COMMONWEALTH EDISON COMPANY

9 July 1970

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U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D. C. 20545

Subject: Additional Information Relative to Provisional Operating License DPR-19 for Dresden Unit 2, Docket #50-237

Regulatory File Cy.

Dear Dr. Morris:

The purpose of this letter is to provide you with additional information relative to the use of furnace sensitized stainless steel components in Dresden Unit 2.

Attached hereto is Exhibit I which contains a list of furnace sensitized stainless steel internal brackets and safe ends and a discussion of the consequences of failure of each of the internal brackets.

In addition to three signed originals, 19 copies of this information are also submitted.

Very truly yours,

Byron Lee Jr

Byron Lee, Jr.
Assistant to the President

SUBSCRIBED and SWORN to before me this 9th day of July, 1970.

Ernest A Rohana
Notary Public

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EXHIBIT I

50-237

Regulatory File Cy.

Received w/Ltr Dated 7-9-70

Information on Dresden 2 Sensitized Stainless Steel Internal Brackets, Safe Ends and Consequences of Failure of Each of the Internal Brackets

I. A list of the Dresden 2 RPV sensitized internal brackets and safe-ends

A. The furnace sensitized internal brackets in the Dresden 2 vessel are:

1. Upper and lower steam dryer guide brackets (2 upper and 2 lower).
2. Upper and lower surveillance specimen holder brackets (6 upper and 6 lower).
3. Steam dryer support brackets (four).
4. Feedwater sparger brackets (eight).
5. Core spray line brackets (four, with 2 studs each). These were installed by the vessel vendor. Four more brackets were installed in the field which are not furnace sensitized.
6. Shroud head guide bracket pads (two). The brackets are installed in the field and are not furnace sensitized.
7. Jet pump riser support pads (twenty). The braces are installed in the field and are not furnace sensitized.

B. The furnace sensitized stainless steel nozzle safe-ends on the Dresden 2 Vessel are:

1. Recirculation Outlet (two, 28-inch).
2. Recirculation Inlet (ten, 12-inch).
3. Isolation Condenser (two, 14-inch).
4. Vent (Top Head) (one, 4-inch, flanged).
5. CRD Hyd. Syst. Ret. (one, 3-inch).
6. Core ΔP and Liquid Control (one, 2-inch).

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7. Level instrumentation (four, 2-inch).
8. Instrumentation (Top Head (two, 6-inch, flanged).
9. Core Spray (two, 10-inch).
10. Jet Pump Inst. (two, 4-inch).

II. A Short discussion for each of the brackets of the consequences of failure.

A. The consequences of failure of each of the brackets listed in I.A. are:

1. The purpose of the steam dryer guide brackets is to anchor steam dryer guide rods in place radially and tangentially while allowing for relative axial growth between the pressure vessel and the guide rod. If an upper and lower pair of steam dryer guide brackets should become completely separated from the vessel during reactor operation, the rod and brackets would fall down about 8 inches and remain captured by the steam dryer guide channel. The lower guide bracket, not captured by the rod, could, depending on the chain of events, fall free of the guide rod and fall to the shroud support. This bracket, in the process of falling, could improbably be sucked into the recirculation outlet nozzle to the recirculation pump, causing damage to the pump. However, the outlet is about 50 inches tangentially from the spot directly under the guide bracket and horizontal annular flow velocities are low. Considering the weight of the bracket ($\sim$ 5 lbs), the likelihood of its being swept into the outlet is extremely low. The loose piece may fall on the jet pump instrumentation lines causing some damage.

If an upper bracket only should sever completely from the vessel, the rod would fall a short distance ($\sim$ 2") into the lower bracket, bottoming out. The upper rod would rest either against the vessel or in the guide channel on the dryer assembly. No flow induced vibration would be expected in this relatively dead water channel. If the dryer skirt vibrates, light chaffing of the vessel clad and dryer skirt could occur.

If a lower bracket of the Dryer Guide Rod should separate from the vessel wall, the bracket could fall to the shroud support plate area and possibly, but not likely, be sucked into the recirculation outlet as described above. (See Item 6 for discussion of shroud head guide rod brackets.)

2. Holders containing surveillance specimens are attached to the surveillance specimen brackets. If the upper bracket should break off the vessel wall while in operation, the sample holder would fall, strike the recirculation inlet elbow top surface, slide off and come to rest on the shroud support shelf leaning on a jet pump, or the shroud, or the vessel wall. Flow induced vibration could cause

chaffing damage to the jet pumps. If this bracket should break near the jet pump instrumentation nozzle azimuth, a glancing blow on the recirculation inlet elbow may translate the holder tangentially enough to come down on the instrument lines in that cluster causing damage to the lines or chaffing by flow induced vibration of the parts in contact.

If a lower bracket breaks off, the spring tension release may cause the holder to hop off the upper bracket which will yield the same result as the previous paragraph. If the holder does not hop off, for one reason or another, the holder will hang in place and possibly swing tangentially with cross flow. If the amount of swing is large enough, the holder will strike the riser brace arms, causing some impact damage. If the holder comes apart (not expected) the samples could be dropped to the shroud support or on jet pump instrumentation lines. It is practically inconceivable that any of these brackets or loose parts could find their way to the recirculation outlet because of the distances and annular velocities involved.

3. If a single steam dryer support bracket falls off the vessel, it could cause some damage as noted above. If two non-adjacent dryer support brackets broke off no more than tipping of the dryer is expected; no more than $\sim$3 inches of tip could be expected. The dryer skirt in this case would rest against the shroud head bolts and shroud head bolt support ring. If two or more adjacent dryer support brackets broke off, the dryer would fall onto the feedwater spargers and/or steam separator assembly causing damage or failure of those parts. Displacement of the dryer could break instrumentation leads in that region.

4. Failure of a single feedwater sparger bracket while operating would cause the remaining pre-load of the sparger to be released against the thermal sleeve joint. The feedwater jet reaction would tend to balance this force but manifold jet vibration could cause damage to and eventual failure of the feedwater sparger and remaining bracket and or thermal sleeve. Failure of both brackets on a single sparger causes the sparger to be ejected toward the steam separator assembly coming to rest against the shroud head bolts. This may jam the adjacent shroud head bolts and inhibit normal shroud head assembly removal. The restraining pins may vibrate out and free the broken brackets to fall into the annulus region with similar damage as discussed above.

5. The core spray line brackets which were vessel vendor installed could, should they fail, cause damage to the recirculation pump as discussed above. These brackets are intended to limit vibration of

the core spray line and if missing would not perform that function. These pipes would then be subject to fatigue damage caused by steam separator discharge induced vibration.

6. Should the shroud head guide bracket pads fail the shroud head guide bracket (field installed) would come off the vessel. The guide rod would slide down into the lateral support bracket provided on the shroud until binding occurred or until the instrument lines and clamps stop it. The top of the shroud head guide rod would rest against the vessel, feedwater sparger brackets and core spray line, or steam separator stand-pipes and braces. The turbulence of the flow in this region will cause the rod to move freely. Eventual failure of the shroud bracket may result with the guide rod falling to the bottom of the annulus and damaging the jet pump instrumentation lines and pulling vibration instrument leads with it. These small leads could break up in small pieces depending on their eventual exposure to cross flow in the shroud-vessel annulus and be swept into the recirculation system.

7. If a jet pump riser support pad breaks off the pressure vessel wall during operation, the additional loading applied on the remaining riser brace arm will cause it to fail. If both riser brace pads have failed the riser is free to move tangentially and radially causing damage to the recirculation inlet thermal sleeve, mixers and diffusers. If this causes riser or thermal sleeve failure, core flow degradation may result.

III. Stress expected in the various brackets

A. The stresses expected in the various brackets listed in I.A. above are as follows:

1. During normal operation, the stresses in the upper and lower steam dryer guide brackets will be negligible. When the dryer is being installed in the vessel or removed from it, the stress intensity for primary stresses may be as high as 12.7 KSI for the upper bracket and 10.2 KSI for the lower bracket and the shear stresses may be as high as 3.72 KSI and 1.88 KSI for the upper and lower brackets respectively.

2. During normal operation, the stresses in the upper and lower surveillance specimen brackets should be negligible. When the specimen holders are being installed or removed the stress intensity for primary stresses may be as high as 3.50 KSI in the upper bracket and 2.85 KSI in the lower bracket while the shear stresses may be as high as 0.26 KSI and 0.28 KSI in the upper and lower brackets respectively.

3. During normal steady state operation the stress intensity in the steam dryer support brackets for primary stresses could be as high as 7.54 KSI with shear stresses of 1.98 KSI. During heat-up and cool-down, additional loads will be imposed by friction between the dryer and the supports as the dryer expands and contracts relative to the vessel. When these loads are combined with the steady state loads we have for the stress intensity for primary stresses a value of 9.52 KSI with a shear stress of 1.98.

When we combine the stresses from the operating basis earthquake with the steady state stresses we then have for the primary stresses a stress intensity of 18.84 KSI and a shear stress of 2.24 KSI. These loads are to be compared with S_m = 15.8 KSI, 1.5 S_m = 23.7 KSI, 0.6 S_m = 9.5 KSI and Sy @ 546°F = 17.8 KSI.

The stress intensity given above for the steady state condition with the operating basis earthquake exceeds the yield stress for Type 304 stainless steel at 546°F; however, this should not be a cause for concern because these stresses were calculated on the assumption that the load was applied at the extreme inboard end of the bracket and, in addition, the effect of the large fillet welds (much larger than are shown on the vendor drawing) was ignored. The actual stresses, then, should be less than yield stress.

4. The stresses in the feedwater sparger bracket are negligible. They are less than 0.2 KSI.

5. There will be no stresses in the core spray line brackets which were installed by the vessel vendor except during core spray operation. During core spray operation the stress will be 0.32 KSI.

During normal operation the stresses in the field-installed core spray line brackets will be 3.2 KSI. During core spray operation there will be no stresses.

Field installed core spray line brackets are welded to stainless steel plates which are themselves welded to the vessel wall by fillet welds. The shear stress in these fillet welds during normal operation is 1.5 KSI, and will be zero during core spray operation.

6. During normal operation the stresses in the shroud head guide brackets are negligible. During installation or removal of the shroud head the stress intensity for primary stresses may be as high as 23.2 KSI with shear stresses of 5.2 KSI. At room temperature, S_m = 20 KSI and Sy = 30 KSI.

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7. The primary stresses in the jet pump riser braces are negligible except for vibration induced stresses which are approximately 2.1 KSI. The stress intensity range for the sum of primary plus secondary stresses expected in the braces is 24.3 KSI. These stresses are caused by differential thermal expansion between the vessel wall and the riser and riser braces. The stresses reported above are the stresses in the leaves of the brace arms where the leaves attach to the end piece. The stresses where the end piece is attached to the vessel wall are negligible.