are not addressed by the specification, therefore, BISCO did not design or install to satisfy such criteria.
- c. "BISCO considers the dislodgement of penetration seal number 435/49 to be an isolated case. Since we are unable to determine the specific root cause of the seals displacement...."

(2) BISCO letter No. 0387 identified the weight of the seal as 1,535 pounds, while the DER identified the seal weight as 1,875 pounds, or a difference of 340 pounds. During this review, the licensee available documentation did not identify the reason for this disagreement on the weight of the seal in penetration number 435/49.



- (3) Bechtel interoffice memorandum, IOM-CE-10963, dated April 9, 1984, stated the following:

"...Engineering has completed a review of a submittal from BISCO,..., containing a statement that structural supports are not necessary for seals installed in Unit 2. In support of this statement, BISCO submitted test data for load test....It is engineering's opinion that the data submitted does not support the conclusion reach by BISCO that structural supports are not required for Unit 2 penetration seals."

- (4) Of concern to the inspector is the fact that based on the Bechtel interoffice memorandum, approximately 21 months prior to this event, Bechtel's own staff had notified them that they did not agree with BISCO's position of installing seals without supports. The documents available during this review could not show where Bechtel addressed this Bechtel engineering opinion to BISCO or notified BISCO that they could not install applicable seals without structural support. This is an apparent example of Bechtel's weakness in engineering follow through, subcontractor administration and surveillance to ensure that subcontractors are complying with their own and the licensee's requirements. This information was not identified in this DER.

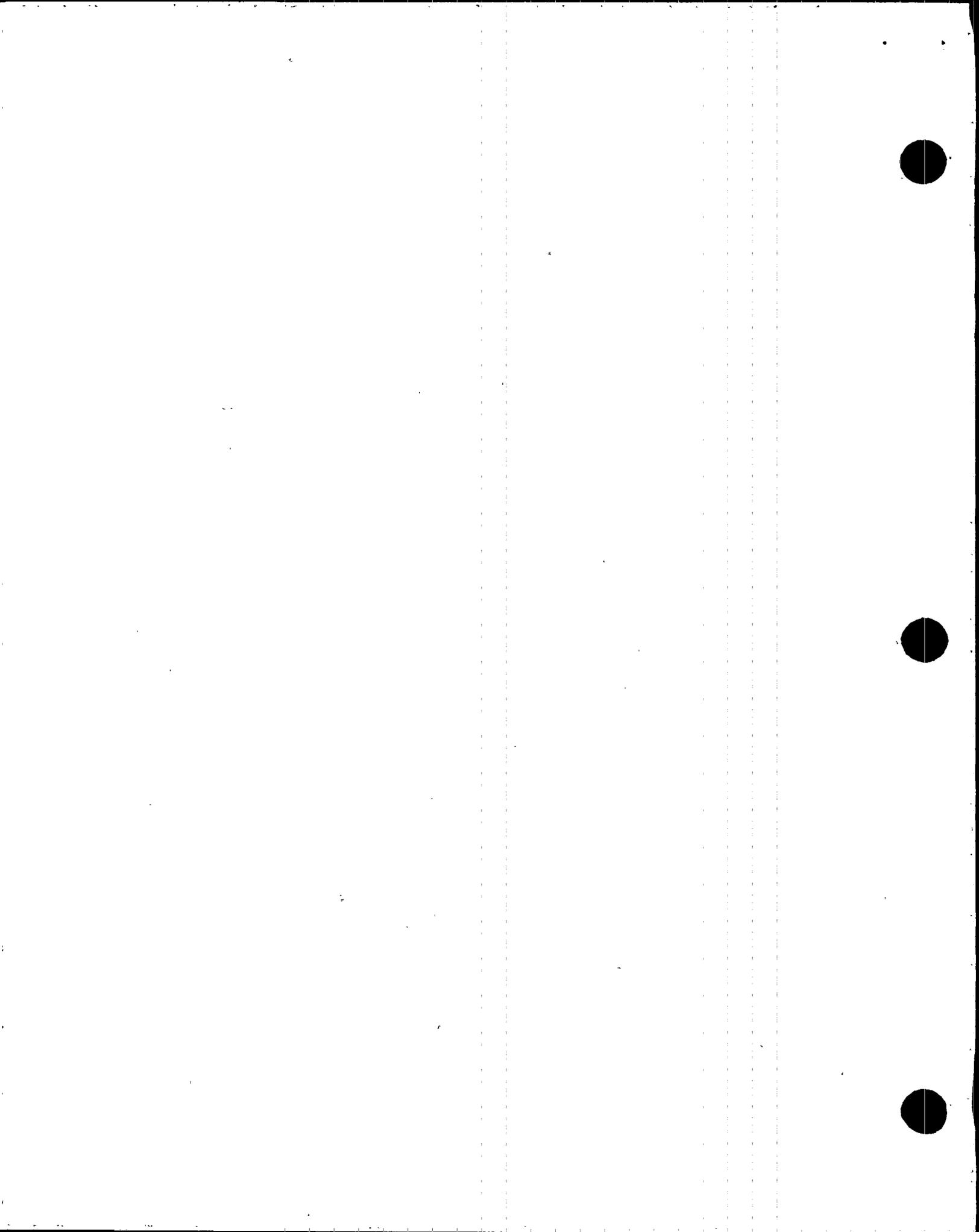
Based on the onsite inspection, the licensee and Bechtel have issued documents and procedures to correct the identified unacceptable conditions in Units 1, 2, and 3. The licensee has stated that the possibility of this occurring in future work is reduced by the fact that the licensee management and engineering staff will be involved in engineering review of all future work for Units 1, 2, and 3 (when turned over to the licensee). The licensee is still following up on this event, via HOT LINE File NO. 85-121, which is awaiting completion of work in Unit 2 for close out. Since the licensee appears to have taken appropriate corrective actions to correct existing unacceptable seal installations in Units 1 and 2, and established responsibility for assuring their acceptable completion for Units 1, 2, and 3, this DER can be closed out.

This item is closed.

B. (Closed) DER 86-12, Revision 0, "Partial Penetration Welded Nozzles" - Unit 3

In March of 1986, while performing design change package (DCP) 3CJ-SB-021, to shim certain partial penetration welded (PPW) nozzles with condensate pots, it was discovered that similar nozzles not included in the DCP may have also required shimming.

The ASME Section III, Subsection NB-3337.3, requires all Classes 1 and 2 nozzles having partial penetration welds to have "substantially no piping reaction" loads imposed on them by the



attached piping. This requirement can be met by shimming the nozzles.

For each unit there are 350 instrumentation PPW nozzles provided by CE on the steam generators, pressurizer, safety injection tanks, reactor vessel, reactor coolant pumps, and primary piping. The code states that this type of design is acceptable only when used under the conditions that "substantially no loads" are imposed by the attached piping. The loads for this condition are due to dead weight and thermal expansion only.

Per Availability Data Program (ADP) Information Bulletin 83-03, dated March 2, 1983, CE informed Bechtel that the loads imposed on some instrumentation nozzle partial penetration welds due to dead weight and thermal expansion may exceed the limits allowed by the ASME code. The ADP Bulletin recommended one of the following means to satisfy the code requirements.

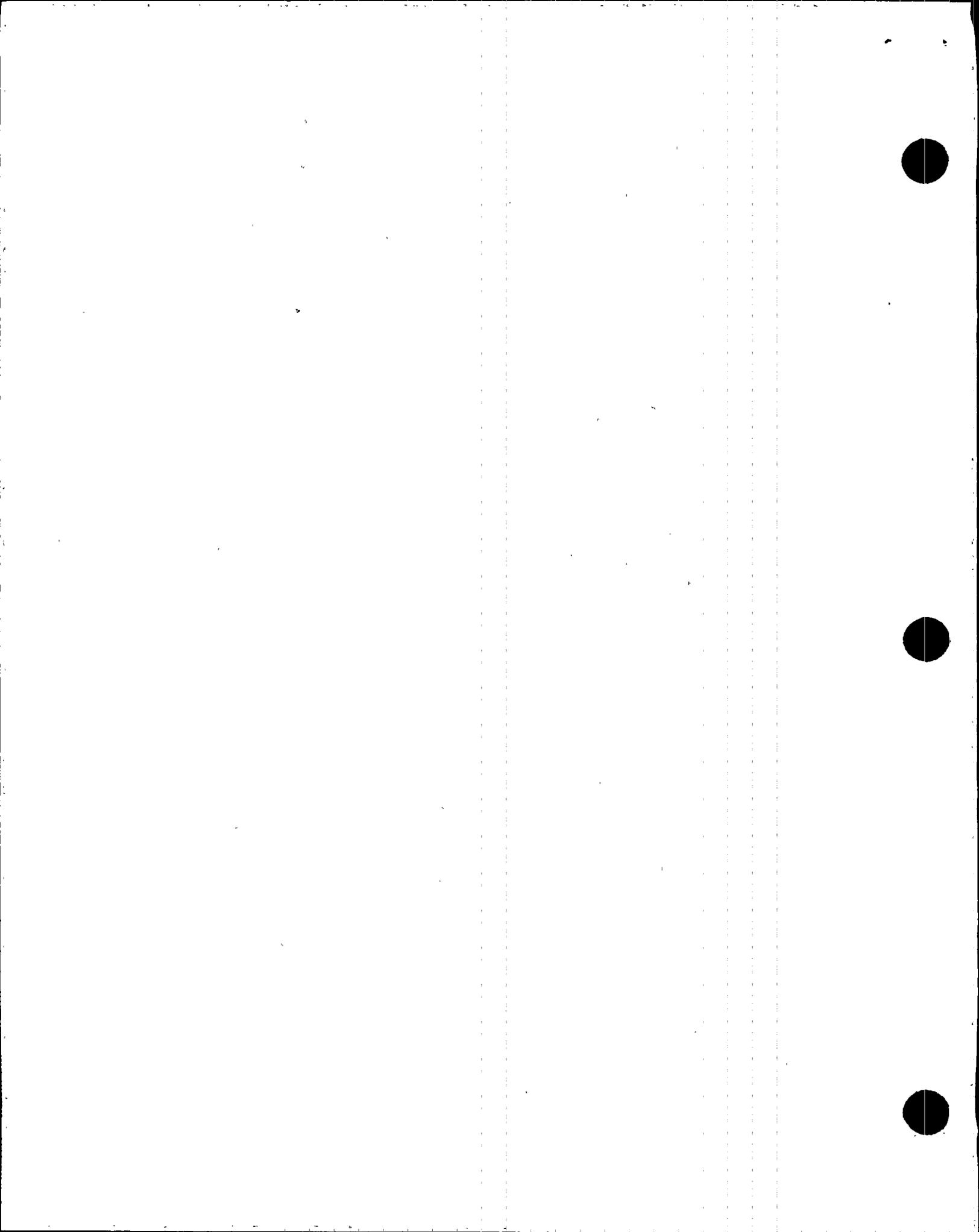
- (1) Compare the instrumentation nozzle loads resulting from the as-built configuration with those loads assumed in the CE code stress analysis.
- (2) Confirm that the calculated stresses due to normal loads at the critical section for partial penetration instrumentation nozzle welds comply with the following design requirements:
 - a. Class 1 nozzles are acceptable if the calculated stress is less than 10% of yield, or if the calculated stress is less than 20% of yield and a fatigue evaluation shows a cumulative usage factor less than 1.0.
 - b. Class 2 nozzles are acceptable if the calculated stress is less than 20% of yield.

Since the CE code stress analysis assumed zero load from the connected piping, Alternative (2) was the only available criteria.

All of the 350 nozzles with partial penetration welds were analyzed using Alternative (2) criteria. Of the 350 nozzles (per unit), 12 nozzles which had condensate pots on the piping were shimmed previously under DCP 1SJ, 2SJ, and 3CJ-SB-021 to reduce the loading at the critical section of the nozzle on the partial penetration weld location to an insignificant magnitude per CE shimming criteria. Thus, these required no further evaluation.

The remaining 338 nozzles were evaluated for the loading imposed upon them from the connected piping. This evaluation was documented in Calculation No. 13-MC-ZZ-033. Per Bechtel Piping Material Classifications "all branch welds to be full penetration and shall be examined in accordance with the code." Therefore, there are no PPW nozzles on Bechtel procured piping.

After the 12 nozzles were shimmed under DCP SB-021, only 3 nozzles of the remaining 338 in each unit did not meet CE Bulletin 83-03



requirements. These nozzles required corrective action in the form of shimming due to high loads imposed by the piping:

- (1) Sample line on the Hot Leg RC-032-42" (Root Valve V-213).
- (2) Pressure instrumentation line on the Hot Leg RC-032-42" (Root Valve V277).
- (3) Pressure instrumentation line on the Hot Leg RC-063-42" (Root Valve V285).

The three nozzles in Units 1 and 2 were shimmed per EER 86-XM-011 and Unit 3 nozzles were shimmed per DCP 3CJ-SB-021 MOD 9 to meet the ASME code and CE Bulletin 83-03 requirements.

The identified root cause of this deficiency was an engineering oversight in identifying all partial penetration welded nozzles requiring shims.

Based on the onsite inspection, the licensee appears to have taken appropriate corrective actions to correct the reported unacceptable PPW nozzle installations.

This item is closed.

C. (Closed) DER 86-17, Revision 2, "Carbon Steel Guides in Stainless Steel Gate Valves" - Unit 3

During startup flushing of the Safety Injection (SI) system in Unit 3, in April of 1986, bright metallic particles were found in certain strainers. When the valves upstream of the strainers in the SI system were disassembled in order to find the source of the metallic particles, the guides in valves 3J-SIA-HV-864, 685, 687, and 688 were found to be rusted. All of the four valves are 10", motor-operated, stainless steel gate valves manufactured by Borg-Warner and supplied by Combustion Engineering. The guide is a rail welded to the body of the valve. The rail guides the gate in a linear motion during opening and closing of the valve. Small sample coupons of the guides taken from each of the four valves were analyzed and found to be carbon steel in lieu of the required stainless steel.

Upon identification of the potential problems in the valve guides, CE provided the licensee with a list of all valves with similar guides - a total of 67 valves in each unit. Also, CE requested Borg-Warner to research their fabrication history to define the extent of the problem.

A total of twenty valves in Unit 3 were inspected as part of the program to determine the source of the metallic particles found during the SI system flushing. Of these twenty valves, four were discovered to have rusted rails made of low alloy steel instead of the specified stainless steel material. As a result of finding the



rusted rails in four of the Unit 3 valves, Unit 2 inspected four valves to obtain assurance that they did not have a similar problem.

Per Borg-Warner's research, the root cause of the deficiency was that four (4) sets of low alloy steel guides were issued from Borg-Warner stock, inspected and identified as the incorrect material. However, the original low alloy steel guides were inadvertently reidentified on the shop order form with the stainless steel part number and installed. The two part numbers are sequentially one digit apart, 77843-10 (stainless) and 77844-10 (low-alloy).

Borg-Warner's investigation into the non-conforming gate guide material problem has led them to conclude that the incident was an isolated case and is limited to the four valves listed above. This conclusion is based on a review, by Borg-Warner, of all valve shop orders requiring welded stainless steel gate guides. The results of Borg-Warner's investigation found no discrepancies other than those identified above.

In addition, Borg-Warner has also concluded that according to QA records, no similar situation, in which the substitution of incorrect material during the fabrication of nuclear valves, has occurred.

The licensee's inspections of Units 2 and 3 Safety Injection valves provides supplemental information and supports the conclusion of Borg-Warner that this was an isolated incident.

The guide rails of the four deficient Unit 3 valves (SI-684, -685, -687, and -688) were removed and replaced by rails of the correct material. The work was accomplished to original specification requirements using approved procedures.

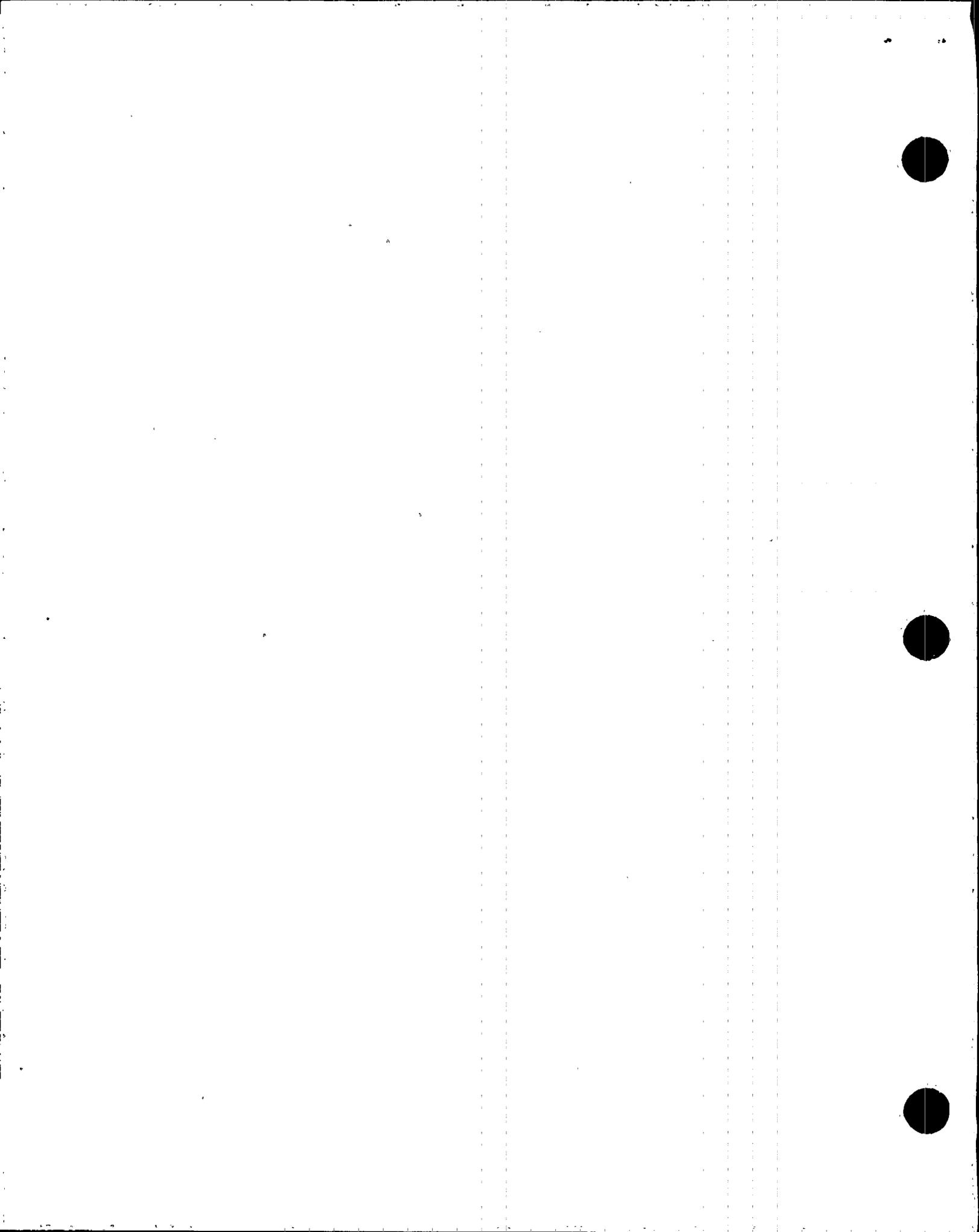
Based on the onsite inspection and review of licensee documents, the licensee appears to have taken appropriate corrective actions to correct the identified unacceptable valve guides.

This item is closed.

D. (Closed) DER 86-18, Revision 0, "Unsealed Penetrations in the AFW Pump Rooms" - Unit 3

During a review in April of 1986, it was identified that not all the applicable piping penetrations were sealed as required.

The Main Steam Support Structure (MSSS) (System ZM) Detailed Design Criteria, paragraph 1.5.2, states: "The portion of the structure below elevation 100 feet - 0 inches shall be designed to be watertight both from external sources of water and internal sources above elevation 100 feet - 0 inches." To implement this criteria, all penetrations through slabs and walls are required to be sealed. Contrary to this, in Units 1, 2, and 3, six penetrations for piping in the MSSS west wall to the containment seismic gap were not



sealed. In each of the two AFW pump rooms, there were two unused penetrations plus one for the 6 inch AFW discharge pipe. The 6" wide seismic gap between the MSSS and the containment allows flow between the two pump rooms and between the pump rooms and the spaces above elevation 100 feet, via the unsealed penetrations.

All walkdowns and reviews are based on Architectural drawings. The penetrations in question were not transferred from Civil to Architectural drawings, as is customary, due to an oversight.

Since the Architectural drawings did not reflect the penetrations, the design seal schedule did not include a requirement to seal them. Also, the system acceptance checklist referred the walkdown engineer to the Architectural design documents as stated above.

Verification of previous DER's utilized documentation from reviews and walkdowns based upon architectural design documents.

The root cause was determined to be a failure to transfer the west wall penetrations, located in the MSSS, from Civil to Architectural drawings.

The licensee has reviewed the Civil and Architectural drawings for penetrations located in the Unit 2 auxiliary building and MSSS. Transfer of information from Civil to Architectural drawings is made only where penetrations are involved. All other Architectural drawings are developed from scratch and undergo ANSI N45.2.11 design review. Verification of the Unit 2 auxiliary building and MSSS represents approximately a 70% sample of areas requiring sealed penetrations.

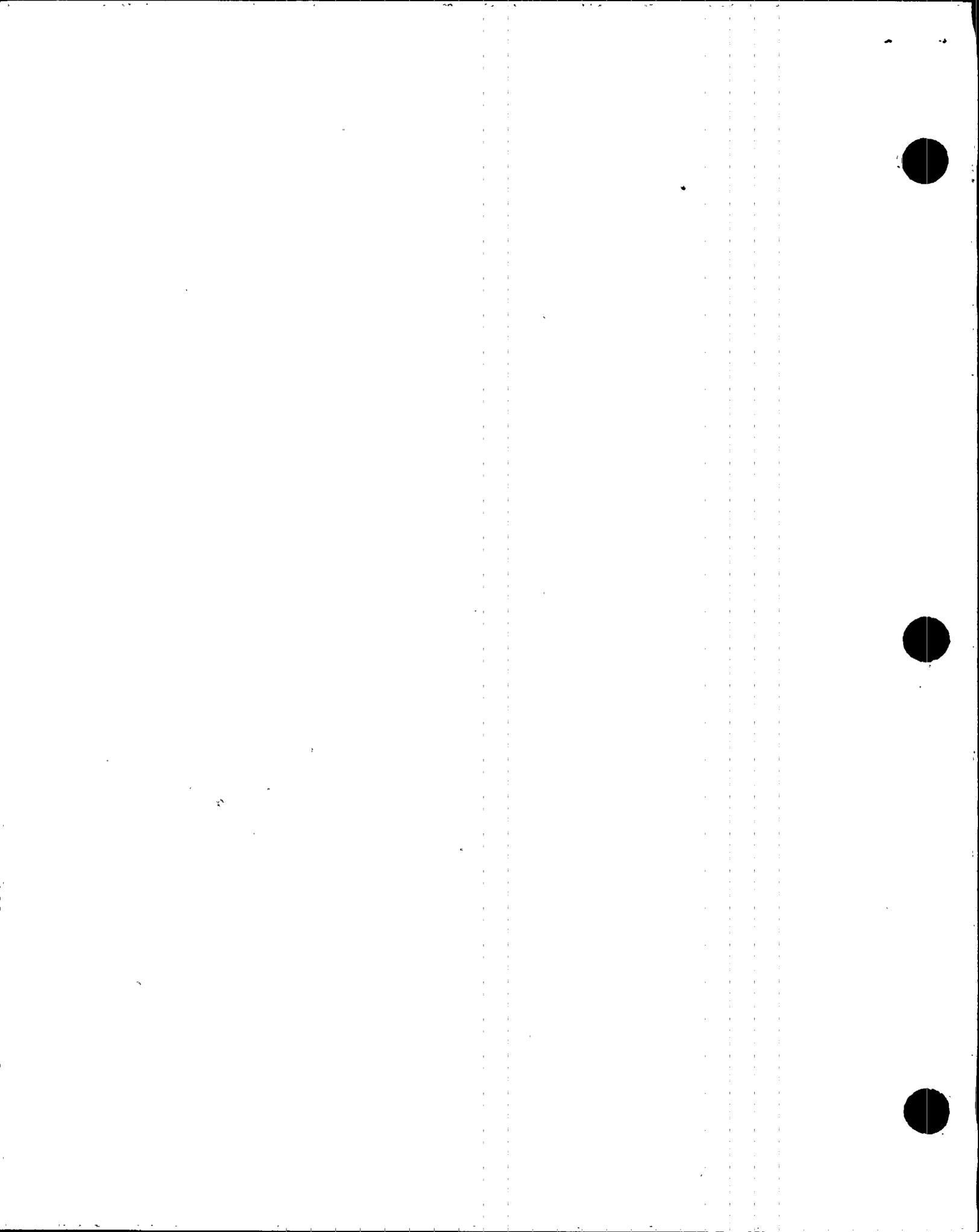
Fire-related rooms, which make up the largest portion of the remaining areas, have not been reverified, as each one has already received a thorough walkdown to ensure that all proper features, including penetration seals, have been installed.

Based on a review of information compiled from the approximate 70% sample, Engineering has concluded that no other walls were omitted from the Architectural drawings and that this was an isolated occurrence.

All affected penetrations in Units 1 and 2 were sealed per EER 86-ZM-001. For Unit 3, field change requests No. 99116-C and No. 99106-C were issued to seal the four unused penetrations and to install sealing boots on the two AFW pipes. The Unit 3 work is scheduled to be completed before fuel load.

Based on the onsite inspection and review of licensee documents, it appears that the licensee has taken appropriate corrective actions and established responsibility for correction of the unsealed penetrations.

This item is closed.



E. (Closed) DER 86-19, Revision 1, "Deficiencies of BOP ESFAS Cabinets"
- Unit 3

In April of 1986, Sorrento Electronics (a Division of General Atomic Technologies, Inc.) informed the licensee that deficient conditions had been reported for the BOP ESFAS digital logic modules repaired at their facility. The BOP ESFAS modules monitor selected plant parameters and provide automatic actuation signals if these parameters exceed predetermined levels.

Per Sorrento Electronics, several BOP ESFAS digital logic modules repaired at their facility and returned to ANPP during the later part of 1985 and early 1986 were missing a #6 lock washer that should have been installed between the screw head and the T0-3 insulating cover. The cover is designed such that the lock washer provides the electrical connection of the mounting screws to the collector of the transistor. Omission of the lock washer may result in the regulated output approaching the unregulated input. In the case of the BOP ESFAS modules, 28vdc will be supplied to the input of all ICs in the modules resulting in IC and module failure. It was recommended that the returned modules be inspected. The modules were inspected and all missing lock washer were installed.

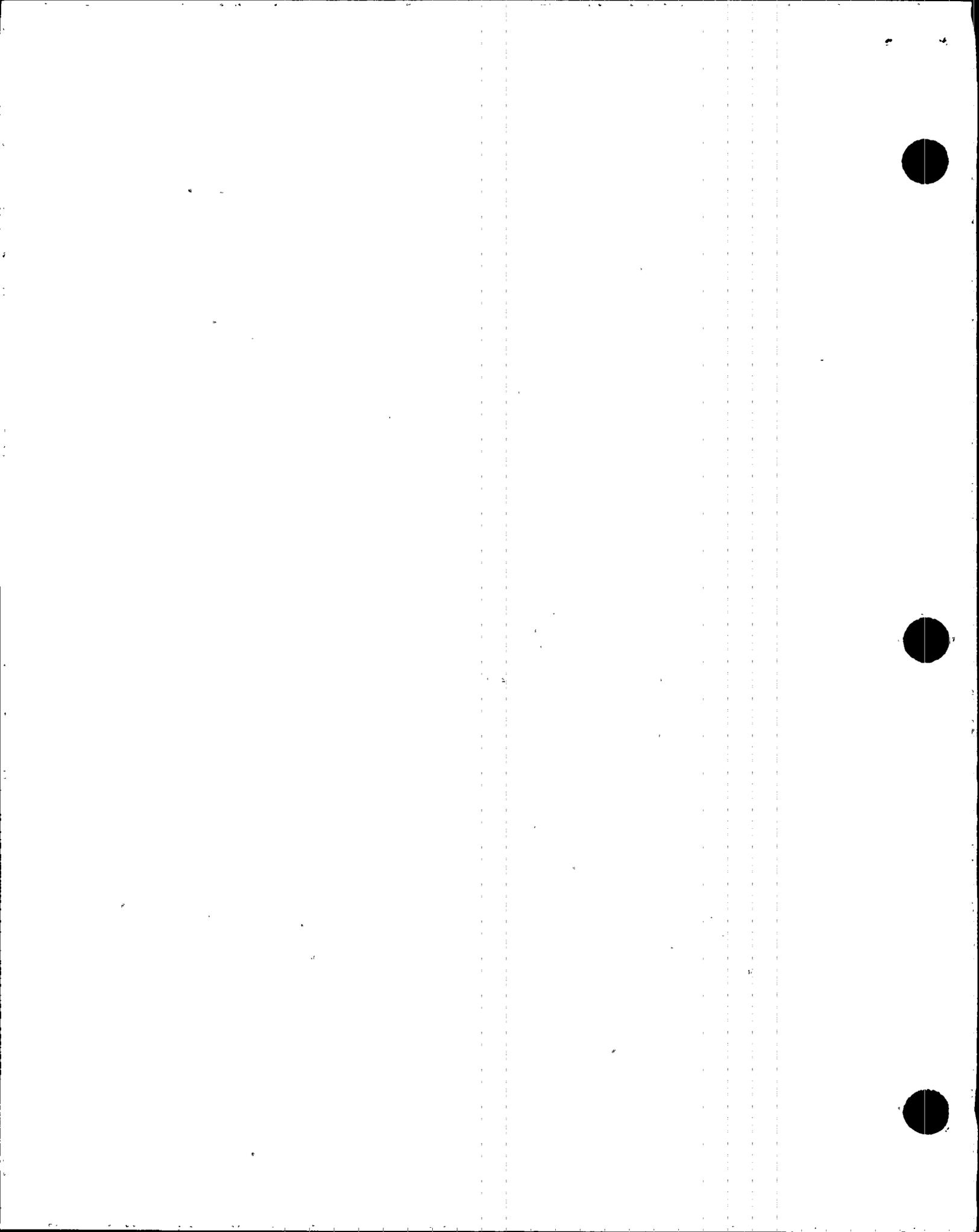
During module inspection, the licensee also identified the following:

- (1) While reworking a loose wire found during testing of the Unit 2 BOP ESFAS system, it was determined that the individual module "multimate" (AMP) pin connectors in cabinet "A" might not meet the required contact length. Further investigation determined that the problem also existed in cabinet "B". Units 1 and 3 have similar AMP pin connectors and were also scheduled for inspection.

Licensee investigation revealed that on the back panel where the socket connectors are mounted, there existed a slight bow condition at the center area of the panel. This created a gap between the mating face of the "M" series connectors. Further, dimensional analysis revealed marginal contact engagement using the shallow "M" series connector. All modules had longer pin connectors installed, and brackets to prevent wire movement.

- (2) A licensee review of past problems revealed that several broken wires had been found in the internal wiring of the BOP ESFAS cabinets over the past year. In each case, the wires broke at the crimped socket contacts of the AMP connectors that the modules plug into. Also, where two wires were crimped in a single contact, the socket size appeared larger than required.

An inspection found that the crimped wire had an insulation diameter larger than the barrel of the contact so full insertion of the stripped wire and insulation was prevented. The crimp is intended to provide an electrical connection and strain relief.



A review of two 22AWG wires crimped in a 14AWG socket was made by a representative of AMP, Inc. and it was determined that the equivalent size for these two wires is 19AWG while the correct socket size is 16-18AWG. Tests were performed at the AMP facility to verify that this combination provided a good fit and electrical connection. The female end (cabinet side) of the connectors were all resocketed.

To alleviate any wire strain that may be occurring on these connections, a strain relief bracket has been installed to support the field wiring harnesses.

- (3) There was a problem with regard to the physical size of the voltage regulator heat sink on two of the spare modules and two of the Unit 1 modules. The size of these heat sinks prevents the chip from fully inserting into the socket, however, it is held firmly in place by the mounting hardware.

GA/Sorrento determined that the size of the heat sinks used on the four modules differs only in metal thickness. The heat sinks were procured from two subsuppliers under the same part number. Neither size heat sink should prevent the transistor from being fully inserted. To prevent this mix in heat sinks, all future procurement will be made from one supplier. All modules had heat sinks of the correct size installed.

- (4) Also, the shoulders on the socket for the voltage regulators did not properly mate with (a) the holes in the module case, and (b) the socket that the voltage regulator plugs into. Neither of these items affect operability.

GA/Sorrento evaluated the shoulder size on the sockets for mounting the voltage regulators. The socket is provided in the TO-3 mounting kit. Small dimensional variations exist between kits, but it was decided this would not affect operability, and all modules had the misfitting voltage regulator sockets reseated.

All the root causes identified by the licensee for the problems discussed in this DER are noted below:

- o The root cause for the problem of missing lock washers was an oversight by the subsupplier. Sorrento procured the insulating cover and hardware in kit form and sometimes the lockwashers were missing from the kit. This was not noticed since the lockwashers are not called out separately in the description of the transistor cover (GA or the cover vendor) and cannot be inspected for after final assembly without removal of the cover and retaining hardware.
- o Investigation by ANPP Operations Engineering revealed that the broken wires resulted from frequent manual movement by



personnel in trying to achieve a good electrical connection, while assuming the connectors were correct.

- o The root cause for the connector pin to socket contact engagement problem was an inadequate design review by GA Sorrento, and inadequate pin selection.
- o The larger size heat sink for the voltage regulator was due to inattention to detail in providing the same size heat sink as originally provided. The T0-3 mounting kit has standard parts for mounting transistors. The misfit was attributed to a buildup of production tolerances making for a tight fit.

Based on the onsite inspection and review of licensee's documents, the licensee appears to have taken appropriate actions to correct all the problems identified for the BOP ESFAS cabinets in Units 1, 2, and 3.

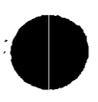
This item is closed.

F. (Closed) DER 86-27, Revision 0, "Diesel Engine Cylinder Head Air Starting Valve Seat Insert Problem" - Unit 3

On August 12, 1986, Cooper Energy Services (CES) informed the licensee of a potential problem with two emergency diesel generator engines at PVNGS based on an occurrence at Niagara Mohawk's Nine Mile Point facility. A problem could occur with the air starting valve inserts in the following engines: Unit 1B diesel engine 1M-DGB-H01 (S/N 7185), power head SN-8L3010 and Unit 3A diesel engine 3M-DGA-H01 (S/N 7188), power head SN-0M1801. CES has identified the above power heads as having copper plated counter-bores at the air starting valve inserts. The copper plating was used on these power heads to achieve the proper press fit between the counter-bore and the valve insert. At elevated operating temperatures, the copper plating may fail due to compressive yield. When this happens, the air valve insert could loosen and slide down in the counter-bore.

The construction of the cast iron cylinder head includes a steel insert for the air starting valve seat. This insert is designed to be fixed in the cylinder head counter-bore by an interference fit of .0010 to .0025 inch. CES has indicated that the air starting valve counter-bore was machined oversize (in error) and returned to size by copper plating. The use of copper plating was subsequently found to be defective and required rework.

The diesel engine has one cylinder head per cylinder for a total of twenty cylinder heads per engine. Each cylinder head has one air starting valve. The air starting valve insert is located in an area subject to thermal cycling. Temperatures vary between 300°F and 400°F with coincident expansion and contraction of the steel insert, copper plating, and cast iron head. The difference in thermal expansion rates for the copper plating, the cast iron head, and the



steel insert may cause the insert to lose its required interference fit with the head. The sensitivity of an insert to loosen under such circumstances would be a function of the thickness of the copper plating and the temperature to which the assembly would be subjected. Higher than normal temperatures, for example, would increase this sensitivity.

The root cause of this deficiency is believed to be related to an inadequate repair method for these machined components. CES's repair procedure was to resize a counter-bore by copper plating. CES has since identified this as unacceptable and changed the copper plating repair method to iron plating.

The potential defective cylinder heads shall be reworked by CES to remove the copper plating. The new repair method of iron plating will not be used; instead, an oversize valve seat insert shall be fitted assuring the required .0010 to .0025 inch interference. The heads will then be returned to PVNGS as spares.

According to CES immediate removal of the affected unit head was not recommended. The condition described above (and experienced at Nine Mile Point) is not likely to occur at PVNGS. The failure at Nine Mile Point was caused by elevated combustion temperatures resulting from diesel engine operation in an overload condition for an extended period of time.

The subject Unit 1 cylinder head has been inspected per the CES inspection procedure for high temperature areas and found acceptable for operation, until it can be replaced during a future outage. At the time of this inspection, the Unit 1 cylinder head was scheduled for replacement in September of 1987.

There is no identified Unit 2 defective cylinder head.

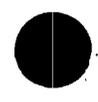
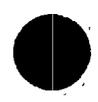
The subject Unit 3 cylinder head has been replaced with a spare from the ANPP warehouse.

Based on the onsite inspection and review of licensee documents, the licensee appears to have taken appropriate actions and established responsibility for correction of the potential defective cylinder heads.

This item is closed.

4. Review of Licensee Unit 3 Containment Integrated Leak rate Test (ILRT) Report

The inspector reviewed the licensee submittal of PVNGS Unit 3 Reactor Containment Building Integrated Leak Rate Test Summary Technical Report (File: 86-G-056-026), for the preoperational type "A" ILRT test of Unit 3 containment, performed during September 14-16, 1986.



It appears that the information reported by the licensee was technically adequate and satisfied the applicable reporting requirement of 10 CFR 50, Appendix J, for reporting an acceptable preoperation containment ILRT.

5. Exit Meeting

The inspector met with licensee management representatives denoted in paragraph 1 on February 13, 1987. The scope of the inspection, observations and findings as noted in this report were discussed.

