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June 6, 1994

Mr. William T. Russell, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Dresden Nuclear Power Station Units 2 and 3
Quad Cities Nuclear Power Station Units 1 and 2
Response to Request for Additional Information (RAI)
NRC Docket Nos. 50-237/249 and 50-254/265

Reference: (a) John F. Stang letter to D.L. Farrar, dated May 6, 1994, Request for Additional Information Concerning Core Shroud Cracking at Dresden, Units 2 and 3, and Quad Cities, Units 1 and 2

Dear Mr. Russell:

In the Reference (a) letter, the NRC staff requested additional information regarding the core shroud cracking at Dresden and Quad Cities Stations. Responses to these questions, as of today, are included as an attachment to this letter.

The nature of the NRC staff's questions raised certain issues not normally considered for the design basis or current licensing basis determination for Dresden and Quad Cities Stations. Therefore, additional analytical methodologies and evaluation techniques were performed by Commonwealth Edison and its contractor employees to respond to a portion of this RAI. In addition, the accumulation of core shroud and vessel internal examination results is a dynamic process. Due to the nature of the inputs and methodologies associated with and utilized to formulate our response, Commonwealth Edison is reviewing the inputs provided by contractor employees and consultants. As such, because of the ongoing examination result disposition process, it is possible that some changes to our analyses performed to date that address this RAI may be necessary. Therefore, Commonwealth Edison will update this response accordingly, if any such changes are identified.

To the best of my knowledge and belief, the statements contained in this response are true and correct. In some respects, these statements are not based on my personal knowledge, but obtained information furnished by other Commonwealth Edison employees, contractor employees, and consultants. Such information has been reviewed in accordance with company practice, and I believe it to be reliable.

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Please direct any questions you may have concerning this response to this office.

Sincerely,

Michael D. Lyster
Site Vice-President
Dresden Station

Attachment: Response to RAI

cc: J.B. Martin, Regional Administrator - RIII
C. Miller, Senior Resident Inspector - Quad Cities
M. N. Leach, Senior Resident Inspector - Dresden
C.P. Patel, Project Manager - NRR
J.F. Stang, Project Manager - NRR
Office of Nuclear Facility Safety - IDNS

50-237 DRESDEN 2 CEC

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
CONCERNING CORE SHROUD CRACKING

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RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION CONCERNING CORE SHROUD CRACKING AT DRESDEN, UNITS 2 AND 3, AND QUAD CITIES, UNITS 1 AND 2

Commonwealth Edison Company

June 6, 1994

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Plant-specific Questions Regarding Dresden Unit 3 and Quad Cities Unit 1

(1) Request:

Describe the methods, scope, and results of the inspections that have been performed at Dresden 3 and Quad Cities 1. Include in this discussion the types of inspections performed (e.g. visual, ultrasonic) and the lengths and depths (where characterized) of the detected indications.

(1) Response:

The original scope of the core shroud inspections at Dresden 3 and Quad Cities 1 consisted of a visual examination of the circumferential shroud welds H1 through H7 (as shown on Figure 2) from the outside diameter and, where accessible, from the inside diameter. The primary objective of the inspection was to identify sufficiently distributed unflawed material at each weld location to positively demonstrate shroud integrity under all design basis events for at least one operating cycle.

The final extent of the core shroud visual inspection scope, as well as the inspection results, are identified in the attached Table 1 for Dresden Unit 3, and Table 2 for Quad Cities Unit 1. In summary, welds H1, H2, H3, H4, H6, and H7 at both Dresden Unit 3 and Quad Cities Unit 1 passed the visual screening criteria and were qualified visually for a minimum of one operating cycle. The H5 weld at both stations failed the visual screening criteria and required further evaluation.

Following the review of the visual examination results, ComEd commissioned General Electric to develop modifications to the OD tracker and suction cup ultrasonic examination systems. This action was consistent with the objective of demonstrating shroud integrity for at least one operating cycle. The purpose for these modifications was to develop an ultrasonic examination system capable of characterizing the visual examination findings at the H5 weld and corroborating the visual examination findings at the H6 and H7 welds. Ultrasonic examination was also used to corroborate the visual examination findings at the H2 weld since, as in welds H6 and H7, the visual examination was limited to one side only.

The final extent of the core shroud ultrasonic examination scope, as well as the examination results, are identified in the attached Table 3 for Dresden Unit 3, and Table 4 for Quad Cities Unit 1. In summary, the ultrasonic examination of welds H2, H6, and H7 at both Dresden Unit 3 (D-3) and Quad Cities Unit 1 (QC-1) corroborated the visual qualification of these welds, for a minimum of one operating cycle, by providing a qualitative assessment of the extent and depth of the cracking observed. The ultrasonic examination of the H5 weld at both stations provided a maximum bounding flaw depth to be used in the structural margin assessment. Additionally, refer to the Question (2) response for D-3 and QC-1 for a description of the limitations and expected reliability of the ultrasonic examinations performed.

(2) Request:

Provide information on the qualification and expected reliability of the testing methods used (e.g. visual, ultrasonic). Describe qualifications that have been performed on mock-ups including the configurations of the mock-ups and their applicability to the crack locations in the Dresden and Quad Cities core shrouds. Describe any limitations in the locations that can be inspected and for the ultrasonic testing technique describe any limitations in quantifying crack depths.

(2) Response:

The visual examination was conducted by Level II and Level III certified VT-1 visual examiners from both ComEd and General Electric, utilizing underwater video equipment capable of resolving a 1 mil wire. Distances from the camera lens to the inspection surface varied somewhat due to accessibility. The focal distance from the camera to the inspection surface ranged between 1 inch and 5 inches. At a 1 inch focal distance using a 25 millimeter lens, the effective magnification is approximately 4X and at a 5 inch focal distance it is approximately 2X. The inspection surfaces were cleaned with nylon bristle brushes to remove loose contaminants and oxides that could inhibit the ability to detect fine crack indications. Careful attention was also given to lighting and camera angles to avoid shadows that could mask indications. Additionally, all visual examinations were independently reviewed by a Level II or III certified VT-1 visual examiner in order to substantiate the inspection findings. Based on the above, the expected reliability of the visual examination performed is high.

The OD visual examinations below the H3 weld were limited to the areas between the jet pumps. This limitation restricted the maximum inspection locations from the OD to approximately 40% of the shroud circumference. The ID visual examinations were limited to the H3 and H4 welds due to interferences from the core spray spargers and top guide above the H3 location, and the core plate below the H4 location. The ID examinations at the H3 and H4 locations were limited only by the focal distances that could be achieved through the periphery of the top guide.

The ultrasonic techniques used for the core shroud examination are a standard 45° shear wave, full V-path pulse echo method, and a 60° refracted longitudinal wave pitch catch method. The 45° shear wave is the primary detection search unit, while the 60° RL is used for sizing and confirmation. Originally, qualifications of these techniques were performed on blocks of 304 stainless steel, with EDM notches ranging from 0.0625" to 1.0" in depth machined in both surfaces of the block . The techniques have also been qualified on actual "as-built" weld configurations, such as the H1, H2, and H3 welds. Scanning was performed from both the OD and ID surfaces of these mock-ups to determine the accuracy from both surfaces. Qualifications have also been performed on plate to plate blocks with a typical weld in the block. In all cases the 45° shear wave was limited in its ability to penetrate the weld material and consequently, is only valid for examination on the same side of the weld from which the sound beam originates. By contrast, the 60° RL did reliably penetrate the weld metal to detect and size weld defects on the opposite side of the weld. All ultrasonic qualifications were performed by scanning the qualification block statically and then dynamically.

Additionally, all qualification blocks were attached to a qualification fixture and lowered into the reactor "mock-up" in San Jose in order to qualify the ultrasonic technique at underwater depth.

The qualification process described above was used to generically qualify the UT techniques and procedure for core shroud inspection. Plant specific UT accuracy must be demonstrated based upon the specific core shroud geometry of the plant to be inspected. For the Dresden and Quad Cities examination two special calibration/qualification blocks were manufactured. The first block was for the H5/H6 weld configuration, which was a welded "mock-up" built to match the Dresden/Quad Cities core shroud configuration. The second calibration/qualification block was for the H7 weld configuration. This block was made of Alloy 600 material with EDM notches installed at a fixed distance from a simulated backing ring. Based upon the generic qualification data and the Dresden/Quad Cities specific qualification block data, the following conclusions were made regarding the UT detectability and sizing accuracy for the Dresden and Quad Cities core shroud examinations:

- The 45° shear wave search unit will reliably detect a flaw on the same surface (scanning surface), using a full V-path, of 0.100" to 0.125" in depth. Using a 1/2 V-path, the 45° shear wave will reliably detect a flaw on the opposite surface of less than 0.100" in depth.

- The 60° RL search unit, which is primarily used for confirmation and sizing, is limited in its ability to detect flaws on the same surface (scanning surface) by the front of wedge to exit point dimension on the search unit, and the near field affects. The limit of detectability for this search unit, which is focussed at 0.800", is approximately 0.200".

- The limiting variable for both the 45° and 60° search units is the flaw morphology, which can affect both detectability and sizing accuracy. Not withstanding this, sizing accuracy for flaws that fall within the detectability bounds described above is plus or minus 0.100". This level of accuracy is supported by empirical metallurgical data obtained from several boat samples removed from BWR shrouds. These boat samples have shown the actual measured crack depth to be within 0.060" to 0.100" of the ultrasonic depth measurement, using the 60° RL tip diffraction method of sizing.

In order to validate the above conclusion for the H5 weld location, two boat samples were removed from the H5 welds at both the Dresden Unit 3 and Quad Cities Unit 1 stations. The boat samples at Quad Cities Unit 1 were removed prior to the UT examination, while the boat samples at Dresden Unit 3 were removed after the UT examination. The following is a summary of the preliminary boat sample findings:

DRESDEN UNIT 3:

153° Sample: UT identified 1 crack at 0.300" depth.
Boat sample showed single crack at 0.610" depth.

324° Sample: UT identified 1 crack at 0.520" depth.
Boat sample showed 4 parallel cracks at the following orientations and depths:

- 0.640" depth at 0.140" below fusion line.
- ≈0.100" depth at ≈0.250" below fusion line.
- ≈0.300" depth at ≈0.370" below fusion line.
- ≈0.100" depth at ≈0.600" below fusion line.

QUAD CITIES UNIT 1:

154° Sample: UT identified no flaws in the areas adjacent to the boat sample location.
Boat sample showed 3 parallel cracks at the following orientations and depths:

- 0.285" depth at ≈0.290" below fusion line.
- 0.085" depth at ≈0.610" below fusion line.
- 0.044" depth at ≈1.350" below fusion line.

342° Sample: UT identified 1 crack at 0.390" depth in the areas adjacent to the boat sample location.
Boat sample showed maximum crack depths of ≈0.400" and ≈0.690" at two separate cross-sections.

Based upon a comparison of the ultrasonic examination findings against the results of the boat samples, the limit of detectability at the near surface and the flaw sizing accuracy predicted for the OD Tracker system were not reliably achieved. Consequently, the limitations in detecting flaws and quantifying crack depths utilizing this system, as well as the suction cup scanner system, are unknown at this time. Further rigorous qualification of these systems is necessary to accurately establish specific limitations.

However, due to the design of the H5 weld at Dresden and Quad Cities stations, the UT examination results can be used to demonstrate that the flaw can not be any greater than 1.24" in depth. The H5 weld contains a 1.0" reinforcing fillet on the ID of the weld. A signal from the toe of this reinforcing fillet at the shroud cylinder was observed with the 45° transducer throughout the entire H5 examination. As can be seen from Figure 1, a flaw that started at the sound beam entry surface and intersected the sound beam at its central axis would be 1.24" in depth. A flaw any deeper than this would prevent the sound beam from reaching the toe of the reinforcing fillet and the signal from this reflector would be lost. Based on the above, the bounding depth of the H5 cracking at both Dresden Unit 3 and Quad Cities Unit 1 is 1.24".

(3) Request:

Provide results of the fracture mechanics evaluations of the detected cracks including calculated margins to failure and the sensitivity of these margins to nondestructive testing uncertainty and assumed crack growth rates.

(3) Response:

Shroud Visual and UT Examinations

Welds H1, H2, H3, H4, H6, and H7 at both Dresden Unit 3 and Quad Cities Unit 1 have been structurally qualified using visual examinations in accordance with an evaluation and screening criteria. Additionally, the visual qualifications were corroborated by performing UT on H2, H6, and H7.

H5 Weld Visual and UT Examinations

The H5 welds at Dresden Unit 3 and Quad Cities Unit 1 could not be structurally qualified in accordance with the evaluation and screening criteria, based on the extent of visual indications; for this reason, automated and manual UT exams of the H5 welds at both units were performed from the shroud OD.

Based on the results of automated and manual UT exams of the H5 welds and on the results of boat samples taken from the H5 welds of both units, the probability of detection of flaws deeper than 1.24" on the core plate support ring side of the H5 weld is very high, and no flaws deeper than 1.24" were detected in either unit. For this reason, the bounding maximum flaw depth used for both units for the purpose of structural margin assessment is 1.24". See the response to Question (2) for details.

Backwall geometrical reflectors were readily observed during the automated and manual UT examinations, assuring a high probability of flaw detection from the surface opposite the scanned surface. No flaws initiating from the opposite (ID) surfaces were detected.

Based on the use of a conservative bounding maximum flaw depth and on the low uncertainty associated with backwall reflector detection, the ASME Section XI Appendix C factor of safety of 1.39 under emergency and faulted conditions utilized in the structural margin assessment of the H5 welds provides sufficient margin to account for UT examination uncertainties when performing limit load analysis of flaws.

H5 Weld Limit Load Analysis Results

Limit load analyses were performed to define structural margins assuming a bounding 360° crack depth of 1.24" for Dresden 3 and Quad Cities 1. Limit load evaluation of allowable flaw depth was performed using ASME Section III Subsection NG-3200 methodology (with Section XI IWB-3640 and Appendix C for guidance).

Limit load analysis is appropriate for evaluating structural margins of the shroud in the H5 weld area, because the material is Type 304 stainless steel and the neutron fluence levels are low. At the 3E+16 n/cm^2 (E> 1MeV) fluence level in the H5 location, the austenitic stainless steel of the shroud is comparable in toughness and ductility to that of fully plastic unirradiated material.

Faulted loading conditions used in the structural margin assessment conservatively include concurrent loading from both a design basis earthquake and a main steam line break inside containment, which is the most limiting load combination.

The results of the assessment show that the maximum allowable flaw depth on the core plate support ring side of the H5 weld can be 98% at Dresden 3 and 96% at Quad Cities 1, while still maintaining ASME Code minimum structural margins. This is based on a minimum thickness of three inches that a crack in the core plate support ring must traverse before reaching through-wall, including the two inch thickness of the shroud barrel and the one inch leg fillet weld on the ID of the H5 weld. It follows that the minimum required ligament thickness is 0.060" for Dresden 3 and 0.120" for Quad Cities 1.

Crack Growth Rates

A conservative crack growth rate of 5E-5 inch/hour was used. This is an upper bound value for intergranular stress corrosion cracking (IGSCC).

A more realistic best estimate crack growth rate was also developed, which factors in more recent predictions considering plant-specific water chemistry. Dresden 3 currently operates below 0.1μS/cm conductivity and Quad Cities 1 currently operates below 0.15μS/cm. More importantly, both Dresden 3 and Quad Cities 1 currently operate below 5ppb chloride and sulfate combined. Based on the GE PLEDGE predictive model for IGSCC crack growth rates, which accounts for conductivity, the best estimate crack growth rate is 1.24E-5 inch/hour under current water chemistry conditions. Both of the aforementioned crack growth rates (5E-5 inch/hour and 1.24E-5 inch/hour) are conservative according to the 1993 revision of the EPRI BWR Water Chemistry Guidelines which relate the beneficial effects of lower sulfate and chloride levels on crack growth rates, and because Quad Cities Unit 1 will be operating with hydrogen water chemistry during the next operating cycle.

H5 Weld Structural Margin

Crack growth estimates were combined with the maximum allowable flaw sizes based on limit load analysis to determine structural margin. The resulting structural margins, using both the bounding crack growth rate and the best estimate crack growth rate, are shown below:

DRESDEN UNIT 3
STRUCTURAL MARGIN RESULTS FOR WELD H5
(Based on a 360°, 1.24 Depth Flaw)

Case	Crack Growth Rate (inch/hour)	Crack Growth Period (months)	Crack Growth[1] (inches)	Final Crack Depth (inches)	Allowable Crack Depth (inches)	Margin Factor[2]	Time Until Allowable Depth is Reached[3] [hours(yrs)]
1	5×10^{-5}	6	0.20	1.44	2.94	26.0	34,000 (4.25)
2	5×10^{-5}	24	0.80	2.04	2.94	16.0	34,000 (4.25)
3	1.24×10^{-5}	6	0.05	1.29	2.94	28.5	137,000 (17.1)
4	1.24×10^{-5}	24	0.20	1.44	2.94	26.0	137,000 (17.1)

QUAD CITIES UNIT 1
STRUCTURAL MARGIN RESULTS FOR WELD H5
(Based on a 360°, 1.24 Depth Flaw)

Case	Crack Growth Rate (inch/hour)	Crack Growth Period (months)	Crack Growth[1] (inches)	Final Crack Depth (inches)	Allowable Crack Depth (inches)	Margin Factor[2]	Time Until Allowable Depth is Reached[3] [hours(yrs)]
1	5×10^{-5}	6	0.20	1.44	2.88	13.0	32,800 (4.1)
2	5×10^{-5}	18	0.60	1.84	2.88	9.7	32,800 (4.1)
3	1.24×10^{-5}	6	0.05	1.29	2.88	14.25	132,258 (16.5)
4	1.24×10^{-5}	18	0.15	1.39	2.88	13.4	132,258 (16.5)

NOTE: (1) Crack growth is determined for a 24-month or 18-month period assuming 8,000 hours per year (≈91% availability).

(2) The margin factor is calculated by dividing the remaining ligament at the end of an operating cycle by the required ligament, as in the following example (thickness = 3" but allowable depth varies between units):

Margin Factor = Remaining Ligament/Required Ligament
= (3.0-1.44)/(3.0-2.88)
= 13.0

(3) The time until the allowable crack depth is reached is determined by dividing the minimum existing ligament margin by the crack growth rate, as follows (allowable depth varies between units):

Time = Minimum Existing Ligament/Crack Growth Rate
= (Allow. Depth-Current Maximum Depth)/Crack Growth Rate
= $(2.88-1.24)/5\times10^{-5}$
= 32,800 hours
or 32,800/8,000 = 4.1 years

For the purposes of showing structural margin, the bounding maximum flaw depth was assumed to be consistent around the entire circumference. This is conservative since limit load analysis can be based on the actual structural area available, while the flaws actually observed vary considerably in depth. Actual margins to failure are significantly higher, considering the factors of safety included in ASME Code minimum requirements.

From the tables above it is concluded that a factor of 16 on ASME Code minimum cross-sectional area will remain after a 24 month operating cycle using the bounding crack depth of 1.24" at the H5 weld of the Dresden Unit 3 shroud, and a factor of 9.7 on ASME Code minimum cross-sectional area will remain after an 18 month fuel cycle using the bounding crack depth of 1.24" at the H5 weld of the Quad Cities 1 shroud.

Structural Assessment Uncertainty and Compensatory Measures

Structural assessment uncertainty in this case is the result of uncertainty in nondestructive examination crack detection and sizing capability and in crack growth rates. The application of engineering margins, as discussed above, effectively compensates for these uncertainties.

Even though the shroud is not a primary pressure boundary, Section XI safety factors for primary pressure boundaries were applied to compensate for uncertainties in nondestructive examination, and the use of an upper bound crack growth rate compensates for uncertainty in crack growth rates. When combined with a bounding maximum depth flaw applied along the entire circumference of the shroud, the resulting margin factors demonstrate that the flaws observed represent no immediate safety concern, and all applicable ASME Code safety margins will be maintained well beyond the end of the next operating cycle for both Dresden Unit 3 and Quad Cities Unit 1.

(4) <u>Request</u>:

Discuss how bypass leakage through the shroud at various elevations can be detected and responded to during normal operating conditions. Discuss the adequacy of plant operating procedures and operator training with regard to the above.

(4) <u>Response</u>:

There is no direct measurement capability of shroud leakage. However, depending on the location (upper versus lower shroud) and the amount of leakage, parameters such as reactor power and reactor recirculation loop temperature may provide indication of leakage.

For upper shroud leakage (above the H4 weld), the strongest indicator would be the resultant reduction in power level (thermal and MWe), causing a power-to-flow (rod line) anomaly. The power-to-flow anomaly was the initial indicator during the core shroud head / steam separator assembly lift event on Dresden Unit 2 in 1991. It should be noted that significant upper shroud bypass leakage would be required for detection, and that this indicator may be masked by xenon transients. By procedure, the Control Room Operators record the power, core flow, and rod line information at the beginning of each shift, and routinely monitor power and core flow conditions during the course of a shift. Existing procedures which address jet pump and shroud access cover anomalies provide sufficient operator guidance in the event of shroud leakage. In addition, training has been provided to licensed personnel on the symptoms resulting from shroud leakage.

For lower shroud leakage (below the H4 weld), there are no detectable symptoms/indicators given the fact that the leakage flow temperature would be very similar to the fluid temperature in the downcomer annulus area. Additionally, during normal operation only minor leakage flow would be expected through a shroud crack (assuming a crack width of 0.002 inches around the entire shroud circumference at weld location H5 under normal operating conditions, the leakage flow would be less than 40 gpm).

(5) <u>Request</u>:

Evaluate the safety significance of a 360° through wall failure at the H5 weld location in the core shroud during: (a) normal operation; (b) anticipated transients; and (c) postulated accident conditions. Include evaluation of the design basis loss-of-coolant accident combined with safe-shutdown earthquake loads (LOCA + SSE). This evaluation should address questions such as: (a) estimated potential shroud movement vertically or laterally; (b) control rod scram capability; (c) boron injection capability; (d) short & long term core cooling capability, including core spray capability; and (e) ability to maintain 2/3 core coverage with bypass leakage at various elevations.

(5) <u>Response</u>:

<u>Normal Operation:</u>

If 360 degree, through-wall cracking were to occur at the H5 location, the weight of the core shroud above H5 is sufficient to hold the core shroud assembly in place during all normal operating conditions. Assuming a gap of 0.002 inch around the entire circumference, and normal operating pressure drop across the upper shroud (7 psid at Dresden, 8 psid at Quad Cities) the resulting leakage flow would be approximately 30 gpm at Dresden and 35 gpm at Quad Cities. These flows would have no consequence on plant operation (nor would they be detectable).

<u>Anticipated Transients</u>

Anticipated transients that could increase shroud loads above those experienced during normal operation were reviewed (transients associated with occurrences that tend to depressurize the reactor vessel or increase core flow). The following transients were reviewed.

- Pressure Regulator Failure - Open
- Recirculation Flow Control Failure - Maximum Flow
- Inadvertent Actuation of ADS

Pressure Regulator Failure (Open): This postulated event involves a failure in the pressure controls such that the turbine control valves and the turbine bypass valves are opened as far as the Maximum Combined Flow Limiter (MCFL) allows. Steam flow increase, and associated force on the core shroud, would be limited by the MCFL (limited to 105%). The weight of the core shroud above H5 is sufficiently high to hold the core shroud assembly in place and no movement will occur. The postulated leakage flow through an assumed gap less than 0.002 inch would be less than 40 gpm at both Dresden and Quad Cities. A leakage flow of this magnitude has no consequence for plant operation.

Recirculation Flow Control Failure: This postulated event involves a recirculation control failure that causes both recirculation loops to increase to maximum flow. In this case, the pressure drop could change from a part-load condition to the high/maximum flow condition over a time period of several seconds, but it should not significantly exceed the pressure drop expected for normal full power, high core flow operating conditions (7 psid for Dresden, 8 psid for Quad Cities) . Existing operating procedures are sufficient to minimize the consequences of this potential transient, and the resulting force is not high enough to displace the shroud.

Inadvertent Actuation of the Automatic Depressurization System: Inadvertent actuation of the Automatic Depressurization System (ADS) valves is another postulated event that could put an increased load on the upper shroud. The maximum steam flow and the depressurization rate are significantly smaller than for the postulated main steamline break, causing a short-term increase in steam flow of approximately 30% of rated steam flow. The increase in the shroud dP resulting from the opening of the ADS valves would occur over a period of about one second, spreading the load change on the shroud. The increase in the shroud dP is not expected to cause lifting of the shroud. Inadvertent ADS is also a very low probability event; it is considered to be in the ASME Emergency category for vessel thermal duty design.

Postulated Accident Conditions:

The bounding postulated accident condition is the main steamline break inside containment. This accident imposes the largest potential lifting loads on the shroud head. Liquid breaks, up to and including the recirculation line break, do not impose significant pressure drops on the shroud head.

It is not within the licensing basis of either the Dresden or Quad Cities core shrouds to consider a Design Basis Accident concurrent with a Design Basis Earthquake. The FSAR stress combinations for the reactor primary internals include dead load with SSE, dead load with OBE and dead load with LOCA.

Main Steamline Break: The main steamline break inside containment is the postulated worst case accident because it results in the largest depressurization rate. During this SAR event, the reactor is rapidly depressurized as a result of a postulated instantaneous, double-ended break of the largest steamline. Thus a larger than normal pressure difference could develop across the shroud as fluid flow is drawn from the core region toward the break. For Dresden, the design basis pressure difference is 12 psid for the guillotine break of a main steam line. The Quad Cities design basis pressure difference across the shroud is 20 psid.

At Dresden, the weight of the core shroud above H5 is sufficiently high to hold the core shroud assembly in place during the main steam line break. At Quad Cities, the core shroud could lift momentarily by up to 4 inches during the vessel depressurization resulting from a main steamline break. If the main steamline break occurs simultaneously with the design basis earthquake, an upward displacement of the shroud less than 2 inches would result at Dresden and less than 8 inches at Quad Cities. The top guide would not disengage from the fuel bundles in the worst case lift. Lateral movement of the shroud at the H5 location is limited to less than 2 inches at Dresden and Quad Cities by the clearance between the shroud inner wall and the core support plate.

The shroud head pressure drop characteristics calculated for the instantaneous, double-ended steamline break accident were evaluated. The initial shroud head pressure drop loading is a result of the decompression wave which reduces system pressure overall, but would increase differential pressure across the shroud in the short term. The pressure loading increase is short-lived (less than two seconds) and decreases to below normal steady-state operating loads. If it is postulated that the initial load pulse causes the shroud to separate, the last part of the pressure loading transient could cause the shroud assembly to lift. The flow path created by any separation reduces the upward lifting forces.

One of the key considerations of this postulated accident case is the ability of the control rods to insert before or during the postulated accident. Scram is initiated during the main steamline break (inside containment) accident by the high drywell pressure trip signal. Drywell pressure exceeds the setpoint almost instantaneously, so the only delays in starting rod insertion come from the sensors, the Reactor Protection System, and rod motion. For the main steamline break outside containment, shroud loads are reduced, MSIV closure is initiated by high steam flow, and scram is initiated from the MSIV closure.

For the postulated steamline break scenarios, the insertion of all control rods will occur. Normal CRD alignment from the bottom end of the fuel bundles to the CRD flange will be maintained and no binding within the CRD mechanisms is anticipated during a scram. However, during the design basis earthquake, the shroud assembly could shift laterally up to 2 inches. With the random displacement anticipated during seismic events, the CRD alignment in the core region would undergo intermittent periods of misalignment. Hence, the CRD scram speed would assume an oscillatory velocity profile, such as typically expected under seismic events.

At Dresden, movement of the upper shroud assembly could affect the core spray system if it impacts the core spray line connection. The 2 inch lift can be accommodated by a 1.69 inch vertical clearance in the core spray line brackets and the flexibility in the core spray line. The coolant flow to the two core spray spargers is assured. Therefore, no change is predicted in the emergency core cooling function. At Quad Cities, the upper shroud movement could affect the coolant flow to the core by deflecting the core spray sparger and/or riser. Failure of the sparger or riser would not, however, prevent entry of core spray system water into the vessel. A floodable volume is maintained after the main steamline break accident because the break location is above 2/3 core height.

The Standby Liquid Control System function would not be affected by the H5 weld cracking. Although the shroud assembly may lift during a main steamline break accident (alone at Quad Cities or coupled with SSE at Dresden) the effect on boron density will be minimal because the break is above the reactor water level.

Recirculation Line Break For the design basis recirculation line break, the differential pressure across the upper shroud decreases from the initial value as the reactor depressurizes, upward forces are reduced, and thus there is no significant threat to core shroud integrity. Even if the entire circumference is postulated to be severed, the shroud assembly does not lift, and the lateral loading due to the acoustic phenomena of the event will not significantly move the shroud. The lateral loading is due to an instantaneous break of the recirculation suction line. An asymmetric load would result because the sound wave takes finite time to travel from the broken suction line side to the unbroken suction line side of the annulus. The duration of this load is extremely short (approximately 5 milliseconds) and this limits the lateral motion of the shroud to a very small magnitude. The calculated leakage flow is very small compared to the emergency core cooling system flow capacity, and there is no significant decrease of coolant to the core. Therefore, the recirculation line break analysis results are unchanged.

If a recirculation suction line break were to occur in combination with an SSE, the core shroud assembly will not lift and retains substantial downward load even if the entire circumference is postulated to have a through wall crack. Substantial resisting forces exist with the downward load due to the irregular mating surfaces along the crack face both in radial and circumferential directions. Therefore the shroud assembly is unlikely to move laterally. Any lateral motion near the H5 weld, if postulated, is restricted to less than 2" by the limited spacing between the shroud, the weldment, and the core support plate. Since there is no significant threat to core shroud integrity in the vertical direction, shroud integrity will be maintained and a floodable core region is preserved. The resulting leakage flow is small compared to ECCS flow capacity and there is no significant decrease in coolant to the core. In addition, the Standby Liquid Control System function will not be affected by the recirculation line break. The relatively small leakage rates that may occur will not significantly affect boron density in the core or ECCS capability. With an SSE and recirculation line break occurring simultaneously, the recirculation line break analysis results are unchanged.

An evaluation of the ability to maintain 2/3 core coverage with bypass leakage at various elevations of the core shroud has not yet been completed. This effort is being sponsored by the BWR Owner's Group. ComEd will be working in conjunction with the BWROG and GE to address this issue.

(6) Request:

Describe the methods, scope, and results of inspections conducted on reactor vessel internal components other than the core shroud. Discuss the safety significance of any indications found in these components and how these indications were dispositioned.

(6) Response:

During the current refueling outages for Quad Cities Unit 1 and Dresden Unit 3, visual VT-1 and VT-3 inspections of the reactor vessel internals were conducted utilizing an underwater video camera capable of resolving a 1 mil wire. Additionally, ultrasonic examination of selected components was also performed. These examinations included the following:

In-Vessel Visual Inspection

RPV interior surfaces, interior attachments to RPV, specimen holder brackets and welds, steam dryer support and guide pin bracket welds, shroud head guide pin welds, selected areas of the top guide, SRM/IRM guide tubes, and general areas of cladding.

Core Spray Sparger Visual Inspection

Upper and lower core spray spargers, the segments of piping between the inlet nozzles and the core shroud, and the entire T-box to front cover plate welds, and bracket welds.

Feedwater Sparger Visual Inspection:

Accessible portions of the four feedwater spargers, the individual nozzles on each sparger, the bore region on all four feedwater nozzles, and the eight end mounting bracket assemblies.

Jet Pump Visual Inspections:

A visual inspection of all 20 jet pumps and their associated risers was conducted. The examination included the hold down beams, beam bolt keepers, lockplates and retainers; restrainer wedges, stops, adjusting screws, clamp bolts and keepers; riser brace welds, sensing lines and sensing line brackets.

Jet Pump Hold Down Beam Ultrasonic Examinations:

Ultrasonic examination of all twenty jet pump hold down beams.

Shroud Head Bolt Ultrasonic Examinations:

Ultrasonic examination of all 48 shroud head bolts.

Access Hole Cover Examinations:

Ultrasonic examination of both access hole covers at Dresden Station only (Quad Unit 1 access hole covers were replaced during Q1R12).

Examination Results:

Any adverse conditions identified in the above examinations, their safety significance and their final disposition are summarized in the attached Table 5 for Dresden Unit 3, and Table 6 for Quad Cities Unit 1.

(7) <u>Request:</u>

Identify reactor vessel internal components or portions of those components that were not or cannot be inspected and have potential safety significance. Discuss the potential consequences of cracking in these locations. Discuss plans for developing inspection methods and repairs for these components.

(7) <u>Response:</u>

ComEd is currently working with the BWR Owner's Group under an aggressive schedule to identify, and prioritize based upon susceptibility, vessel internal components that have a potential safety significance. Once these components have been identified, the potential consequences of cracking at these locations will be determined and plans will be developed for inspection and repair of these components. Phase one of this program (identification and prioritization) is expected to be complete prior to the next meeting between the BWROG and the NRC staff, which is currently scheduled for June 28, 1994.

(8) Request:

Describe repair options for cracks at various locations in the core shroud. Include discussion of actions to achieve ALARA personnel exposure and provide estimates of exposure levels associated with each repair option.

(8) Response:

The core shroud is a cylindrical assembly within the reactor vessel that provides a partition to properly distribute the flow of coolant delivered to and circulated in the vessel. Its safety design is based upon the following considerations:

- Provide a floodable volume in which the core can be adequately cooled in the event of a breach in the nuclear system process barrier external to the reactor vessel.

- Limit deflections of the reactor vessel internals to assure that the control rods and the core standby cooling systems can perform their safety functions during abnormal operational transients and accidents.

Repair options have been developed that assure conformance to original design bases (identified above), and maintain core shroud operational functions. Two types of repair approaches are identified.

- The first repair approach represents a comprehensive repair for the entire shroud assembly and assumes no functional credit for any of the existing horizontal weldments in the core shroud (H-1 through H-7). As a result, this approach requires no further inspection of any shroud weld.

- The second repair approach only addresses individual welds (H-5 in the case of Dresden Unit 3 and Quad Cities Unit 1), and also assumes no credit for the integrity of the weld addressed. This approach is designed to be a permanent repair for a single weld or a combination of welds at a single location (such as H-2/H-3). It does not address possible degradation of other welds and therefore continues to require inspection of unrepaired welds on a scheduled inspection interval.

For either approach, the following two requirements must be met:

- The structural design must be capable of resisting lift for the shroud structure positioned above the weld being evaluated (in order to preserve the floodable volume); and

- Lateral deflections must be limited to prescribed levels such that control rods can be inserted for safe shutdown.

There are several acceptable repair options to accommodate lifting loads on the shroud. One method is to position tie-rods on either side of the shroud cylinder assembly, systematically spaced around the circumference, and secured above and below the welds protected. Specific designs developed include the installation of long multiple rods and/or rod extensions extending vertically downward from either the shroud head supporting ring or from the top guide support ring to a location on the jet pump support deck or on the shroud support ring. Some options use substantial pretensioning to resist vertical lift, while others apply only light pretensioning. The latter group does not maintain a no-leak condition, but does maintain control of leakage during the accident events to levels below those which can be conservatively accommodated and still maintain core reflood capability. Either approach provides assurance of essential functional requirements for the core shroud. Other designs utilize multiple bolted brackets at each weld to accomplish the same purpose. The bracket methods were considered less desirable because these designs take up a great deal of room in the vessel/shroud annulus volume and decrease the access capabilities for future inspection requirements.

There are two primary methods to resist lateral movement of the shroud (and the associated core and top guide support rings). First, bumpers or stabilizers can be positioned around the periphery of the shroud to limit lateral displacement of these support rings to acceptable safety levels. Second, the vertical tie rods can be tensioned sufficiently such that friction can resist lateral movement without credit for the welds. Bumpers or stabilizers likely would need to be removed for reactor vessel inspection from the annulus. The tensioned tie rods periodically would have to be retensioned to accommodate potential relaxation of the rods.

One of the design selection criteria is ALARA. The installation of these permanent repairs is performed remotely using specialized tooling from the refueling deck and results in very low exposure levels to workers. Each vendor's repair method is different in details that may result in some ALARA differences, although none of the methods would result in large radiation doses to personnel.

Plant-Specific Questions Regarding Dresden Unit 2 and Quad Cities Unit 2

(1) Request:

Discuss the scope and results of any prior core shroud or other vessel internals inspections conducted at these units.

(1) Response:

Visual VT-1 and VT-3 inspections of the reactor vessel internals are conducted each refueling outage utilizing an underwater video camera capable of resolving a 1 mil wire. Additionally, ultrasonic examination of selected components is also performed each outage. Although the exact scope of in-vessel inspections varies, they typically include a combination of the following:

In-Vessel Visual Inspection

RPV interior surfaces, interior attachments to RPV, specimen holder brackets and welds, steam dryer support and guide pin bracket welds, shroud head guide pin welds, selected areas of the top guide, SRM/IRM guide tubes, and general areas of cladding.

Core Spray Sparger Visual Inspection

Upper and lower core spray spargers, the segments of piping between the inlet nozzles and the core shroud, and the entire T-box to front cover plate welds, and bracket welds.

Feedwater Sparger Visual Inspection:

Accessible portions of the four feedwater spargers, the individual nozzles on each sparger, the bore region on all four feedwater nozzles, and the eight end mounting bracket assemblies.

Jet Pump Visual Inspections:

Jet pumps and their associated risers, including the hold down beams, beam bolt keepers, lockplates and retainers; restrainer wedges, stops, adjusting screws, clamp bolts and keepers; riser brace welds, sensing lines and sensing line brackets.

Jet Pump Hold Down Beam Ultrasonic Examinations:

Ultrasonic examination of all twenty jet pump hold down beams.

Shroud Head Bolt Ultrasonic Examinations:

Ultrasonic examination of all 48 shroud head bolts.

Access Hole Cover Examinations:

Ultrasonic examination of both access hole covers.

Examination History:

The in-vessel examination history, including scope and results, for the Dresden and Quad Cities units are summarized in the following tables. This history was compiled from a review of ISI Summary Reports and start-up on-site reviews from approximately 1980 to present.

Dresden Unit 2:	Table 7
Dresden Unit 3:	Table 8
Quad Cities Unit 1:	Table 9
Quad Cities Unit 2:	Table 10

(2) Request:

Identify any differences between these units and Dresden Unit 3 and Quad Cities Unit 1 with regard to core shroud geometry, materials, fabrication methods, operating times, water chemistry or other factors affecting susceptibility to cracking.

(2) Response:

Core Shroud Geometry

Based on design drawings, the core shroud geometry is identical for all four units (D-2, D-3, QC-1, and QC-2).

Materials

Material specification, ASTM A-240 Type 304 stainless steel plate, is specified for all four shrouds. Carbon content varies from 0.044 to 0.063, depending on the heat number.

Filler material specification, ASTM Type E308 and ER-308, is specified for all four units. Material certificates provided by Willamette show low carbon content filler material, < 0.03%, might have been used, however, this could not be established positively.

Fabrication Methods

The shroud at all four units were fabricated by Willamette, no significant fabrication differences were observed between units.

The top flange ring subassembly was fabricated from four strip segments (4.5" x 6.5") abrasively cut from plate, roll formed, and welded end-to-end to form the rough ring assembly. This way the rolled segments would not expose the end-grain surfaces to the outer periphery of the completed assembly. Machining of all ring surfaces would be required to achieve the finished 4" x 6" cross section.

The top guide ring was fabricated from six arc segments (3" thick) that were cut from plate materials. The arc segments were welded end-to-end to form the ring assembly. This way the end-grain surface would be exposed at the vertical surfaces of the ring. The finished cross section of the ring (2.5" thick) indicates machining of all surfaces.

The core support plate ring was fabricated from six arc segments (4 1/2" thick) that were cut from plate materials. The arc segments were welded end-to-end to form the ring assembly. This way the end-grain surface would be exposed at the vertical surfaces of the ring. The finished cross section of the ring (4" thick) indicates machining of all surfaces.

The shell subassemblies were all made of three 2-inch plate sections that were rolled to curvature and joined by vertical welds.

The same welding procedure was used to fabricate the shroud at all four units.

Deviation Disposition Reports (DDR) for all four units were reviewed. No DDR's indicating major fabricating repairs or rework on any shroud assembly were identified that would suggest unusual welding stresses.

The shroud fabrication sequence was deduced from the review of the Quality Control inspection records. The sequence appears to vary between the four shroud assemblies and no conclusions could be drawn regarding unusual welding stresses.

Operating Times & Water Chemistry

The operating histories are similar for Dresden Units 2 and 3, and Quad Cities Units 1 and 2. Dresden Unit 2 is currently in operating cycle 14, while Unit 3 has recently completed operating cycle 13. Quad Cities Unit 1 has recently completed operating cycle 13, while Unit 2 is currently in operating cycle 13.

As of April 1, 1994, Dresden Unit 2 has accumulated 155,874 reactor critical hours while Dresden Unit 3 has 144,348 critical hrs.

As of April 30, 1994, Quad Cities Unit 1 has accumulated 151,487 reactor critical hours while Quad Cities Unit 2 has 146,195 critical hrs.

Dresden Units 2 and 3 have been operated at similar mean conductivity levels. The mean conductivity level for both units has improved from 0.3Sμ/cm - 0.4μS/cm during the first five operating cycles to 0.06μS/cm - 0.08μS/cm currently. Unlike Dresden Unit 3, Dresden Unit 2 has been operating with hydrogen injection beginning with operating cycle 9 (1983). Hydrogen injection has ranged from 1.0 - 1.5 ppm at approximately 90% availability. While not sufficiently high to completely protect the reactor internals from IGSCC or IASCC, it still significantly retards crack propagation.

Quad Cities Units 1 and 2 have been operated at similar mean conductivity levels. The mean conductivity level for both units has improved from 0.6μS/cm - 0.7μS/cm during the first five operating cycles to 0.15μS/cm - 0.2μS/cm currently. Additionally, both units have been operating with hydrogen injection beginning with operating cycle 12 (1990).

(3) <u>Request</u>:

Discuss existing procedures and operator training for monitoring for core shroud bypass flow or other indications of vessel internals failures.

(3) <u>Response</u>:

As indicated in the response to question 4 (for Dresden Unit 3 and Quad Cities Unit 1), the strongest indicator of significant upper shroud leakage would be the resultant power level reduction, causing a power-to-flow anomaly. By procedure, the Control Room Operators record the power, core flow and rod line information at the beginning of each shift, and routinely monitor power and core flow conditions during the course of a shift. Existing procedures which address jet pump and shroud access cover anomalies provide sufficient operator guidance in the event of shroud leakage. In addition, training has been provided to licensed personnel on the symptoms resulting from shroud leakage.

With respect to the monitoring for other potential vessel internals failures, jet pump and shroud access hole cover integrity are verified on a daily basis through comparisons of:

- Reactor Recirculation pump speed versus pump flow;
- Reactor Recirculation pump speed versus loop flow; and
- core plate differential pressure versus core flow.

Additionally, jet pump integrity and operability are verified through the daily performance of a jet pump flow distribution comparison.

(4) Request:

Provide an evaluation of the safety significance of a 360° through wall failure at each weld location in the core shroud during normal operation, anticipated transient, and postulated accident conditions. Include evaluation of the design basis loss-of-coolant accident combined with safe-shutdown earthquake loads (LOCA + SSE). This evaluation should address questions such as: (a) estimated potential shroud movement vertically or laterally; (b) control rod scram capability; (c) boron injection capability; (d) short & long term core cooling capability, including core spray capability; and (e) ability to maintain 2/3 core coverage with bypass leakage at various elevations.

(4) Response:

The response to question 5 for Dresden Unit 3 and Quad Cities Unit 1 is applicable to the H5 welds on Dresden Unit 2 and Quad Cities Unit 2. The evaluation of the safety significance of 360 degree through wall failures at the other weld locations is being sponsored by the BWR Owner's Group. ComEd will be working in conjunction with the BWROG and GE to address this issue.

(5) Request:

Discuss the adequacy of emergency procedures and operator training with regard to design basis accident conditions with postulated core shroud failure and by-pass flow.

(5) Response:

The Dresden and Quad Cities Emergency Operating Procedures (EOPs) are symptom based procedures (e.g., reactor pressure, water level, power) and are capable of addressing a full spectrum of transients and design basis accident conditions. Given that basis, the EOPs do not require diagnosis of any particular event.

As discussed in the response to question 5 (for Dresden Unit 3 and Quad Cities Unit 1), the Main Steam Line (MSL) Break (inside containment) event is the worst postulated design basis accident condition, in that it imposes the largest lifting loads on the shroud. Neglecting the presence of any shroud ligament at the H-5 weld, this event could result in the momentary separation (lifting) of the shroud assembly, and potential lateral movement, from the lower shroud. The EOPs provide the necessary guidance for reactor power control in the event scram capability function has been impacted (including the appropriate use of the SBLC System) and the level control requirements to ensure core cooling. For the MSL Break event, the integrity of the shroud is not required to maintain core coverage, or a floodable region.

For the design basis Recirculation Line Break event, the differential pressure across the upper shroud and the lateral loads (on the side of the shroud) will not lift, or significantly laterally shift the shroud. The bypass leakage would be very small compared to the emergency core cooling system flow capacity, (see response to question 5 for Dresden Unit 3 and Quad Cities Unit 1), resulting in no significant decrease in core cooling. Given the minor bypass leakage impact, coupled with the conclusion that minimal shroud movement is expected (shroud integrity is maintained), the current guidance in the EOPs to respond to a design basis Recirculation Line Break event is adequate.

The Dresden and Quad Cities EOPs provide the necessary direction to restore and maintain parameters within specified limits. Licensed operators are routinely trained on the EOP's, and are required to demonstrate their ability to implement those procedures in the simulator.

FIGURE 1

H5 BOUNDING FLAW DETERMINATION

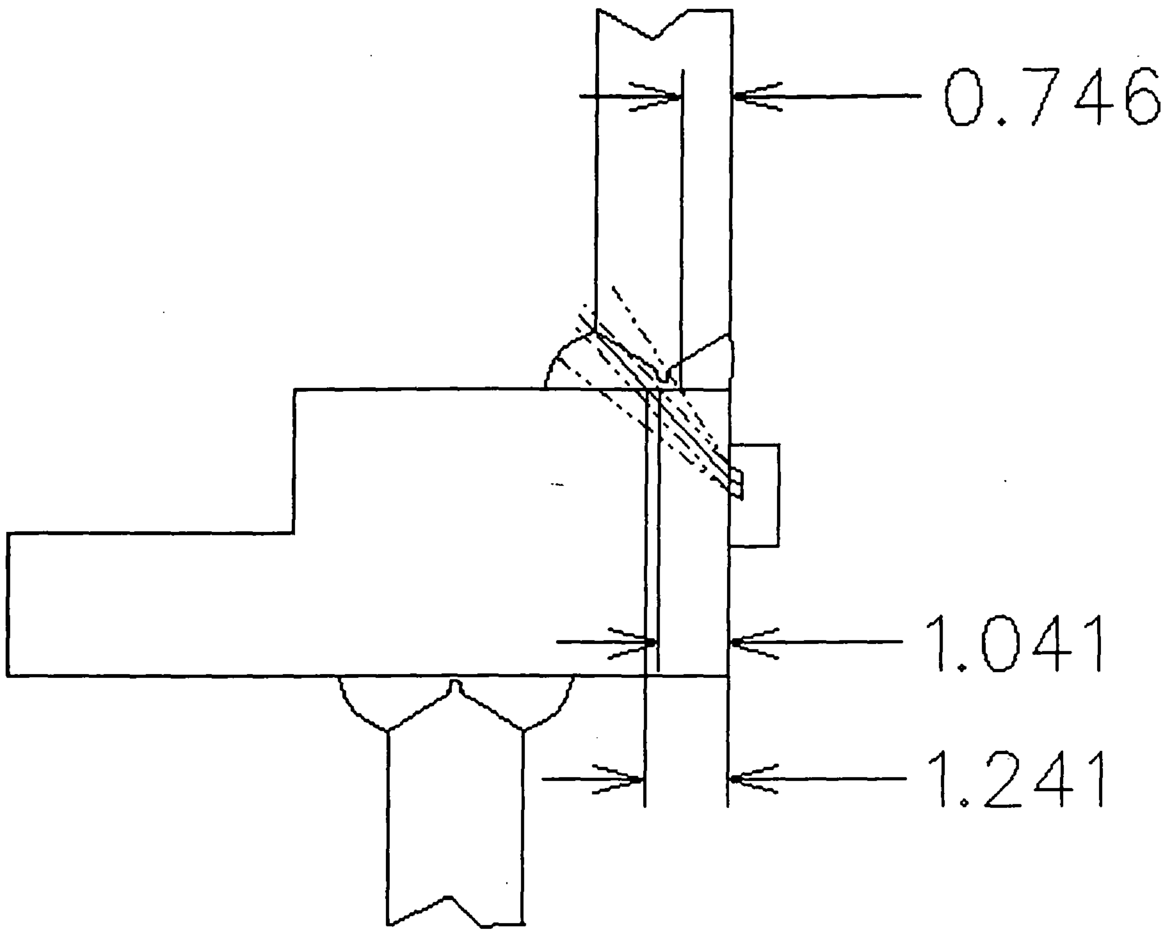

FIGURE 2

LOCATION OF WELDS

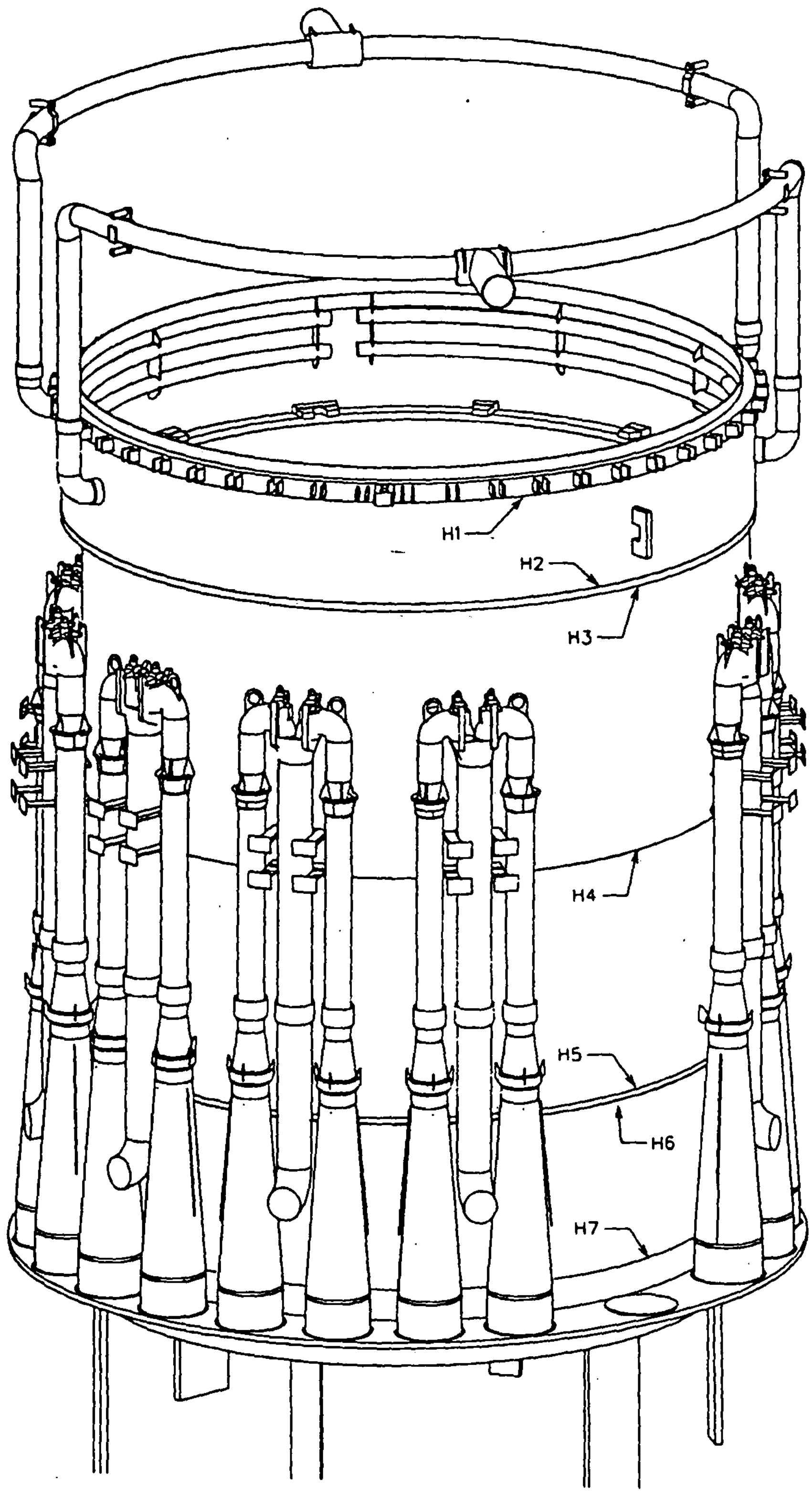

TABLE 1
DRESDEN UNIT 3
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H1	O.D.	44° - 54° (19")	LINEAR CIRC INDICATION ~ 2" IDENTIFIED IN UPPER HAZ at 52°.	QUALIFIED VISUALLY
		136° - 144° (15")	NO INDICATIONS IDENTIFIED	
		226° - 234° (15")	NO INDICATIONS IDENTIFIED	
		316° - 330° (27")	LINEAR CIRC INDICATION ~ 2" IDENTIFIED IN UPPER HAZ BEHIND JET PUMP 20 (315°), OUTSIDE INSPECTION ZONE.	
H2	O.D.	38° - 54° (31") (38° - 42° LOWER HAZ ONLY)	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		136° - 144° (15")	NO INDICATIONS IDENTIFIED	
		226° - 234° (15")	NO INDICATIONS IDENTIFIED	
		316° - 323° (14")	LINEAR CIRC INDICATION < 1" IN LOWER HAZ AT 320°	
H3	O.D.	0° - 20° (36")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		90° - 106° (29")	NO INDICATIONS IDENTIFIED	
		180° - 196° (29")	NO INDICATIONS IDENTIFIED	
		265° - 284° (34")	NO INDICATIONS IDENTIFIED	
H3	I.D.	0° - 31° (60")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		40° - 68° (50")	NO INDICATIONS IDENTIFIED	
		90° - 112° (40")	LINEAR CIRC INDICATION ~12" LONG IN LOWER HAZ FROM 105° TO 112°	

TABLE 1
DRESDEN UNIT 3
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H3 (CONT'D)	I.D. (CONT'D)	121° - 170° (88")	LINEAR VERTICAL INDICATION IN UPPER HAZ ~ 1" AT 140° LINEAR CIRC INDICATION ~77" LONG IN LOWER HAZ FROM 121° TO 164°	QUALIFIED VISUALLY
		173° - 180° (13")	LINEAR CIRC INDICATION ~13" LONG IN UPPER HAZ FROM 173° TO 180°	
		180° - 200° (36")	LINEAR CIRC INDICATION ~4" LONG IN LOWER HAZ FROM 190° TO 192°	
		200° - 215° (27") (LOWER HAZ ONLY)	NO INDICATIONS IDENTIFIED	
		218° - 245° (49") (LOWER HAZ ONLY)	2 LINEAR CIRC INDICATIONS ~4" LONG IN LOWER HAZ FROM 218° TO 220° AND 225° TO 227°	
		270° - 295° (45") (LOWER HAZ ONLY)	LINEAR CIRC INDICATION ~18" LONG IN LOWER HAZ FROM 278° TO 288°	
		313° - 323° (18") (UPPER HAZ ONLY)	LINEAR CIRC INDICATIONS ~18" LONG IN UPPER HAZ FROM 313° TO 323°	
		324° - 331° (13")	LINEAR CIRC INDICATIONS ~13" LONG TOTAL IN UPPER HAZ FROM 325° TO 331° LINEAR CIRC INDICATION ~8" LONG IN LOWER HAZ FROM 327° TO 331°	
		332° - 341° (16")	LINEAR CIRC INDICATION ~6" LONG IN LOWER HAZ FROM 338° TO 341°	

TABLE 1
DRESDEN UNIT 3
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H4	O.D.	43° - 57° (25")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		135° - 151° (29")	NO INDICATIONS IDENTIFIED	
		220° - 234° (25")	LINEAR CIRC INDICATION < 1" IN LOWER HAZ AT 227°	
		315° - 325° (18")	LINEAR CIRC INDICATION < 1" IN UPPER HAZ AT 318°	
H4	I.D.	10° - 25° (27")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		44° - 55° (20")	NO INDICATIONS IDENTIFIED	
		96° - 115° (34")	2 LINEAR VERTICAL INDICATIONS < 1" IN LOWER HAZ AT 114°	
		134° - 152° (32")	LINEAR CIRC INDICATION < 1" IN LOWER HAZ AT 146°	
		188° - 205° (30")	NO INDICATIONS IDENTIFIED	
		226° - 238° (22")	LINEAR CIRC INDICATION < 1" IN UPPER HAZ AT 230°	
		275° - 295° (36")	NO INDICATIONS IDENTIFIED	
		316° - 329° (23")	4 LINEAR VERTICAL INDICATIONS < 1" IN UPPER HAZ AT 320°	
H5	O.D.	100% OF ACCESSIBLE AREA, WHICH CONSISTS OF ~ 40% OF THE WELD CIRCUMFERENCE.	LINEAR CIRC INDICATION IN LOWER HAZ FOR 100% OF THE AREA EXAMINED (ASSUMED TO BE ESSENTIALLY 360°). VERIFIED TO BE A CRACK USING INFORMATIONAL UT.	FAILED SCREENING CRITERIA.

TABLE 1
DRESDEN UNIT 3
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H6	O.D.	46° - 54° (14")	LINEAR VERTICAL INDICATION < 1" IN UPPER HAZ AT 47°	QUALIFIED VISUALLY
		76° - 84° (14")	NO INDICATIONS IDENTIFIED	
		143° - 151° (14")	NO INDICATIONS IDENTIFIED	
		166° - 174° (14")	NO INDICATIONS IDENTIFIED	
		224° - 235° (20")	NO INDICATIONS IDENTIFIED	
		256° - 264° (14")	NO INDICATIONS IDENTIFIED	
		316° - 324° (14")	NO INDICATIONS IDENTIFIED	
		346° - 354° (14")	NO INDICATIONS IDENTIFIED	
H7	O.D.	15° - 115° (17")	LINEAR CIRC INDICATION < 1" IN UPPER HAZ AT 20°	QUALIFIED VISUALLY
		105° - 115° (17")	NO INDICATIONS IDENTIFIED	
		135° - 147° (21")	NO INDICATIONS IDENTIFIED	
		196° - 204° (14")	NO INDICATIONS IDENTIFIED	
		286° - 292° (10")	NO INDICATIONS IDENTIFIED	
		325° - 335° (17")	NO INDICATIONS IDENTIFIED	

TABLE 2
QUAD CITIES UNIT 1
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H1	O.D.	42° - 49° (13")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		132° - 139° (13")	NO INDICATIONS IDENTIFIED	
		222° - 229° (13")	NO INDICATIONS IDENTIFIED	
		322° - 329° (13")	NO INDICATIONS IDENTIFIED	
H2	O.D.	42° - 49° (13")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		132° - 139° (13")	NO INDICATIONS IDENTIFIED	
		222° - 229° (13")	NO INDICATIONS IDENTIFIED	
		322° - 329° (13")	NO INDICATIONS IDENTIFIED	
H3	O.D.	100% (651")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
H3	I.D.	100% (638")	LINEAR CIRC INDICATION ~ 10" LONG IN LOWER HAZ FROM 85° - 90°	QUALIFIED VISUALLY
			LINEAR CIRC INDICATION ~ 3" LONG IN LOWER HAZ FROM 90° - 92°	
			LINEAR CIRC INDICATION ~ 6" LONG IN LOWER HAZ FROM 148° - 152°	
			LINEAR CIRC INDICATION ~ 9" LONG IN LOWER HAZ FROM 160° - 165°	
			LINEAR CIRC INDICATION ~ 11" LONG IN LOWER HAZ FROM 187° - 193°	

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H3 (CONT'D)	I.D. (CONT'D)	100% (638")	LINEAR CIRC INDICATION ~ 35" LONG IN UPPER HAZ FROM 185° - 205°	QUALIFIED VISUALLY
			LINEAR CIRC INDICATION ~ 17" LONG IN LOWER HAZ FROM 205° - 215°	
			LINEAR CIRC INDICATION ~ 17" LONG IN LOWER HAZ FROM 250° - 260°	
			LINEAR CIRC INDICATION ~ 60" LONG IN LOWER HAZ FROM 225° - 260°	

TABLE 2
QUAD CITIES UNIT 1
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H4	O.D.	75° - 85° (19")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		140° - 175° (62")	NO INDICATIONS IDENTIFIED	
		255° - 265° (19")	NO INDICATIONS IDENTIFIED	
		320° - 355° (62")	NO INDICATIONS IDENTIFIED	
H4	I.D.	83° - 97° (23")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		173° - 187° (23")	NO INDICATIONS IDENTIFIED	
		260° - 280° (35")	TWO INDICATIONS ~ 1/2" LONG EACH IN LOWER HAZ AT 260° AND 277°	
		355° - 15° (35")	NO INDICATIONS IDENTIFIED	
H5	O.D.	15° - 25° (17")	NUMEROUS, RANDOM LINEAR INDICATIONS (CIRC AND AXIAL) WERE OBSERVED BELOW THE WELD IN AREAS INSPECTED; NO INDICATIONS WERE IDENTIFIED ON THE UPPER SIDE OF THE WELD. UT INSPECTIONS AT SIX LOCATIONS VERIFIED PRESENCE OF CRACKS WITH DEPTHS UP TO 1.20".	FAILED SCREENING CRITERIA.
		45° - 55° (17")		
		75° - 85° (17")		
		105° - 115° (17")		
		135° - 175° (72")		
		195° - 205° (17")		
		225° - 235° (17")		
		255° - 265° (17")		
		285° - 295° (17")		
		320° - 355° (60")		

TABLE 2
QUAD CITIES UNIT 1
SHROUD VISUAL INSPECTION STATUS

WELD #	SURFACE	AREA EXAMINED	INSPECTION RESULTS	QUALIFICATION STATUS
H6	O.D.	15° - 25° (17")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		75° - 85° (17")	NO INDICATIONS IDENTIFIED	
		105° - 115° (17")	NO INDICATIONS IDENTIFIED	
		135° - 175° (70")	NO INDICATIONS IDENTIFIED	
		195° - 205° (17")	NO INDICATIONS IDENTIFIED	
		255° - 265° (17")	LINEAR CIRC INDICATION ~ 7" LONG IN UPPER HAZ FROM 257° - 261°	
		286° - 295° (16")	NO INDICATIONS IDENTIFIED	
		320° - 355° (60")	NO INDICATIONS IDENTIFIED	
H7	O.D.	41° - 49° (13")	NO INDICATIONS IDENTIFIED	QUALIFIED VISUALLY
		135° - 170° (60")	NO INDICATIONS IDENTIFIED	
		296° - 304° (13")	NO INDICATIONS IDENTIFIED	
		320° - 355° (60")	NO INDICATIONS IDENTIFIED	

TABLE 3
DRESDEN UNIT 3
SHROUD ULTRASONIC EXAMINATION STATUS

WELD #	AREA SCANNED	FLAW LENGTH	MAX FLAW DEPTH	MINIMUM REMAINING LIGAMENT	WELD SIDE	EXAMINATION SUMMARY
H2	16° - 74.5° (112")	8 FLAWS - 15.6" TOTAL 4 FLAWS - 24.8" TOTAL	.75" .56"	2.25" 1.44"	LOWER UPPER	EXAMINATION COVERED ALL ACCESSIBLE AREAS, OR ≈534" (77%) OF THE TOTAL 691" WELD LENGTH. THE SUM OF THE LOWER HAZ INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 114.5". THE SUM OF THE UPPER HAZ INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 63.5". VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
	76° - 102° (50")	6 FLAWS - 3.4" TOTAL 2 FLAWS - 8" TOTAL	.46" .37"	2.54" 1.63"	LOWER UPPER	
	106° - 151° (86.5")	4 FLAWS - 21.7" TOTAL 3 FLAWS - 9" TOTAL	.71" .39"	2.29" 1.61"	LOWER UPPER	
	188° - 191° (6")	1 FLAW - 5.1"	.61"	2.39"	LOWER	
	218.5° - 253.5° (67")	6 FLAWS - 18.6" TOTAL 5 FLAWS - 10" TOTAL	.70" .71"	2.30" 1.39"	LOWER UPPER	
	256° - 280° (46")	1 FLAW - 1.5" 1 FLAW -1. 8"	.38" .20"	2.62" 1.80"	LOWER UPPER	
	286° - 12.5° (166")	19 FLAWS - 48.8" TOTAL 4 FLAWS -9.9" TOTAL	.61" .32"	2.39" 1.68"	LOWER UPPER	
H5	31° - 52.5° (39")	NO RECORDABLE INDICATIONS				EXAMINATION COVERED ALL ACCESSIBLE AREAS, OR ≈271" (41.5%) OF THE TOTAL 651" WELD LENGTH. THE SUM OF THE INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 127.5".
	113.5° - 170.5° (103")	129° - 144° (27")	.45"	2.55"	LOWER	
	113.5° - 170.5° (103")	150° - 158° (14")	.30"	2.70"	LOWER	
	214.5° - 237.5° (42")	225° - 237.5° (23")	.47"	2.53"	LOWER	
	297.5 - 345.5° (87")	310.5° - 345° (63.5")	.84"	2.16"	LOWER	

TABLE 3
DRESDEN UNIT 3
SHROUD ULTRASONIC EXAMINATION STATUS

WELD #	AREA SCANNED	FLAW LENGTH	MAX FLAW DEPTH	MINIMUM REMAINING LIGAMENT	WELD SIDE	EXAMINATION SUMMARY
H6	147° - 153° (10.5")	NO RECORDABLE INDICATIONS				EXAMINATION COVERED 4 ACCESSIBLE AREAS AT THE ACCESS HOLE COVERS, OR ≈42" OF THE 650" WELD LENGTH. NO RECORDABLE INDICATIONS WERE IDENTIFIED. VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
	169.5° - 175.5° (10.5")	NO RECORDABLE INDICATIONS				
	327° - 333° (10.5")	NO RECORDABLE INDICATIONS				
	349.5° - 355.5° (10.5")	NO RECORDABLE INDICATIONS				
H7	147° - 153° (10.5")	NO RECORDABLE INDICATIONS				EXAMINATION COVERED 4 ACCESSIBLE AREAS AT THE ACCESS HOLE COVERS, OR ≈42" OF THE 650" WELD LENGTH. THE SUM OF THE INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 7.9" VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
	169.5° - 175.5° (10.5")	NO RECORDABLE INDICATIONS				
	327° - 333° (10.5")	NO RECORDABLE INDICATIONS				
	349.5° - 355.5° (10.5")	2 FLAWS - 7.9" TOTAL	.42"	1.83"	LOWER	

TABLE 4
QUAD CITIES UNIT 1
SHROUD ULTRASONIC EXAMINATION STATUS

WELD #	AREA SCANNED	FLAW LENGTH	MAX FLAW DEPTH	MINIMUM REMAINING LIGAMENT	WELD SIDE	EXAMINATION SUMMARY
H2	336° - 76° (192")	341° - 342° (3") OD	0.20"	1.80"	UPPER	THE EXAMINATION COVERED ~ 539" (77.9%) OF THE TOTAL 691" WELD LENGTH. THE SUM OF THE INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 139" (20.1%). VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
		350° - 356° (11") OD	0.20"	1.80"	UPPER	
		6° - 7° (1") ID	0.25"	1.55"	UPPER	
		6° - 17° (21") OD	0.20"	1.55"	UPPER	
		19° - 28° (17") OD	0.20"	1.80	UPPER	
		25° - 26° (1")	0.32"	2.68"	LOWER	
		66° - 75° (17") OD	0.20"	1.80"	UPPER	
	81° - 106° (48")	NO RECORDABLE INDICATIONS				
	111° - 153° (81")	111° - 116° (10") 0D	0.20"	1.80"	UPPER	
		122° - 125° (6") OD	0.20"	1.80"	UPPER	
		127° - 128° (0.5") OD	0.20"	1.80"	UPPER	
		129° - 130° (1") OD	0.20"	1.80"	UPPER	
		144° - 145° (1") OD	0.20"	1.80"	UPPER	
		149° - 152° (5") ID	0.20"	1.80"	UPPER	
	219° - 286° (129")	250° - 252° (3") ID	0.30"	1.70"	UPPER	
		263° - 264° (1")	0.35"	2.65"	LOWER	
		278° - 281° (5") ID	0.25"	1.75"	UPPER	

TABLE 4
QUAD CITIES UNIT 1
SHROUD ULTRASONIC EXAMINATION STATUS

WELD #	AREA SCANNED	FLAW LENGTH	MAX FLAW DEPTH	MINIMUM REMAINING LIGAMENT	WELD SIDE	EXAMINATION SUMMARY
H2 (CONT)	291° - 331° (77")	296° - 298° (4") OD	0.20"	1.80"	UPPER	THE EXAMINATION COVERED ~ 539" (77.9%) OF THE TOTAL 691" WELD LENGTH. THE SUM OF THE INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 139" (20.1%). VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
		303° - 306° (6") OD	0.20"	1.80"	UPPER	
		308° - 310° (3") ID	0.20"	1.80"	UPPER	
		312° - 317° (10") ID	0.35"	1.65"	UPPER	
		317° - 322° (9") OD	0.20"	1.46"	UPPER	
		319° - 321° (3") ID	0.34"	1.46"	UPPER	

TABLE 4
QUAD CITIES UNIT 1
SHROUD ULTRASONIC EXAMINATION STATUS

WELD #	AREA SCANNED	FLAW LENGTH	MAX. FLAW DEPTH	MINIMUM REMAINING LIGAMENT	WELD SIDE	EXAMINATION SUMMARY
H5	126° - 181° (99")	NO RECORDABLE INDICATIONS				THE EXAMINATION COVERED ~ 207" (31.8%) OF THE TOTAL 651" WELD LENGTH. THE SUM OF THE INDICATIONS RECORDED EXTEND FOR A TOTAL LENGTH OF 27" (4.1%).
	224° - 233° (16")	NO RECORDABLE INDICATIONS				
	306° - 338° (58")	327° - 328° (2") ID	0.25"	1.75"	UPPER	
	344° - 360° (29")	345° - 347° (4")	0.39"	2.61"	LOWER	
		349° - 361° (21")	0.57"	2.43"	LOWER	
H6	141° - 147° (11")	145° - 146° (2") ID	0.25"	1.75"	LOWER	THE EXAMINATION WAS PERFORMED IN FOUR (4) ACCESSIBLE LOCATIONS WHICH COVERED ~ 42" (6.7%) OF THE TOTAL 631" WELD LENGTH. VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
	163° - 169° (11")	NO RECORDABLE INDICATIONS				
	328° - 334° (11")	NO RECORDABLE INDICATIONS				
	343° - 349° (11")	NO RECORDABLE INDICATIONS				
H7	141° - 146° (9")	NO RECORDABLE INDICATIONS				THE EXAMINATION WAS PERFORMED IN FOUR (4) ACCESSIBLE LOCATIONS WHICH COVERED ~ 42" (6.7%) OF THE TOTAL 631" WELD LENGTH. VISUAL WELD QUALIFICATION CORROBORATED BY UT RESULTS.
	163° - 169° (11")	NO RECORDABLE INDICATIONS				
	328° - 334° (11")	NO RECORDABLE INDICATIONS				
	343° - 349° (11")	NO RECORDABLE INDICATIONS				

TA[illegible]5
DRESDEN D3R13
IN-VESSEL EXAMINATION STATUS
Page 1 of 2

COMPONENT	PROBLEM IDENTIFIED	RESOLUTION STATUS
Core Spray downcomer weld #16 at 120° azimuth	Crack ≈ 4" in length identified in the lower HAZ of the upper elbow weld, just upstream of the connection through the shroud.	Weld will be repaired after fuel load, but prior to start up, using a mechanical clamping device. Safety significance of this item is minimal as it did not fail during injection test.
Core Spray downcomer weld #16 at 290° azimuth	Crack ≈ 6" in length identified in the lower HAZ of the upper elbow weld, just upstream of the connection through the shroud.	Weld will be repaired after fuel load, but prior to start up, using a mechanical clamping device. Safety significance of this item is minimal as it did not fail during injection test.
Top guide bolts 5, 26, and 27	Crack identified in the bolt head at the HAZ of the fillet weld locking the bolt head to the top guide ring.	Preliminary evaluation shows this condition to be acceptable as is. The bolts are still capable of carrying the loads and remain locked in place.
IRM Dry Tube #12 (location 24-37)	Crack ≈ 180° of circumference identified in the guide tube in the upper HAZ of the weld joining the primary pressure boundary to the spring tube.	The Dry Tube will be replaced prior to fuel load. No safety significance as crack is in non-pressure retaining portion of tube.
Jet Pump 3 & 4 upper riser brace	Upper and lower leafs are cracked through wall and separated in the leaf material near the shop weld buildup region at the yoke end on the jet pump 3 side. Upper leaf is cracked ≈ 50% in the leaf material near the shop weld buildup region at the yoke end on the jet pump 4 side.	Preliminary evaluation shows all riser brace cracking to be acceptable as is for at least one fuel cycle. This is based upon: (1) the redundant riser brace design installed on Unit 3, (2) an evaluation that demonstrates cracking at the vessel to leaf weld, which could result in loose parts, to be extremely unlikely, and (3) a loose parts analysis that demonstrates that even in the unlikely event that a riser brace leaf became a loose part, it would have no impact on safety.

TABLE 5
DRESDEN D3R13
IN-VESSEL EXAMINATION STATUS

COMPONENT	PROBLEM IDENTIFIED	RESOLUTION STATUS
Jet Pump 15 &16 upper riser brace	Upper leaf is cracked through wall in the leaf material near the shop weld buildup region at the yoke end on the jet pump 16 side.	Preliminary evaluation shows all riser brace cracking to be acceptable as is for at least one fuel cycle. This is based upon: (1) the redundant riser brace design installed on unit 3, (2) an evaluation that demonstrates cracking at the vessel to leaf weld, which could result in loose parts, to be extremely unlikely, and (3) a loose parts analysis that demonstrates that even in the unlikely event that a riser brace leaf became a loose part, it would have no impact on safety.
Jet Pump 19 &20 upper riser brace	Upper leafs are cracked through wall in the leaf material near the shop weld buildup region at the yoke end on both the jet pump 19 and 20 sides.	
Jet Pump 18 and Jet Pump 20	Restrainer wedge assembly handles appear bent and possibly unloaded.	Preliminary evaluation shows this condition to be acceptable as is since wedge has full contact.
Jet Pump 3	Outside and inside lock plate flat head screw tack welds on vessel side are cracked. Outside lock plate flat head screw on shroud side cracked.	Accept as-is. The configuration of the crack face against the cap screw head will prevent rotation of the screw.
Jet Pump 7	Outside lock plate flat head screw tack weld on vessel side is cracked.	Accept as-is. The configuration of the crack face against the cap screw head will prevent rotation of the screw.
Jet Pump 8	Outside lock plate flat head screw tack weld on shroud side is cracked.	Accept as-is. The configuration of the crack face against the cap screw head will prevent rotation of the screw.
Shroud Head Bolts	2 previously unflawed bolts cracked	Accept as-is. Spacing of unflawed welds is sufficient to demonstrate integrity of the joint.

TABLE 6
QUAD CITIES Q1R13
IN-VESSEL EXAMINATION STATUS

COMPONENT	PROBLEM IDENTIFIED	RESOLUTION STATUS
Core Spray B-loop T-box to south pipe weld (Located at 155°).	Crack identified in the HAZ of the pipe weld, 7" long.	Plans are to operate for one cycle and repair. Preliminary evaluation shows crack to be acceptable as is for one operating cycle, based upon: structural analysis, loose parts analysis, and effect on LOCA analysis.
Top guide bolt # 6 (clockwise from 0°)	Crack identified in the bolt head at the HAZ of the fillet weld locking the bolt head to the top guide ring.	Preliminary evaluation by G.E. shows this condition to be acceptable as is. The bolts are still capable of carrying the loads and remain locked in place.
SRM Dry Tube #22(location 40-21)	Transverse crack/indication on the guide plug to perforated tube weld (upper weld).	The Dry Tube has been replaced.
IRM Dry Tube #14 (location 48-13)	Transverse crack/indication on the guide plug to perforated tube weld (upper weld). The transverse crack propagated into the perforated tube approximately 1/4" to 1/2" long.	The Dry Tube has been replaced.
Jet Pump 5 & 6	Crack identified on Riser brace fillet weld to riser pipe located in the HAZ of the riser pipe. This crack traveled almost the total length of the weld. Two cracks also noted on riser pipe, each one approximately 6" long, one traveling up the riser pipe at a 45° angle off the brace and the other traveling down the riser at a 45° angle off the brace .	Riser and brace will be repaired using a mechanical clamping device. Safety significance is minimal because jet pump was still operable at shutdown.

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DRESDEN UNIT 2
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
SHROUD ACCESS HOLE COVERS (2)	SIL No. 462 revision and NRC Information Notice 92-57. VT and Axial UT Inspection	D2R13	Inspection not performed. Both covers were proactively replaced during the D2R13 outage.	
JET PUMP BEAMS (20)	SIL No. 330, I.E. Notice 80-07 and NUREG-3052. UT Inspection	D2R07	Jet pump beams 9 & 20 found cracked.	Both beams were replaced.
		D2R08, 09, 10, 11, 12, 13	No further indications identified.	
SHROUD HEAD BOLTS (48)	SIL No. 433 UT Inspection	D2R10	Bolt #42 found to have crack indication.	Left in place since.
		D2R11, D2R12	No further indications identified.	
INCORE SRM/IRM DRY TUBES (12)	SIL No. 409 Visual Inspection of upper 2'.	D2R10	Dry tube plunger on IRM 18 broken off.	Dry tube was replaced.
		D2R11	Dry tubes 11, 22, 14, 15 & 17 not fully engaged in top guide.	Dry tubes were replaced.
		D2R12	None	
CORE SPRAY SPARGER, NOZZLE, T-BOX, PIPING AND ATTACHMENTS	SIL No. 289 and I.E. Bulletin 80-13. VT-1 Inspection	D2R07, 08, 09, 10, 11, 12, 13	None	

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DRESDEN UNIT 2
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
RPV HEAD AND VESSEL-FLANGE CLADDING	RICSIL No. 050, SIL No. 539 and NRC Commitment. VT-3 Inspection	D2R12	None	
JET PUMP INSPECTIONS	RICSIL No. 045 and SIL No. 551 VT-1 & VT-3	D2R07	Jet pump #3 inboard restrainer clamp bolt keeper loose.	Keeper re-tacked.
		D2R08, 09, 10, 11, 12	None	
		D2R13	Jet pump #2 inboard restrainer clamp bolt keeper loose.	Keeper re-tacked.
FEEDWATER SPARGER, NOZZLES, NOZZLE BORES, BRACKETS	NUREG 0619 VT-1 & VT-3	D2R09, 10, 11, 12, 13	None	
INVESSEL VISUAL INSPECTION (INCLUDES: RPV Interior Accessible surfaces, Interior Attachments to RPV, Steam Dryer and guides, Steam Separator and guides, Upper Shroud and Shroud Head guides, Steam Separator lugs on Shroud, Surveillance Sample holders, Top Fuel Grid, etc.)	Section XI Category B-N-1 and B-N-2 VT-1 & 3 Inspection	D2R07, 08, 09, 10, 11, 12, 13	None	

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DRESDEN UNIT 3
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
SHROUD ACCESS HOLE COVERS (2)	SIL No. 462 VT and UT Exam	D3R10	None	
	SIL No. 462 revision and NRC Information Notice 92-57. VT and UT Inspection	D3R12	None	
JET PUMP BEAMS (20)	SIL No. 330, I.E. Notice 80-07 and NUREG-3052. UT Inspection	D3R06	Jet Pump 13 hold down beam failed with pump lying on jet pump 12. outboard restrainer stop adjusting screw on jet pump 13 also broken. Ut also identified cracked hold down beams on jet pumps 2, 5, 9, 11, 17 & 20.	Hold down beams on Jet pumps 2, 5, 9, 11, 13, 17 & 20 were replaced. Jet pump 13 restrainer stop was also replace.
		D3R07	Jet pump 7 hold down beam cracked.	Jet pump 7 hold down beam was replaced.
		D3R08	Jet pump 12 hold down beam and 1 beam bolt cracked.	Jet pump 12 hold down beam and bolt was replaced.
		D3R09	Jet pump 11 hold down beam cracked.	Jet pump 11 hold down beam was replaced.
		D3R10	Jet pump 1 hold down beam cracked.	Jet pump 1 hold down beam was replaced.
		D3R11	Jet pump 4 hold down beam cracked.	Jet pump 4 hold down beam was replaced.
CORE SPRAY SPARGER, NOZZLE, T-BOX, PIPING AND ATTACHMENTS	SIL No. 289 and I.E. Bulletin 80-13. VT-1 Inspection	D3R06, 07, 08, 09, 10, 11, 12	None	

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DRESDEN UNIT 3
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
SHROUD HEAD BOLTS (48)	SIL No. 433 UT Inspection	D3R09	7 bolts cracked.	Evaluation determined condition to be acceptable as-is.
		D3R10	4 previously unflawed bolts cracked.	Evaluation determined condition to be acceptable as-is.
		D3R11	1 previously unflawed bolt cracked.	The cracked bolts were rearranged around the shroud to maintain even spacing of unflawed bolts.
		D3R12	16 previously unflawed bolts cracked.	11 of the cracked bolts were replaced (10 of the replacement bolts were the non-creviced design). Remaining bolts were redistributed around the shroud to separate all cracked bolts by at least 1 unflawed bolt.
INCORE SRM/IRM DRY TUBES (12)	SIL No. 409 Visual Inspection of upper 2'.	D3R10	SRM & IRM guide tubes badly engaged into top guide.	All 14 guide tubes were replaced.
		D3R11, D3R12	No further indications	
RPV HEAD AND VESSEL-FLANGE CLADDING	RICSIL No. 050, SIL No. 539 and NRC Commitment. VT-3 Inspection	D3R12	None	
JET PUMP INSPECTIONS	RICSIL No. 045 and SIL No. 551 VT-1 & VT-3	D3R06, 07, 08, 09,10, 11	No indications other than those previously identified under Jet Pump Hold Down Beams	
		D3R12	Jet pump 2 outboard restrainer clamp bolt keeper cracked.	Keeper re-tacked.

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DRESDEN UNIT 3
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
FEEDWATER SPARGER, NOZZLES, NOZZLE BORES, BRACKETS	NUREG 0619 VT-1 & VT-3	D3R06, 07, 08, 09, 10, 11, 12	None	
INVESSEL VISUAL INSPECTION (INCLUDES: RPV Interior Accessible surfaces, Interior Attachments to RPV, Steam Dryer and guides, Steam Separator and guides, Upper Shroud and Shroud Head guides, Steam Separator lugs on Shroud, Surveillance Sample holders, Top Fuel Grid, etc.)	Section XI Category B-N-1 and B-N-2 VT-1 & 3 Inspection	D3R06, 07, 08, 09, 10, 11, 12	None	

TA[illegible] 9
QUAD CITIES UNIT 1
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
SHROUD ACCESS HOLE COVERS (2)	SIL No. 462 revision and NRC Information Notice 92-57. VT and Axial UT Inspection	Q1R12	No circumferential UT crack inspection performed due to the planned repair of both cover plate welds. No Axial cracking detected by Visual or UT inspections, but circ. cracking could be seen visually.	Permanent fix installed.
JET PUMP BEAMS (20)	SIL No. 330, I.E. Notice 80-07 and NUREG-3052. UT Inspection	Q1R08	One Crack Beam Bolt Recorded on Jet Pump No. 13.	Bolt replaced.
		Q1R09, 10, 11, 12	None	
SHROUD HEAD BOLTS (48)	SIL No. 433 UT Inspection	Q1R08, 12	None (Equipment problem prevented examination during Q1R11)	
INCORE SRM/IRM DRY TUBES (12)	SIL No. 409 Visual Inspection of upper 2'.	Q1R08, 12	None	
JET PUMP SENSING LINE SUPPORTS	SIL No. 420 VT-1 Inspection	Q1R11, 12	None	
JET PUMP RISER BRACES (10)	RICSIL No. 045 and SIL No. 551 Visual Inspection	Q1R12	Two riser braces, located next to Jet Pump #12 and #13, still had vibration monitoring equipment installed on underside of bracket.	Vibration monitoring equipment was removed.
CORE SPRAY SPARGER, NOZZLE, T-BOX, PIPING AND ATTACHMENTS	SIL No. 289 and I.E. Bulletin 80-13. VT-1 Inspection	Q1R06, 07, 08, 09, 10, 11, 12	None	

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QUAD CITIES UNIT 1
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
RPV HEAD AND VESSEL-FLANGE CLADDING	RICSIL No. 050, SIL No. 539 and NRC Commitment. VT-3 Inspection	Q1R12	Clad cracking seen intermittently 360° on RPV Head-Flange weld.	Acceptable as-is and are monitoring specified areas on a periodic bases.
INVESSEL VISUAL INSPECTION (INCLUDES: RPV Interior Accessible surfaces, Interior Attachments to RPV, Steam Dryer and guides, Steam Separator and guides, Upper Shroud and Shroud Head guides, Steam Separator lugs on Shroud, Feedwater Sparger and Attachments, Control Rod Drive Penetration, Surveillance Sample holders, Jet Pumps, Top Fuel Grid, etc.)	Section XI Category B-N-1 and B-N-2 VT-1 & 3 Inspection	Q1R06	CRD Thermal Sleeve Retaining Ring had crack-like indication (Feedwater nozzle spargers not examined due to scheduled removal and replacement).	CRD Thermal Sleeve Retaining Ring was scheduled for removal.
		Q1R07	None	
		Q1R08	None	
		Q1R09	None	
		Q1R10	None	
		Q1R11	None	
		Q1R12	Undercut was noted on Jet Pumps #1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 16, 18, 19, and 20 Adapter Ring to Diffuser fillet weld. Jet Pump #14 contained two areas which where grind out. Top of the Separator Guide Rod was found bent. Small metal plate found laying next to Jet Pump #8.	The Undercut on the fillet welds and the two grind out areas appeared to have insignificant depth and were acceptable as-is. The bent portion of the Separator Guide Rod was accepted as-is. The loose plate material was removed.

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QUAD CITIES UNIT 2
IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
SHROUD ACCESS HOLE COVERS (2)	SIL No. 462 VT and UT Inspection	Q2R11	Significant through-wall circumferential cracking on both cover plate welds.	Temporary fix applied during Q2R11 and permanent fix installed Q2R12.
	SIL No. 462 revision and NRC Information Notice 92-57. Axial UT Inspection	Q2R12	None	
JET PUMP BEAMS (20)	SIL No. 330, I.E. Notice 80-07 and NUREG-3052. UT Inspection	Q2R08, 09, 10, 11, 12	None	
SHROUD HEAD BOLTS (48)	SIL No. 433 UT Inspection	Q2R08, 10, 11	None	
INCORE SRM/IRM DRY TUBES (12)	SIL No. 409 Visual Inspection of upper 2'.	Q2R11	None	
		Q2R12	Undercut noted on lower weld of plunger mechanism.	Acceptable as-is.
JET PUMP SENSING LINE SUPPORTS	SIL No. 420 VT-1 Inspection	Q2R10, 11, 12	None	
JET PUMP RISER BRACES (10)	RICSIL No. 045 and SIL No. 551 Visual Inspection	Q2R12	None	
CORE SPRAY SPARGER, NOZZLE, T-BOX, PIPING AND ATTACHMENTS	SIL No. 289 and I.E. Bulletin 80-13. VT-1 Inspection	Q2R05, 06, 07, 08, 09, 10, 11, 12	None	

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QUAD CITIES UNIT 2

IN-VESSEL EXAMINATION HISTORY REVIEW

COMPONENT	SCOPE & METHOD	OUTAGE	PROBLEM IDENTIFIED	DISPOSITION
RPV HEAD CLADDING	RICSIL No. 050, SIL No. 539 and NRC Commitment. VT-1, VT-3 and UT Inspection	Q2R10, Q2R11	Clad cracking seen intermittently 360° on RPV Head-Flange weld.	Acceptable as-is and are monitoring specified areas on a periodic bases.
INVESSEL VISUAL INSPECTION (INCLUDES: RPV Interior Accessible surfaces, Interior Attachments to RPV, Steam Dryer and guides, Steam Separator and guides, Upper Shroud and Shroud Head guides, Steam Separator lugs on Shroud, Feedwater Sparger and Attachments, Control Rod Drive Penetration, Surveillance Sample holders, Jet Pumps, Top Fuel Grid, etc.)	Section XI Category B-N-1 and B-N-2 VT-1 & 3 Inspection	Q2R05	None	
		Q2R06	60° and 240° sparger brackets had nut spun back to tack weld on bolt. 240° sparger had hex nut lodged in a nozzle.	Nuts tightened by underwater diver and hex nut removed from nozzle. Tack weld on bolt installed per drawing.
		Q2R07	Steam Separator has one bent tube.	Acceptable as-is.
		Q2R08	No new indications.	
		Q2R09	No new indications.	
		Q2R10	No new indications.	
		Q2R11	Bent Feedwater Sparger Nozzle.	Acceptable as-is.
		Q2R12	Minor pitting seen on some Steam Separator lugs on Shroud.	Acceptable as-is.