

TURKEY POINT 3 AND 4
SAFETY EVALUATION
ENGINEERING BRANCH
DIVISION OF OPERATING REACTORS

Discussion

10 CFR Part 50, Appendix G. "Fracture Toughness Requirements", requires that pressure-temperature limits be established for reactor coolant system heat-up and cooldown operations, inservice leak and hydrostatic tests, and reactor core operation. These limits are required to ensure that the stresses in the reactor vessel remain within acceptable limits. They are intended to provide adequate margins of safety during any condition of normal operation, including anticipated operational occurrences.

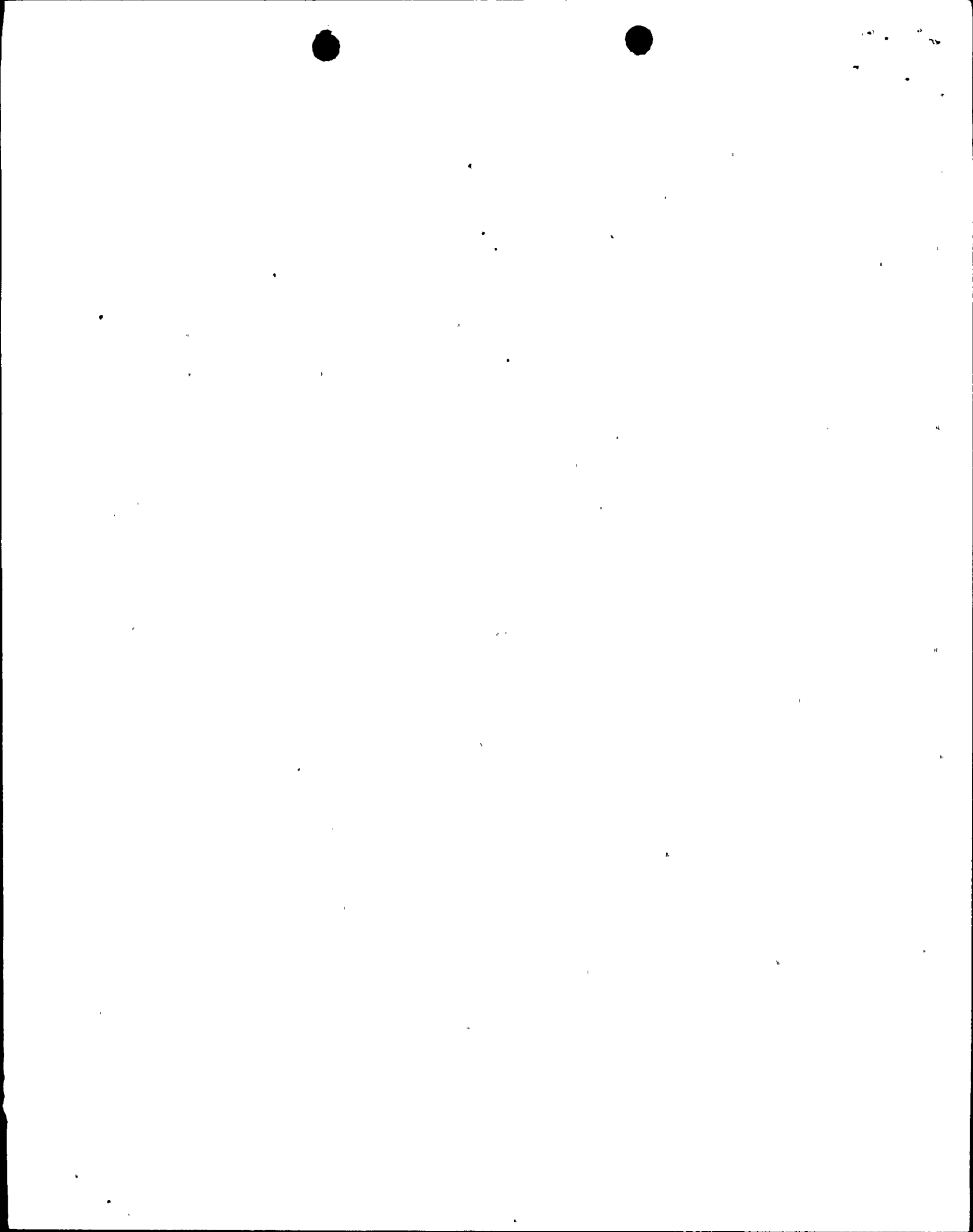
The pressure-temperature limits depend upon the metallurgical properties of the reactor vessel materials. The properties of material in the vessel belt-line region vary over the lifetime of the vessel because of the effects of neutron irradiation. One principle effect of the neutron irradiation is that it causes the vessel material nil-ductility temperature (RT_{NDT}) to increase with time. The pressure-temperature operating limits must be modified periodically to account for this radiation induced increase in RT_{NDT} by increasing the temperature required for a given pressure. The operating limits for a particular operating period are based on the material properties at the end of the operating period. By periodically revising the pressure-temperature limits to account for radiation damage, the stresses and stress intensities in the reactor vessel are maintained with acceptable limits.

Estimates of radiation damage, increase in RT_{NDT} , are obtained from the test results on irradiated surveillance specimens. Appendix H, 10 CFR Part 50 requires that all water cooled power reactors have a material surveillance program to monitor fracture toughness properties of beltline ferritic materials. Surveillance capsules are required to be removed periodically from the reactor vessel and tested.

Evaluation

By letter dated November 2, 1979, Florida Power and Light submitted an amendment to the Technical Specifications of Turkey Point 3 and 4 regarding pressure-temperature operating limits. These limits are proposed for operation through 10 EFPY. Calculations were performed in accordance with Appendix G, 10 CFR Part 50 and were based on the test results on Turkey Point material surveillance capsules (capsule T for both vessels). These test results showed that weld metal was the limiting material for both vessels.

We have reviewed the pressure-temperature operating limits proposed for Turkey Point 3 and 4 and have performed independent calculations to verify compliance with Appendix G, 10 CFR Part 50. Also, we reviewed the results of tests that have been conducted on material surveillance specimens. Two capsules have been removed from each vessel and tested (capsules S and T). We agree that these test results show weld metal to be the limiting vessel material. Weld metal samples in Capsule T of Unit 3 showed an increase in RT_{NDT} of 155°F at the 30 ft-lb level for a neutron exposure equal to 5.7×10^{18} n/cm². Weld metal samples in Capsule T of Unit 4 had an increase in RT_{NDT} of 255°F at a fluence of 6.05×10^{18} n/cm². Capsules S did not contain any weld metal specimens. However, dosimetry from capsules S provided a means to predict fluences on the vessels wall at 10 EFPY. For Unit 3 the fluence at the 1/2 T location is calculated to be 1.4×10^{19} n/cm². For Unit 4 the fluence is estimated to be 1.2×10^{19} n/cm² at 10 EFPY. These values are consistent with previous calculations that we have made.



We calculated radiation damage, increase in RT_{NDT} , from the above fluence estimates and surveillance program results, and by the damage estimates in Regulatory Guide 1.99, Revision 1. Our damage calculations agree with those submitted by the licensee.

From our review we conclude that the proposed pressure-temperature operating limits for Turkey Point 3 and 4 are acceptable for operation through 10 EFPY and are in accordance with Appendix G, 10 CFR Part 50 for this operational period. Compliance with Appendix G in establishing safe operating limitations will ensure adequate safety margins during operation, testing, maintenance and postulated accident conditions and constitute an acceptable basis for satisfying the requirements of NRC General Design Criterion 31, Appendix A, 10 CFR Part 50.

We also conclude that the material surveillance programs for Turkey Point 3 and 4 are acceptable and as far as practical are in accordance with Appendix H, 10 CFR Part 50. A surveillance capsule is scheduled to be removed from each vessel at about 7 EFPY. We recommend that these be Type II capsules containing weld metal specimens.

