SAFETY EVALUATION FOR
DRESDEN UNIT 3
CORE SPRAY SPARGER RISER REPAIR

May, 1994

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Dresden 3 Core Spray Sparger Riser Repair Project

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1.0 INTRODUCTION

Each core spray sparger (CSS) includes two 6 NPS schedule 40 inlet pipes which penetrate the shroud. An elbow and vertical pipe spool are connected to these inlet pipes outside the shroud; the assembly of this elbow and the vertical pipe spool will be referred to as the CSS riser. The core spray lines (CSL) connect to the CSS riser pipes at the approximate elevation of the top of the shroud. During the Dresden Unit 3 (D3R13) 1994 refueling outage and inspections done in response to SIL 572, circumferential IGSCC defects were found on two of the CSS riser elbows, at 110° and 290°, adjacent to the horizontal weld to the vertical riser pipe spool, see figure 1-1. The cracks are visible for a maximum of 180 degrees, and are in the weld heat affected zone base material, on the elbow itself, about 1/8 inch from the weld. A repair (by modification) was designed that addresses the identified and potential further cracking adjacent to the these elbow to riser pipe welds.

2.0 SUMMARY

The core spray sparger riser repair clamp is designed to assure that the existing core spray sparger riser will perform its function of directing ECCS flow to the core spray spargers. The core spray sparger riser repair clamp has been designed for the remainder of the 40 year life. The core spray sparger riser repair clamp was designed using materials and stress limits which will assure adequate margins for all design basis conditions. The hardware is designed using ASME Boiler and Pressure Vessel Code, Section III, Subsection NG stress limits. The materials used to fabricate the repair clamp hardware were selected to provide the required strength and compatibility with the reactor environment.

The leakage through this joint was also considered and it is concluded that the leakage should have no significant effect on the existing LOCA analyses. Finally, there will be no change in the scenarios for accidents or anticipated transients.

3.0 RESPONSE TO 10CFR 50.59 QUESTIONS

3.1 Documents Implementing the Proposed Change.

a. FDI No. 0419-57145

b. Drawing. 148C6322G001

c. Parts List PL148C6322G001

3.2 Description and Purpose of the Proposed Change.

The function of the modification is to assure the structural integrity of the CSS riser even if the reported defects were to grow to the full circumference of the weld. The proposed change adds two clamps to the area where the CSS and CSL join. The repair is shown conceptually in figure 3-2 The upper clamp mechanically grips the CSL, and bears on the top of the collar that attaches the core spray line to the core spray sparger riser pipe. A rod supports and locates the lower clamp from the upper clamp. The lower clamp is centered over the riser pipe-to-riser elbow weld joint, where the crack is located. A U-bolt that attaches to the upper clamp provides axial restraint between the CSL collar and the riser elbow, spanning the crack location. The lower clamp provides lateral restraint to keep the riser pipe aligned with the riser elbow, in the event the present defect were to grow to a full 360°.

3.3 The proposed change is permanent.

The proposed change is designed for the remainder of the 40 year plant life using the ASME Boiler and Pressure Vessel Code, Section III, Subsection NG (1989 Edition) as a guide for design and analysis. The repair clamp hardware is classified as safety-related, and is designed to current accepted standards. Therefore, it can withstand the same design bases loads as the current core spray sparger riser under normal and abnormal operating conditions. The installation of this hardware will not affect (degrade) the other RPV internals.

3.4 List of SAR sections which describe the affected systems, structures or components (SSCs) or activities. Also, list the SAR accident analysis sections which discuss the affected SCCs or their operation. List any other controlling documents such as SERs, previous modifications or Safety Evaluations, etc.

SSCs & Accident Analyses	SAR Sections
Core Spray System	6.3, 3.9.5, 4.5.2
Core Spray Safe End Replacement	*none*
Loss of Coolant Accident (LOCA)	15.6.5
Recirculation Pump Seizure	15.3.3

3.5 Description of how the change will affects plant operation when the changed SSCs function as intended (i.e. , focus on system operation/interactions in the absence of equipment failures). Consider all applicable operating modes. Include a discussion of any changed interactions with other SCCs.

If the current cracks grows to a sufficient size, the remaining riser elbow material will no longer be capable of holding the riser pipe to the riser elbow during a core spray system injection. The design of the modification assumes that the present cracks will eventually grow to 360°. The installation of the core spray sparger riser repair will limit the separation between the riser pipe and the riser elbow to 0.054 inch. The modification will also maintain the alignment of the pipe and elbow. This maximum separation results from the temporary cooling of the CSS riser relative to the CSS riser repair U-bolt. It is conservatively assumed that the U-bolt is still at 550 °F when the CSS riser is cooled to 310°F, average temperature, by the injected water from the torus (240 °F temperature difference). After a few minutes of post LOCA core spray system injection, the riser pipe and U-bolt temperatures will equilibrated, and the CSS modification hardware will again close the opening to a typical tight crack width (assumed 0.005 inch).

There are several *original design* leakage locations in the CSL and the CSS riser as well as the cracks. Calculated leak flows from these are tabulated below. The total leakage with the crack at maximum separation (197 GPM) is less than the documented 200 GPM excess system capability, and this is only 4.2% of the system capability. The system capability was specified as 4,700 GPM with the reactor at 90 psig after the core spray nozzle safe ends were replaced. In addition, the demonstrated system flow capability as recent as 1977, surveillance test, was reported as 5,850 GPM. Once the temperature difference subsides, the total leakage will be greatly reduced.

Location of Leakage	Calculated Leakage (GPM @ 47 psid)	Calculated Leakage (% of 4700 GPM System Capability, reactor at 90 psig)
Slip Fit Thermal Sleeve-to-Nozzle Safe End (0.005 max. diametral gap)	22	0.5
0.25 dia. Vent Hole In CSL T-box	8	0.2
0.09 dia. Purge Hole In Nozzle Thermal Sleeve	1	0.0
360° Crack @ maximum Separation	166	3.5
360° Crack @ 0.005 inch Separation	15	0.3

3.6 Description of how the change will affect Equipment Failures.

During normal power operation instrumentation continuously monitors the differential pressure between a pressure tap above the core support plate and the core spray sparger (via the CSL), and an alarm will activate if the CSL were to break. The proposed CSS riser repair will keep the CSS riser and elbow tightly together during normal operation so that the CSL break instrumentation function will not be impaired. During normal operation, leakage from the CSS riser crack locations, with the repair installed, will be less than that of the 0.25 inch diameter vent hole in the CSL T-box.

All of the events in Dresden Unit 3 Rebaselined UFSAR, December 1993, were examined to determine if the probability of occurrence of any of these events is increased by the installation of the repair clamps at Dresden 3. Potential failure modes associated with the use of the repair clamp have been investigated, and it has been concluded that the probability of any UFSAR event has not been increased.

The repair clamp has been designed, analyzed, and constructed to meet or exceed the original quality standards as prescribed in the UFSAR. A stress analysis has been performed using the ASME Boiler and Pressure Vessel Code Section III Subsection NG as a guide and this analysis confirms the structural acceptability of the design. The repair design minimizes the potential for intergranular stress corrosion cracking by the elimination of all welding.

The repair has been evaluated for leakage for a design bases LOCA. See 3.5 above.

Consequently, it is concluded that the probability of occurrence of any UFSAR event with the repair clamp installed will not be increased when compared to the currently installed welded type 304 stainless steel with its potential for intergranular stress corrosion cracking.

The probability of loose parts from the CSS riser repair hardware is very low. The hardware is designed using ASME Boiler and Pressure Vessel Code, Section III, Subsection NG stress limits. The crimped retainers used on the threaded fasteners have been used successfully in several previous BWR modifications. Downcomer flow velocity is not sufficiently high to expect any flow induced vibration of the repaired CSS riser.

The safety concerns associated with loose parts in the reactor are the potential for fuel bundle flow blockage and subsequent fuel damage, the potential for interference with control rod operation, and the potential for corrosion or adverse chemical reactions with other reactor materials.

If one of the CSS riser repairs were to break loose for any reason, the parts would most likely drop straight down; the repair parts at 110° would come to rest between jet pump diffusers 8 and 9, while those from the CSS riser repair at 290° would land between jet pump diffusers 18 and 19. These locations are well away from the recirculation suction nozzles; thus, it is extremely unlikely they could be carried into the recirculation suction.

All of the replacement CSS riser repair parts are made from materials which are approved for in-reactor use. There is no potential for corrosion or adverse chemical reaction with other reactor materials.

The probability of the repair clamp failing in such a way that it is drawn into the recirculation suction line and then into the recirculation pump has not increased compared to other RPV internals in the same general location. Therefore, this replacement does not increase the probability of the occurrence of the recirculation pump seizure event abnormal operational transient.

3.7 Identification of each accident or anticipated transient described in the SAR where the change alters the initial conditions used in the SAR analysis, the changed SSC is explicitly or implicitly assumed to function during or after the accident, or operation or failure of the changed SSC could lead to the accident.

3.8 List of Technical Specification (Safety Limit. Limiting Safety System Setting or Limiting Condition for Operation) where the requirement , associated action items, associated surveillance, or bases may be affected.

None

3.9 Will the change involve a Technical Specification Revision?

No

3.10 Response to increased probability or increased consequences questions for each accident listed in Section 3.5.

The probability of occurrence of an accident previously evaluated in the FSAR will not be increased.

The consequences of an accident previously evaluated in the FSAR will not be increased.

All of the events in Dresden 3 UFSAR were examined to determine if the consequences of any of these events is increased by the installation of the repair clamps at Dresden 3. Consequences (i.e., radiological doses) associated with the design basis accidents are evaluated in the FSAR. The existing core spray sparger riser and the repair clamps do not function to mitigate the consequences of any UFSAR event except the design basis LOCA event. No FSAR dose calculation will be impacted by this change. For the design basis LOCA event discussed in the FSAR, the core spray sparger riser and core spray line provide the flow path inside the RPV for the ECCS flow to the core spray spargers. Maintaining this flow path is required to ensure that core reflooding capability is maintained following the design basis LOCA. An assessment of the leakage through the crack in the core spray sparger elbow was performed to confirm that this leakage has no significant effect on the existing ECCS analyses. Therefore, it is concluded that the repair clamp installation ensures that the consequences of a design basis LOCA will not be increased.

The possibility of an accident which is different than any already evaluated in the FSAR will not be created.

As discussed above, the repair clamp installation will not introduce any new failure mode, which might cause an accident. Also, no previously evaluated accident sequence will be affected.

The probability of a malfunction of a safety-related structure, system, or component previously evaluated in the FSAR will not be increased.

The consequences of a malfunction of a safety-related structure, system, or component previously evaluated in the FSAR will not be increased.

The repair clamps will not affect any fission product barrier, will not increase any radiation source term, or prevent any component from performing its safety-related function (such as a containment isolation). Therefore, there will be no method for the installation of this hardware to impact the consequences of any malfunction or accident.

The consequences of the failure of the repair clamps will not increase when compared to the consequences of the failure of the existing core spray sparger riser.

3.11 The possibility of a malfunction of a safety-related structure, system, or component different than any already evaluated in the FSAR will not be created.

The repair clamp is to be supplied as safety-related, and to accepted design requirements. The installation of this hardware will not introduce a new method of impacting other RPV internals. Therefore, no new malfunction is associated with the installation of this hardware.

3.12 No revisions of Technical Specifications are required for this modification, thus the detail questions related to Technical Specification are not answered.

3.13 The margin of safety as defined in the basis for any Technical Specification will not be reduced.

The repair clamp will not affect any accident or transient safety analyses which form the bases for the Technical Specifications.

5.0 CONCLUSION

The use of the repair clamps does not change the safety classification of the core spray sparger riser or core spray line. Nor does their use have an effect on any Technical Specification or the UFSAR. The probability and consequences of design basis accidents are not changed by the installation of the clamps at Dresden 3.

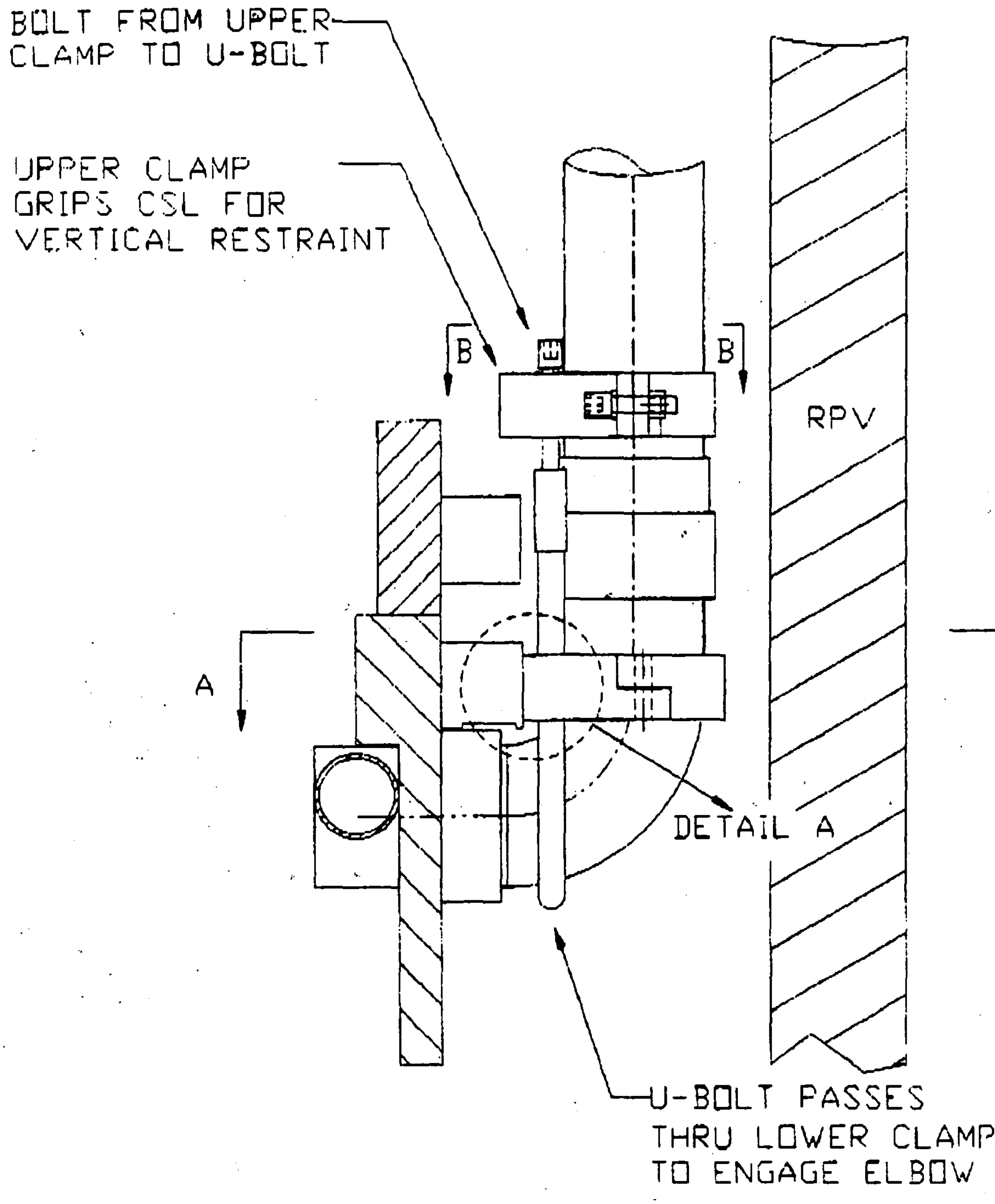

FIGURE 3-2 CSS RISER REPAIR CONCEPT

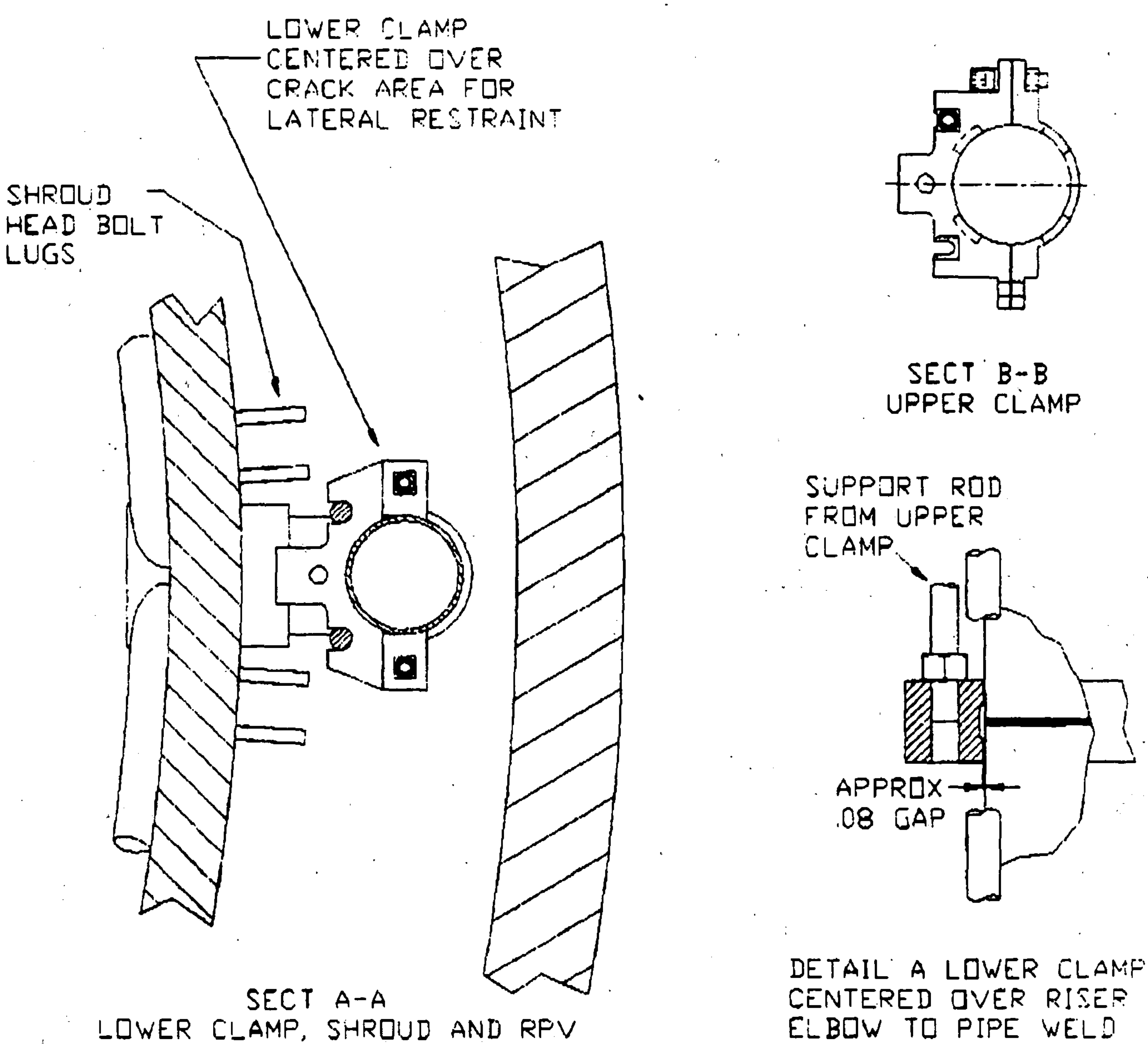

FIGURE 3-2 CSS RISER REPAIR CONCEPT (CONT)