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May 16, 1977

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U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

Mr. Edson G. Case, Deputy Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Quad-Cities Station Units 1 and 2
Proposed Amendment to Facility
Operating License Nos. DPR-19, 25,
29, and 30
NRC Docket Nos. 50-237/249/254/265

Regulatory File Cy.

Dear Mr. Case:

Pursuant to 10 CFR 50.59, Commonwealth Edison proposes to make amendments to Dresden Units 2 and 3 and Quad-Cities Units 1 and 2 Technical Specifications concerning reactor vessel metal surveillance program. The purpose of this change is to make the surveillance program consistent with 10 CFR 50, Appendix H.

The proposed change to Dresden Units 2 and 3 will require amending pages 88, 93, and adding pages 93A and 94A to both DPR-19 and 25. Section 4.6.B.3 should be changed to read:

"Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program where possible conform to ASTM E185. The monitors and samples will be removed and tested as outlined in Table 4.6.2 to experimentally verify the calculated values of integrated neutron flux that are used to determine NDTT for Figure 4.6.1."

Bases: 3.6/4.6.B on page 93 should be amended to include the basis for the change. The additional basis will read:

"The withdrawal schedule in Table 4.6.2 is based on the three capsule surveillance program as defined in Section 11.C.3.a of 10 CFR 50 Appendix H. The accelerated capsule (Near Core Top Guide) are not required by Appendix H but will be tested to provide additional information on the vessel material.

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This surveillance program conforms to ASTM E-185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" with one exception. The base metal specimens of the vessel were made with their longitudinal axes parallel to the principle rolling direction of the vessel plate."

Page 93A is being added because the above mentioned additional basis displaced part of the existing basis onto another page.

Page 94A is being added to accommodate "Table 4.6.2" which defines the sample withdrawal schedule.

The proposed change to Quad-Cities Units 1 and 2 will require amending pages 3.6/4.6-2, 3.6/4.6-9, and adding pages 3.6/4.6-9A and 3.6/4.6-21A to both DPR-29 and 30. Section 4.6.B.3 should be changed to read:

"Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program shall as a minimum conform to ASTM E-185-66. The monitors and samples shall be removed and tested in accordance with the guidelines set forth in 10 CFR 50 Appendix H, to experimentally verify the calculated values of integrated neutron flux that are used to determine the NDTT for Figure 3.6-1."

Bases 3.6.B on page 3.6/4.6-9 should be amended to include the basis for the change. The additional basis will read the same as Dresden's. Page 3.6/4.6-9A is being added because the above mentioned additional basis displaced part of the existing basis onto another page. Page 3.6/4.6-21A is being added to accommodate "Table 4.6.2" which defines the sample withdrawal schedule.

The reactor vessel metal surveillance programs have been updated and reevaluated by Commonwealth Edison. As a result of this reevaluation we recommend new withdrawal schedules based on 10 CFR Appendix H. Section 11.B of 10 CFR 50 Appendix H requires that the surveillance program conform with ASTM E-185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels." ASTM E-185-73 specifies the location and orientation of the actual test specimens from the plate material. All base-metal Charpy "V" notch specimens are to be cut transverse to the principle rolling, whereas actual specimens were cut parallel to the principle rolling direction. The direction of actual specimen cut is in accordance with ASTM E-185-66 since ASTM E-185-73 was not yet written when the specimens were cut. This is the only exception to the requirements of ASTM E-185-73. Therefore, the reference to ASTM E-185-66 remains unchanged in the Quad-Cities Technical Specification to allow this exception.

This proposed change does not increase the probability of any occurrence or the consequence of any accident or malfunction of equipment. The margin of safety, as defined in the basis for any technical specification is not reduced, because the intent of the technical specification is not changed.

Attachment A contains Dresden Units 2 and 3 changes and Attachment B contains Quad-Cities Units 1 and 2 changes.

These Technical Specification changes have received on-site and off-site review and approval. Please direct any additional questions to this office.

Three (3) signed originals and 57 copies are provided for your use.

Very truly yours,

R. L. Bolger
Assistant Vice President

SUBSCRIBED and SWORN to
before me this 24th day
of May, 1977.

Nancy M. Hollingsworth
NOTARY PUBLIC

Commonwealth Edison

ATTACHMENT A

DRESDEN STATION UNIT 2

DPR-19

3.6 LIMITING CONDITION FOR OPERATION	4.6 SURVEILLANCE REQUIREMENT

3.6 LIMITING CONDITION FOR OPERATION

B. Pressurization Temperature

1. The reactor vessel shall be vented and power operation shall not be conducted unless the reactor vessel temperature is equal to or greater than that shown in Figure 4.6.1.

2. The reactor vessel head bolting studs shall not be under tension unless the temperature of the vessel shell immediately below the vessel flange is ≥120°F.

C. Coolant Chemistry

1. The reactor coolant system radioactivity concentration in water shall not exceed 20 microcuries of total iodine per ml of water.

4.6 SURVEILLANCE REQUIREMENT

B. Pressurization Temperature

1. Reactor Vessel shell temperature and reactor coolant pressure shall be permanently recorded at 15 minute intervals whenever the shell temperature is below 220°F and the reactor vessel is not vented.

2. When the reactor vessel head bolting studs are tightened or loosened the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

3. Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program where possible conform to ASTM E 185. The monitors and samples will be removed and tested as outlined in Table 4.6.2 to experimentally verify the calculated values of integrated neutron flux that are used to determine NDTT for Figure 4.6.1.

C. Coolant Chemistry

1. a. A sample of reactor coolant shall be taken at least every 96 hours and analyzed for radio-activity.

   b. Isotopic analysis of a sample of reactor coolant shall be made at least once per month.

the vessel flange have an NDT temperature of 60°F. The design life of the reactor vessel is 40 years and the maximum fast neutron exposure at 40 years is calculated to be 2.7 X 10^{17} nvt.

The NDT temperature limit curve in Figure 4.6.1 uses the "worst case" curve of the SAR to establish the NDT temperature shift and is, therefore, based on more conservative pressure data. For example, the expected NDT temperature shift for this vessel at 2.7 X 10^{17} nvt is expected to be 15°F instead of the 90°F assumed in establishing Figure 4.6.1. Figure 4.6.1 also incorporates a 60°F factor of safety. This factor is based upon the requirements of the ASME code and the considerations which resulted in these requirements. Therefore, the specification provides for "worst case" data as well as 60°F of margin to provide assurance that operation in the non-ductile region will not occur.

The reactor vessel head flange and the vessel flange in combination with the double "0" ring type seal are designed to provide a leak-tight seal when bolted together. When the vessel head is placed on the reactor vessel, only that portion of the head flange near the inside of the vessel rests on the vessel flange. As the head bolts are replaced and tensioned, the vessel head is flexed slightly to bring together the entire contact surfaces adjacent to the "0" rings of the head and vessel flange. The closure flanges and connecting shell materials have an NDT temperature of 10°F, and they are not subject to any appreciable neutron radiation exposure. However, the vertical electroslag seams terminating immediately below the vessel flange have an NDT temperature of 60°F, and they are moderately stressed by tensioning of the studs. Therefore, the minimum temperature of the vessel shell immediately below the vessel flange is established as 60°F + 60°F, or 120°F.

Numerous data are available relating integrated flux and the change in nil-ductility transition temperature (NDTT) in various steels. The most conservative data has been used in Specification 3.6. The integrated flux at the vessel wall is calculated from core physics data and will be measured using flux monitors installed inside the vessel. The measurements of the neutron flux at the vessel wall will be used to check and if necessary correct, the calculated data to determine an accurate NDTT.

In addition, vessel material samples will be located within the vessel to monitor the affect of neutron exposure on these materials. The samples include specimens of base metal, weld zone metal, heat affected zone metal, and standard specimens. These samples will receive neutron exposure more rapidly than the vessel wall material and therefore will lead the vessel in integrated neutron flux exposure. These samples will provide further assurance that the shift in NDTT used in the specification is conservative.

The withdrawal schedule in Table 4.6.2 is based on the three capsule surveillance program as defined in Section 11.C.3.a of 10 CFR 50 Appendix H. The accelerated capsule (Near Core Top Guide) are not required by Appendix H but will be tested to provide additional information on the vessel material.

This surveillance program conforms to ASTM E 185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" with one exception. The base metal specimens of the vessel were made with their longitudinal axes parallel to the principle rolling direction of the vessel plate.

C. Coolant Chemistry — A radioactivity concentration limit of 20 μCi/ml total iodine can be reached if the gaseous effluents are near the limit as set forth in Specification 3.8.C.1 or there is a failure or a prolonged shutdown of the cleanup demineralizer. In the event of a steam line rupture, outside the drywell, the resultant radiological dose at the site boundary would be about 10 rem to the thyroid. This dose was calculated on the basis of a total iodine activity limit of 20 μCi/ml, meteorology corresponding

Table 4.6.2

Neutron Flux and Samples Withdrawal Schedule for Dresden Unit 2

Withdrawal Year	Part No.	Location	Comments
1977	6	Near Core Top Guide - 180°	Accelerated Sample
1980	8	Wall - 215°	
2000	7	Wall - 95°	
	9	Wall - 245°	Standby
	10	Wall - 275°	Standby

ATTACHMENT A

DRESDEN STATION UNIT 3

DPR-25

3.6 LIMITING CONDITION FOR OPERATION	4.6 SURVEILLANCE REQUIREMENT

B. Pressurization Temperature

1. The reactor vessel shall be vented and power operation shall not be conducted unless the reactor vessel temperature is equal to or greater than that shown in Figure 4.6.1.

2. The reactor vessel head bolting studs shall not be under tension unless the temperature of the vessel shell immediately below the vessel flange is ≥120°F.

C. Coolant Chemistry

1. The reactor coolant system radioactivity concentration in water shall not exceed 20 microcuries of total iodine per ml of water.

B. Pressurization Temperature

1. Reactor Vessel shell temperature and reactor coolant pressure shall be permanently recorded at 15 minute intervals whenever the shell temperature is below 220°F and the reactor vessel is not vented.

2. When the reactor vessel head bolting studs are tightened or loosened the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

3. Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program where possible conform to ASTM E 185. The monitors and samples will be removed and tested as outlined in Table 4.6.2 to experimentally verify the calculated values of integrated neutron flux that are used to determine NDTT for Figure 4.6.1.

C. Coolant Chemistry

1. a. A sample of reactor coolant shall be taken at least every 96 hours and analyzed for radio-activity.

   b. Isotopic analysis of a sample of reactor coolant shall be made at least once per month.

the vessel flange have an NDT temperature of 60°F. The design life of the reactor vessel is 40 years and the maximum fast neutron exposure at 40 years is calculated to be 2.7×10^{17} nvt.

The NDT temperature limit curve in Figure 4.6.1 uses the "worst case" curve of the SAR to establish the NDT temperature shift and is, therefore, based on more conservative pressure data. For example, the expected NDT temperature shift for this vessel at 2.7×10^{17} nvt is expected to be 15°F instead of the 90°F assumed in establishing Figure 4.6.1. Figure 4.6.1 also incorporates a 60°F factor of safety. This factor is based upon the requirements of the ASME code and the considerations which resulted in these requirements. Therefore, the specification provides for "worst case" data as well as 60°F of margin to provide assurance that operation in the non-ductile region will not occur.

The reactor vessel head flange and the vessel flange in combination with the double "0" ring type seal are designed to provide a leak-tight seal when bolted together. When the vessel head is placed on the reactor vessel, only that portion of the head flange near the inside of the vessel rests on the vessel flange. As the head bolts are replaced and tensioned, the vessel head is flexed slightly to bring together the entire contact surfaces adjacent to the "0" rings of the head and vessel flange. The closure flanges and connecting shell materials have an NDT temperature of 10°F, and they are not subject to any appreciable neutron radiation exposure. However, the vertical electroslag seams terminating immediately below the vessel flange have an NDT temperature of 60°F, and they are moderately stressed by tensioning of the studs. Therefore, the minimum temperature of the vessel shell immediately below the vessel flange is established as 60°F + 60°F, or 120°F.

Numerous data are available relating integrated flux and the change in nil-ductility transition temperature (NDTT) in various steels. The most conservative data has been used in Specification 3.6. The integrated flux at the vessel wall is calculated from core physics data and will be measured using flux monitors installed inside the vessel. The measurements of the neutron flux at the vessel wall will be used to check and if necessary correct, the calculated data to determine an accurate NDTT.

In addition, vessel material samples will be located within the vessel to monitor the affect of neutron exposure on these materials. The samples include specimens of base metal, weld zone metal, heat affected zone metal, and standard specimens. These samples will receive neutron exposure more rapidly than the vessel wall material and therefore will lead the vessel in integrated neutron flux exposure. These samples will provide further assurance that the shift in NDTT used in the specification is conservative.

The withdrawal schedule in Table 4.6.2 is based on the three capsule surveillance program as defined in Section 11.C.3.a of 10 CFR 50 Appendix H. The accelerated capsule (Near Core Top Guide) are not required by Appendix H but will be tested to provide additional information on the vessel material.

This surveillance program conforms to ASTM E 185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" with one exception. The base metal specimens of the vessel were made with their longitudinal axes parallel to the principle rolling direction of the vessel plate.

C. <u>Coolant Chemistry</u> – A radioactivity concentration limit of 20 μCi/ml total iodine can be reached if the gaseous effluents are near the limit as set forth in Specification 3.8.C.1 or there is a failure or a prolonged shutdown of the cleanup demineralizer. In the event of a steam line rupture, outside the drywell, the resultant radiological dose at the site boundary would be about 10 rem to the thyroid. This dose was calculated on the basis of a total iodine activity limit of 20 μCi/ml, meteorology corresponding

Table 4.6.2

Neutron Flux and Samples Withdrawal Schedule for Dresden Unit 3

Withdrawal Year	Part No.	Location	Comments
1979	16	Near Core Top Guide - 180°	Accelerated Sample
1981	18	Wall - 215°	
2001	17	Wall - 95°	
	19	Wall - 245°	Standby
	20	Wall - 275°	Standby

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ATTACHMENT B

QUAD-CITIES STATION UNIT 1

DPR-29

that shown in Figure 3.6-1. The reactor vessel shall not be pressurized above 250 psig unless the reactor vessel temperature is equal to or greater than 190° F when fuel is in the reactor vessel.

2. For isothermal inservice hydrostatic tests, full test pressures shall be permissible on the vessel above the limiting pressurization temperature as shown in Figure 3.6-1. For isothermal inservice hydrostatic tests conducted between 140° F and the limiting pressurization temperature shown in Figure 3.6-1, test pressures shall be limited to 1/2 of the vessel operating pressure (500 psig).

3. The reactor vessel heat bolting studs shall not be under tension unless the temperature of the vessel shell immediately below the vessel flange is ≥ 100° F.

C. **Coolant Chemistry**

1. The steady-state radioiodine concentration in the reactor coolant shall not exceed 5 μCi of I-131 dose equivalent per gram of water.

below 220°F and the reactor vessel is not vented.

2. Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program shall conform to ASTM E 185-66. The monitors and samples shall be removed and tested in accordance with the guidelines set forth in 10CFR50 Appendix H

to experimentally verify the calculated values of integrated neutron flux that are used to determine the NDTT for Figure 3.6-1.

3. When the reactor vessel head bolting studs are tightened or lossened, the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

C. **Coolant Chemistry**

1. a. A sample of reactor coolant shall be taken at least every 96 hours and analyzed for radioactive iodines of I-131 through I-135 during power operation. In addition, when chimney monitors indicate an increase in radioactive gaseous effluents of 25% or 5000 μCi/sec, whichever is greater, during steady-state reactor operation, a reactor coolant sample shall be taken and analyzed for radioactive iodines.

   b. An isotopic analysis of a reactor coolant sample shall be made at least once per month.

   c. Whenever the steady-state radioiodine concentration of prior operation is greater than 1% but less than 10% of Specification 3.6.C.1, a sample of reactor coolant shall be taken within 24 hours of any reactor startup and analyzed [illegible] region shifts to higher temperatures when the thickness of the specimen tested is increased (size effect).

Accordingly, a conservative reactor vessel pressurization temperature as a function of fast neutron exposure is presented in Figure 3.6-1 to cover 'worst-case' limits required during reactor power operation. This curve is based on an initial NDTT of the vessel shell electroslag welds adjacent to the core of 40° F plus 100° F to assure an adequate fracture toughness for small thickness material plus a 50° F margin to account for the thickness effect of heavy section steel to give 190° F minimum temperature from initial operation to the time when the neutron fluence exceeds 5 x 10^{16} nvt. At that time, the minimum temperature will increase steadily as the neutron fluence increases based on the 'worst-case' curve relating the change in transition temperature to neutron fluence shown in Figure 4.2-2 of the SAR. For temperatures below the limiting pressurization temperature, the vessel pressure will be limited to 250 psig during reactor startup and shutdown operations. The total stress level including hoop stress and transient thermal stress in the reactor vessel during startup and shutdown operation for internal pressures of 250 psig is approximately the same as the reactor vessel hoop stress incurred during isothermal hydrostatic testing at an internal pressure of 500 psig. Therefore during isothermal hydrostatic tests at 500 psig, the pressurization temperature may be below the curve shown in Figure 3.6-1 but above 140° F.

The reactor vessel head flange and the vessel flange in combination with the double 0-ring type seal are designed to provide a leaktight seal when bolted together. When the vessel head is placed on the reactor vessel, only that portion of the head flange near the inside of the vessel rests on the vessel flange. As the head bolts are replaced and tensioned, the vessel head is flexed slightly to bring together the entire contact surfaces adjacent to the 0-rings of the head and vessel flange. The closure flanges and connecting shell materials have an NDTT of 10° F, and they are not subject to any appreciable neutron radiation exposure. However, the vertical electroslag seams terminating immediately below the vessel flange have an NDTT of 40° F, and they are moderately stressed by tensioning of the studs. Therefore, the minimum temperature of the vessel shell immediately below the vessel flange is established as 40° F + 60° F, or 100° F.

Numerous data are available relating integrated flux and the change in NDTT in various steels. The most conservative data has been used in Specification 3.6. The integrated flux at the vessel wall is calculated from core physics data and will be measured using flux monitors installed inside the vessel. The measurements of the neutron flux at the vessel wall will be used to check and if necessary correct the calculated data to determine an accurate NDTT.

In addition, vessel material samples will be located within the vessel to monitor the effect of neutron exposure on these materials. The samples include specimens of base metal, weld zone metal, heat affected zone metal, and standard specimens. These samples will receive neutron exposure more rapidly than the vessel wall material and will therefore lead the vessel in integrated neutron flux exposure. These samples will provide further assurance that the shift in NDTT used in the specification is conservative.

The withdrawal schedule in Table 4.6.2 is based on the three capsule surveillance program as defined in Section 11.C.3.a of 10 CFR 50 Appendix H. The accelerated capsule (Near Core Top Guide) are not required by Appendix H but will be tested to provide additional information on the vessel material.

This surveillance program conforms to ASTM E 185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" with one exception. The base metal specimens of the vessel were made with their longitudinal axes parallel to the principle rolling direction of the vessel plate.

C. Coolant Chemistry

A steady-state radioiodine concentration limit of 5 μCi of I-131 dose equivalent per gram of water in the reactor coolant system can be reached if the gross radioactivity in the gaseous effluents are near the limit as set forth in Specification 3.8.C.1 or there is a failure or prolonged shutdown of the cleanup demineralizer. In the event of a steamline rupture outside the drywell, the NRC staff calculations show the resultant radiological dose at the site boundary to be less than 30 rem to the thyroid. This dose was calculated on the basis of the radioiodine concentration limit of 5 μCi of I-131 dose equivalent per gram of water, atmospheric diffusion from an elevated release at 30 meters under fumigation conditions for Pasquill Type F, 1 meter per second wind speed, and a steamline isolation valve closure time of 5 seconds.

Table 4.6.2

Revised Withdrawal Schedule for Quad-Cities Unit 1

Withdrawal Year	Part No.	Location	Comments
1982	8	Wall - 215°	
2002	7	Wall - 95°	
	9	Wall - 245°	Standby
	5	Wall - 65°	Standby
	10	Wall - 275°	Standby
1981	4	Near Core Top Guide - 90°	
1984	6	Near Core Top Guide - 180°	

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ATTACHMENT B

QUAD-CITIES STATION UNIT 2

DPR-30

that shown in Figure 3.6-1. The reactor vessel shall not be pressurized above 250 psig unless the reactor vessel temperature is equal to or greater than 190° F when fuel is in the reactor vessel.

2. For isothermal inservice hydrostatic tests, full test pressures shall be permissible on the vessel above the limiting pressurization temperature as shown in Figure 3.6-1. For isothermal inservice hydrostatic tests conducted between 140° F and the limiting pressurization temperature shown in Figure 3.6-1, test pressures shall be limited to 1/2 of the vessel operating pressure (500 psig).

3. The reactor vessel heat bolting studs shall not be under tension unless the temperature of the vessel shell immediately below the vessel flange is ≥ 100° F.

C. Coolant Chemistry

1. The steady-state radioiodine concentration in the reactor coolant shall not exceed 5 μCi of I-131 dose equivalent per gram of water.

below 220°F and the reactor vessel is not vented.

2. Neutron flux monitors and samples shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The monitor and sample program shall conform to ASTM E 185-66. The monitors and samples shall be removed and tested in accordance with the guidelines set forth in 10CFR50 Appendix H

to experimentally verify the calculated values of integrated neutron flux that are used to determine the NDTT for Figure 3.6-1.

3. When the reactor vessel head bolting studs are tightened or lossened, the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

C. Coolant Chemistry

1. a. A sample of reactor coolant shall be taken at least every 96 hours and analyzed for radioactive iodines of I-131 through I-135 during power operation. In addition, when chimney monitors indicate an increase in radioactive gaseous effluents of 25% or 5000 μCi/sec, whichever is greater, during steady-state reactor operation, a reactor coolant sample shall be taken and analyzed for radioactive iodines.

b. An isotopic analysis of a reactor coolant sample shall be made at least once per month.

c. Whenever the steady-state radioiodine concentration of prior operation is greater than 1% but less than 10% of Specification 3.6.C.l, a sample of reactor coolant shall be taken within 24 hours of any reactor startup and analyzed [illegible] region shifts to higher temperatures when the thickness of the specimen tested is increased (size effect).

Accordingly, a conservative reactor vessel pressurization temperature as a function of fast neutron exposure is presented in Figure 3.6-1 to cover 'worst-case' limits required during reactor power operation. This curve is based on an initial NDTT of the vessel shell electroslag welds adjacent to the core of 40° F plus 100° F to assure an adequate fracture toughness for small thickness material plus a 50° F margin to account for the thickness effect of heavy section steel to give 190° F minimum temperature from initial operation to the time when the neutron fluence exceeds 5 x 10^{16} nvt. At that time, the minimum temperature will increase steadily as the neutron fluence increases based on the 'worst-case' curve relating the change in transition temperature to neutron fluence shown in Figure 4.2-2 of the SAR. For temperatures below the limiting pressurization temperature, the vessel pressure will be limited to 250 psig during reactor startup and shutdown operations. The total stress level including hoop stress and transient thermal stress in the reactor vessel during startup and shutdown operation for internal pressures of 250 psig is approximately the same as the reactor vessel hoop stress incurred during isothermal hydrostatic testing at an internal pressure of 500 psig. Therefore during isothermal hydrostatic tests at 500 psig, the pressurization temperature may be below the curve shown in Figure 3.6-1 but above 140° F.

The reactor vessel head flange and the vessel flange in combination with the double 0-ring type seal are designed to provide a leaktight seal when bolted together. When the vessel head is placed on the reactor vessel, only that portion of the head flange near the inside of the vessel rests on the vessel flange. As the head bolts are replaced and tensioned, the vessel head is flexed slightly to bring together the entire contact surfaces adjacent to the 0-rings of the head and vessel flange. The closure flanges and connecting shell materials have an NDTT of 10° F, and they are not subject to any appreciable neutron radiation exposure. However, the vertical electroslag seams terminating immediately below the vessel flange have an NDTT of 40° F, and they are moderately stressed by tensioning of the studs. Therefore, the minimum temperature of the vessel shell immediately below the vessel flange is established as 40° F + 60° F, or 100° F.

Numerous data are available relating integrated flux and the change in NDTT in various steels. The most conservative data has been used in Specification 3.6. The integrated flux at the vessel wall is calculated from core physics data and will be measured using flux monitors installed inside the vessel. The measurements of the neutron flux at the vessel wall will be used to check and if necessary correct the calculated data to determine an accurate NDTT.

In addition, vessel material samples will be located within the vessel to monitor the effect of neutron exposure on these materials. The samples include specimens of base metal, weld zone metal, heat affected zone metal, and standard specimens. These samples will receive neutron exposure more rapidly than the vessel wall material and will therefore lead the vessel in integrated neutron flux exposure. These samples will provide further assurance that the shift in NDTT used in the specification is conservative.

The withdrawal schedule in Table 4.6.2 is based on the three capsule surveillance program as defined in Section II.C.3.a of 10 CFR 50 Appendix H. The accelerated capsule (Near Core Top Guide) are not required by Appendix H but will be tested to provide additional information on the vessel material.

This surveillance program conforms to ASTM E 185-73 "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels" with one exception. The base metal specimens of the vessel were made with their longitudinal axes parallel to the principle rolling direction of the vessel plate.

C. Coolant Chemistry

A steady-state radioiodine concentration limit of 5 μCi of I-131 dose equivalent per gram of water in the reactor coolant system can be reached if the gross radioactivity in the gaseous effluents are near the limit as set forth in Specification 3.8.C.1 or there is a failure or prolonged shutdown of the cleanup demineralizer. In the event of a steamline rupture outside the drywell, the NRC staff calculations show the resultant radiological dose at the site boundary to be less than 30 rem to the thyroid. This dose was calculated on the basis of the radioiodine concentration limit of 5 μCi of I-131 dose equivalent per gram of water, atmospheric diffusion from an elevated release at 30 meters under fumigation conditions for Pasquill Type F, 1 meter per second wind speed, and a steamline isolation valve closure time of 5 seconds.

Table 4.6.2

Revised Withdrawal Schedule for Quad-Cities Unit 2

Withdrawal Year	Part No.	Location	Comments
1982	18	Wall - 215°	
2002	17	Wall - 95°	
	19	Wall - 245°	Standby
	15	Wall - 65°	Standby
	20	Wall - 275°	Standby
1980	14	Near Core Top Guide - 0°	
1983	16	Near Core Top Guide - 180°	