Indiana Michigan
Power Company
Cook Nuclear Plant
500 Circle Drive
Buchanan, MI 49107
616-465-5901

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U. S. Nuclear Regulatory Commission
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Donald C. Cook Nuclear Plant Units 1 and 2
NOTIFICATION OF CHANGES TO THE
TECHNICAL SPECIFICATIONS BASES AND
CORE OPERATING LIMITS REPORT

Indiana Michigan Power Company (I&M) is notifying the Nuclear Regulatory Commission (NRC) of changes to the Technical Specifications Bases for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2. The changes were made between July 2, 1999, and May 23, 2001. They were reviewed in accordance with 10 CFR 50.59. NRC approval of these changes is not required.

In accordance with Technical Specification 6.9.1.9.4, I&M is also notifying the NRC of a correction to the Core Operating Limits Report (COLR) on Page 4 for Unit 1 and Page 5 for Unit 2. The equation for allowable power level (APL) is revised to match the APL equation in Technical Specification (T/S) 3.2.6. Administrative changes were also made to improve appearance. The COLR is reissued in its entirety. NRC approval of these changes is not required.

The revised Technical Specification Bases pages and update instructions are provided in Attachment 1. An updated list of effective pages is provided in Attachment 2. Attachment 3 contains the revised CNP Unit 1 and 2 COLR.

This submittal also satisfies the commitment to submit revised Bases pages for T/S 3/4.6.2.2 that was made in a letter from M. W. Rencheck (I&M) to the NRC Document Control Desk dated March 5, 2001.

There are no new commitments being made in this submittal.

A001

Should you have any questions, please contact Mr. Ronald W. Gaston, Manager of Regulatory Affairs, at (616) 697-5020.

Sincerely,

Scot A. Greenlee
Director of Design Engineering and Regulatory Affairs

/dmb

Attachment

c: J. E. Dyer
MDEQ - DW & RPD
NRC Resident Inspector
R. Whale

ATTACHMENT 1 TO C0601-07

REVISED TECHNICAL SPECIFICATIONS BASES PAGES

UPDATE INSTRUCTIONS

Unit 1

Remove	Insert
B 3/4 3-1	B 3/4 3-1
B 3/4 4-3	B 3/4 4-3
B 3/4 6-2	B 3/4 6-2
B 3/4 6-3	B 3/4 6-3
B 3/4 6-4	B 3/4 6-4
B 3/4 6-5	B 3/4 6-5
B 3/4 7-5	B 3/4 7-5
B 3/4 8-1	B 3/4 8-1
B 3/4 8-2	B 3/4 8-2
B 3/4 9-2	B 3/4 9-2
B 3/4 9-3	B 3/4 9-3

Unit 2

Remove	Insert
B 3/4 3-1	B 3/4 3-1
B 3/4 3-3	B 3/4 3-3
B 3/4 4-3	B 3/4 4-3
B 3/4 5-1a	B 3/4 5-1a
B 3/4 5-2	B 3/4 5-2
B 3/4 6-2	B 3/4 6-2
B 3/4 6-3	B 3/4 6-3
B 3/4 6-4a	B 3/4 6-4a
B 3/4 6-4b	B 3/4 6-4b
B 3/4 6-5	B 3/4 6-5
B 3/4 7-4a	B 3/4 7-4a
B 3/4 8-1	B 3/4 8-1
B 3/4 8-2	B 3/4 8-2
B 3/4 9-2	B 3/4 9-2
B 3/4 9-3	B 3/4 9-3

3/4.3.1 and 3/4.3.2 PROTECTIVE AND ENGINEERED SAFETY FEATURES (ESF) INSTRUMENTATION

The OPERABILITY of the protective and ESF instrumentation systems and interlocks ensure that 1) the associated ESF action and/or reactor trip will be initiated when the parameter monitored by each channel or combination thereof exceeds its setpoint, 2) the specified coincidence logic is maintained, 3) sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance, and 4) sufficient system functional capability is available for protective and ESF purposes from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses.

The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

The measurement of response time at the specified frequencies provides assurance that the protective and ESF action function associated with each channel is completed within the time limit assumed in the accident analyses.

Response time may be demonstrated by any series of sequential, overlapping or total channel test measurements provided that such tests demonstrate the total channel response time as defined. Sensor response time verification may be demonstrated by either 1) in place, onsite or offsite test measurements or 2) utilizing replacement sensors with certified response times.

REACTOR TRIP SYSTEM RESPONSE TIME testing is only required for those functional units specified in UFSAR Table 7.2-6, "Reactor Trip System Instrumentation Response Times." ENGINEERED SAFETY FEATURES RESPONSE TIME testing is only required for those functional units specified in UFSAR Table 7.2-7, "Engineered Safety Features Response Times." These response time limits were previously included in the Technical Specifications but were relocated to the UFSAR by license amendments 202 (U1) and 187 (U2).

The linear functions that define the high steam flow Trip Setpoints and Allowable Values in Functional Unit 4.d of Technical Specification Table 3.3-4 are linear with respect to differential pressure. The Trip Setpoints and Allowable Values are permitted to be more conservative than those derived from the linear differential pressure functions. These provisions are consistent with the current plant design. Additionally, permitting the Trip Setpoints and Allowable Values to be more conservative than those derived from the linear differential pressure functions is consistent with Action "a" of LCO 3.3.2.1, since Action a is invoked only if the actual setpoint is less conservative than the Allowable Value in Technical Specification Table 3.3-4.

3/4.4.6 REACTOR COOLANT SYSTEM LEAKAGE

3/4.4.6.1 LEAKAGE DETECTION SYSTEMS

The RCS leakage detection systems required by this specification are provided to monitor and detect Reactor Coolant PRESSURE BOUNDARY LEAKAGE. Leakage detection systems meet the criteria previously established for leak detection systems when utilizing leak-before-break. Specifically, at least one leakage detection system with a sensitivity capable of detecting an unidentified leakage rate of one gpm in four hours should be OPERABLE.

0/4.4.6.2 OPERATIONAL LEAKAGE

Industry experience has shown that while a limited amount of leakage is expected from the RCS, the unidentified portion of this leakage can be reduced to a threshold value of less than 1 gpm. This threshold value is sufficiently low to ensure early detection of additional leakage.

The 10 GPM IDENTIFIED LEAKAGE limitations provides allowance for a limited amount of leakage from known sources whose presence will not interfere with the detection of UNIDENTIFIED LEAKAGE by the leakage detection systems.

The limitation on seal line resistance ensures that the seal line resistance is greater than or equal to the resistance assumed in the minimum safeguards LOCA analysis. This analysis assumes that all of the flow that is diverted from the boron injection line to the seal injection line is unavailable for core cooling.

Maintaining an operating leakage limit of 150 gpd per steam generator (600 gpd total) will minimize the potential for a large leakage event during steam line break under LOCA conditions. This operating leakage limit will ensure the calculated offsite doses will remain within 10 percent of the 10 CFR 100 requirements and that control room habitability continues to meet GDC-19. Leakage in the intact loops is limited to 150 gpd.

Also, the 150 gpd leakage limit incorporated into this specification is more restrictive than the standard operating leakage limit and is intended to provide an additional margin. Hence, the reduced leakage limit, when combined with an effective leak rate monitoring program, provides additional assurance that should a significant leak be experienced in service, it will be detected and the plant shut down in a timely manner.

PRESSURE BOUNDARY LEAKAGE of any magnitude is unacceptable since it may be indicative of an impending gross failure of the pressure boundary. Should PRESSURE BOUNDARY LEAKAGE occur through a component which can be isolated from the balance of the Reactor Coolant System, plant operation may continue provided the leaking component is promptly isolated from the Reactor Coolant System since isolation removes the source of potential failure.

3/4.6.1.4 INTERNAL PRESSURE

The limitations on containment internal pressure ensure that 1) the containment structure is prevented from exceeding its design negative pressure differential with respect to the outside atmosphere of 8 psig and 2) the containment peak pressure does not exceed the design pressure of 12 psig during LOCA conditions.

The maximum peak pressure resulting from a LOCA event, which includes 0.3 psig for initial positive containment pressure, is documented in UFSAR Chapter 14.

3/4.6.1.5 AIR TEMPERATURE

The limitations on containment average air temperature ensure that 1) the containment air mass is limited to an initial mass sufficiently low to prevent exceeding the design pressure during LOCA conditions and 2) the ambient air temperature does not exceed that temperature allowable for the continuous duty rating specified for equipment and instrumentation located within containment.

The containment pressure transient is sensitive to the initially contained air mass during a LOCA. The contained air mass increases with decreasing temperature. The lower temperature limit of 60°F will limit the calculated peak pressure to less than the containment design pressure of 12 psig, as documented in UFSAR Chapter 14. The upper temperature limit influences the peak accident temperature slightly during a LOCA; however, this limit is based primarily upon equipment protection and anticipated operating conditions. Both the upper and lower temperature limits are consistent with the parameters used in the accident analysis.

3/4.6.1.6 CONTAINMENT VESSEL STRUCTURAL INTEGRITY

This limitation ensures that the structural integrity of the containment steel vessel will be maintained comparable to the original design standards for the life of the facility. Structural integrity is required to ensure that (1) the steel liner remains leak tight and (2) the concrete surrounding the steel liner remains capable of providing external missile protection for the steel liner and radiation shielding in the event of a LOCA. A visual inspection in conjunction with Type A leakage tests is sufficient to demonstrate this capability.

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

3/4.6.2.2 SPRAY ADDITIVE SYSTEM

The OPERABILITY of the spray additive system ensures that sufficient NaOH is added to the containment spray in the event of a LOCA. The limits on NaOH minimum volume and concentration, ensure that 1) the iodine removal efficiency of the spray water is maintained because of the increase in pH value, and 2) corrosion effects on components within containment are minimized. These assumptions are consistent with the iodine removal efficiency assumed in the accident analyses.

Surveillance Requirement 4.6.2.2.d is performed by verifying a water flow rate ≥ 45 gpm and ≤ 60 gpm from the spray additive tank test line to each containment spray system with the spray pump operating on recirculation with a pump discharge pressure ≥ 230 psig.

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA.

The opening of containment purge and exhaust valves and locked or sealed closed containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing a qualified individual, who is in constant communication with control room, at the valve controls, (2) instructing this individual to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside the containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL

Hydrogen Analyzers and Recombiners

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with: 1) zirconium-water reactions; 2) radiolytic decomposition of water; and 3) corrosion of metals within containment.

The acceptance criterion of 10,000 ohms is based on the test being performed with the heater element at an ambient temperature, but can be conservatively applied when the heater element is at a temperature above ambient.

3/4.6.5 ICE CONDENSER

The requirements associated with each of the components of the ice condenser ensure that the overall system will be available to provide sufficient pressure suppression capability to limit the containment peak pressure transient to less than 12 psig during LOCA conditions.

3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA, 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA, 4) contain sufficient water to maintain adequate sump inventory, and 5) result in a post-LOCA sump pH within the allowed range. These conditions are consistent with the assumptions used in the accident analyses.

The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a design basis accident and the additional heat loads that would enter containment during several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators.

Over the course of a fuel cycle, sublimation reduces the weight of ice in the ice condenser. For the ice condenser to be considered OPERABLE, the minimum as-found ice weight of 1144 pounds per ice basket, for those ice baskets selected for weighing per the surveillance requirements, must be present at the end of a fuel cycle. An instrument measurement error allowance is included in the required minimum ice basket weight. To account for loss due to sublimation, a conservative average ice bed sublimation of 10% over an eighteen-month period is used. The beginning-of-cycle, or as-left ice basket weight, is adjusted accordingly to assure the LCO limit will be met at the end of each fuel cycle.

The containment subcompartment analysis assumes a uniform 15% blockage of the ice condenser flow channels, utilizing the most restrictive area within the 48 foot height of the ice bed, which are the lattice frame elevations. The analysis conservatively assumes that the restricted area at the lattice frames, further reduced by 15%, exists over the entire 48 foot height of the ice bed. The containment subcompartment analysis lumps the 24 ice condenser bays into six groups for analysis purposes. The 3/8" criterion for frost or ice accumulation in a flow channel provides an indicator of the ice condenser condition. The lattice frame thickness is 3/8" and, therefore, this dimension provides a convenient visual comparison reference during flow passage inspections. More than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser and would require additional flow passage inspection and engineering assessment to ensure that the 15% blockage assumed in containment subcompartment analysis is met.

3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the vent the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

3/4.6.5.3 ICE CONDENSER DOORS

The OPERABILITY of the ice condenser doors and the requirement that they be maintained closed ensures 1) that the reactor coolant system fluid released during a LOCA will be diverted through the ice condenser bays for heat removal and 3) that excessive sublimation of the ice bed will not occur because of warm air intrusion.

3/4.6.5.4 INLET DOOR POSITION MONITORING SYSTEM

The OPERABILITY of the inlet door position monitoring system ensures that the capability is available for monitoring the individual inlet door position. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

3/4.6.5.5 DIVIDER BARRIER PERSONNEL ACCESS DOORS AND EQUIPMENT HATCHES

The requirements for the divider barrier personnel access doors and equipment hatches being closed and OPERABLE ensure that a minimum bypass steam flow will occur from the lower to the upper containment compartments during a LOCA. This condition ensures a diversion of the steam through the ice condenser bays that is consistent with the LOCA analyses.

3/4.6.5.6 CONTAINMENT AIR RECIRCULATION SYSTEMS

The OPERABILITY of the containment air recirculation systems ensures that following a LOCA 1) the containment atmosphere is circulated for cooling by the spray system, 2) the accumulation of hydrogen in localized portions of the containment structure is minimized, and 3) sufficient ice melt, from the ice condenser, occurs to meet the minimum containment sump volume requirements for switchover to recirculation.

3/4.6.5.7 and 3/4.6.5.8 FLOOR AND REFUELING CANAL DRAINS

The OPERABILITY of the ice condenser floor and refueling canal drains ensures that following a LOCA, the water from the melted ice and containment spray system has access for drainage back to the containment lower compartment and subsequently to the sump. This condition ensures the availability of the water for long term cooling of the reactor during the post accident phase.

3/4.7.5 CONTROL ROOM EMERGENCY VENTILATION SYSTEM

The OPERABILITY of the control room emergency ventilation system ensures that the control room will remain habitable for operations personnel during and following all credible accident conditions. The OPERABILITY of this system in conjunction with control room design provisions is based on limiting the radiation exposure to personnel occupying the control room to 5 rem or less whole body, or its equivalent. This limitation is consistent with the requirements of General Design Criteria 19 of Appendix "A", 10 CFR 50.

The Unit 1 control room emergency ventilation system operates automatically on a Safety Injection Signal from either Unit 1 or Unit 2. The automatic start from Unit 2 is only available when the Unit 2 ESF actuation system is active in modes 1 through 4 in Unit 2.

The Limiting Condition for Operation requires two independent control room heating cooling systems. Each cooling system requires a functional air handling unit and associated cooling water supply. Cooling water is provided from a chilled water unit. At the design maximum essential service water (ESW) supply temperature of 86°F, a chilled water unit will maintain the control room temperature below 95°F. Cooling water may also be supplied directly by ESW when ESW supply temperature is ≤ 65°F.

The control room ventilation system normally maintains the control room at temperatures at which control room equipment is qualified for the life of the plant. Continued operation at the Technical Specification limit is permitted since the portion of time the temperature is likely to be elevated is small in comparison to the qualified life of the equipment at the limit.

Each control room cooling system can maintain control room temperature ≤ 102°F during accident conditions with the control room isolated. At control room temperatures of ≤ 102°F, vital control room equipment remains within its manufacturer's recommended operating temperature range.

3/4.7.6 ESF VENTILATION SYSTEM

The OPERABILITY of the ESF ventilation system ensures that adequate cooling is provided for ECCS equipment and that radioactive materials leaking from the ECCS equipment within the pump room following a LOCA are filtered prior to reaching the environment. The operation of this system and the resultant effect on offsite dosage calculations were assumed in the accident analyses.

The 1980 version of ANSI N510 is used as a testing guide. This standard, however, is intended to be rigorously applied only to systems which, unlike the ESF ventilation system, are designed to ANSI N509 standards. For the specific case of the air-aerosol mixing uniformity test required by ANSI N510 as a prerequisite to in-place leak testing of charcoal and HEPA filters, the air-aerosol uniform mixing test acceptance criteria were not rigorously met. For this reason, a statistical correction factor will be applied to applicable surveillance test results where required.

3/4.7.7 SEALED SOURCE CONTAMINATION

The limitations on removable contamination for sources requiring leak testing, including alpha emitters, are based on 10 CFR 70.39(c) limits for plutonium. This limitation will ensure that leakage from byproduct, source, and special nuclear material sources will not exceed allowable intake values.

The OPERABILITY of the A.C. and D.C power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50.

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one of each of the onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source.

Surveillance requirement 4.8.1.1.1.a ensures proper circuit continuity for the offsite A.C. power sources and the associated distribution system by verifying correct breaker alignment and indicated power availability. The 7-day frequency is adequate since information is available to the control room to alert operators, and the offsite transmission network has been analyzed to ensure adequacy with minimum predicted low voltage occurrences.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the facility status.

Specific surveillance requirements (SRs) of SR 4.8.1.2 may be delayed one time until just prior to the first entry into MODE 4 following the extended outage that commenced in 1997. The delay is permitted to recognize the significant ongoing maintenance to safety systems and components that would be required to be OPERABLE solely to support the referenced surveillances. The delay recognizes the reduced decay heat load and fission product activities resulting from the extended shutdown and consequently the small benefit from performing the surveillances prior to the next entry into MODE 4. It is the intent that these SRs must still be capable of being met, but actual performance is not required until the required safety systems are ready to support entry into MODE 4.

The AB and CD station battery systems provide a reliable source of continuous power for supply and control of plant loads such as switchgear and annunciator control circuits, static inverters, valve control centers, emergency lighting and motor control centers. The design duty cycles of these batteries are composite load profiles resulting from the combination of the three hour Loss Of Coolant Accident/Loss Of Offsite Power battery load profiles and the four hour Station Blackout battery load profiles.

The train N station battery system provides an independent 250 volt DC power supply for power and control of the turbine driven auxiliary feedwater pump train. The limiting conditions of operation for the train N battery are consistent with the requirements of the auxiliary feedwater system. The surveillance requirements for the train N battery system are consistent with the requirements of the AB and CD station batteries. The train N battery loads are derived from equipment in the turbine driven auxiliary feedwater pump train and battery sizing is consistent with the functional requirements of these components. Simulated loads for battery tests are loads equivalent to measured actual loads.

Removal of accumulated water as required by 4.8.1.1.2.b.2 is performed by drawing the contents off the bottom of the tank until acceptable results are obtained for either a tape test or a water and sediment test. An acceptable result for the water and sediment content is a measured value less than 0.05 percent volume.

The "proper color" criterion of Surveillance Requirement 4.8.1.1.2.c.3 ensures the translucence of the fuel oil sample will allow observation of water or sediment when analyzed in accordance with ASTM D4176-82. Fuel oil is considered to have proper color if it measures less than or equal to five per ASTM D1500. The addition of visible dyes to fuel oil may interfere with the ASTM D1500 analysis.

The sample specified in 4.8.1.1.2.c.4 is sent offsite for testing. A serious attempt will be made to meet the 31-day limit on the offsite tests; however, if for some reason this limit is not met (e.g., if the sample is lost or broken or if the results are not received in 31 days), the diesel generators should not be considered inoperable. If the sample is lost, broken, or fails the offsite tests and the new oil has already been put into the storage tank, the offsite tests will be performed on a sample taken from the storage tank. If the results on the subsequent storage tank sample are not within specified limits, the diesel generators should be considered OPERABLE and the out-of-spec properties should be returned to within specification as soon as possible.

If the monthly storage tank sample taken in accordance with Specification 4.8.1.1.2.d fails the particulate contamination test, the diesel generators should be considered OPERABLE and the contamination level should be restored to below 10 mg/liter as soon as possible.

The precision leak-detection test described in Surveillance Requirement 4.8.1.1.2.f.2 should be performed as described in NFPA (National Fire Protection Association) -329. As NFPA-329 is revised, the precision leak-detection test may be modified to incorporate changes to the test as described in the revisions to NFPA-329.

The minimum required diesel fuel oil volume is 43,240 gallons. This volume is consistent with operation of one diesel generator continuously for 7 days at rated load, as recommended in Regulatory Guide 1.137, entitled "Fuel Oil System for Standby Diesel Generators." The Technical Specifications require a minimum of 46,000 gallons of fuel. The 46,000 gallons is an indicated volume. This amount includes margin for characteristics such as location of the tank discharge pipes and slope of the tanks.

3/4.9.6 MANIPULATOR CRANE OPERABILITY

The OPERABILITY requirements for the manipulator cranes ensure that: 1) manipulator cranes will be used for movement of control rods and fuel assemblies 2) each crane has sufficient load capacity to lift a control rod or fuel assembly and 3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

3/4.9.7 CRANE TRAVEL - SPENT FUEL STORAGE BUILDING

The restriction on movement of loads in excess of 2,500 lbs. over other fuel assemblies in the storage pool ensures that, in the event of a dropped load, 1) the activity release will be limited to that contained in a single fuel assembly, and 2) any possible distortion of fuel in the storage racks will not result in a critical array. The 2,500-lb. load restriction is based on the combined nominal weight of a fuel assembly, a control rod assembly, and an associated fuel handling tool. Release of activity from a single fuel assembly is consistent with the assumption for the analysis for a fuel handling accident.

The restriction on movements of loads in excess of the impact energy limit, which is based on the kinetic energy of a dropped fuel assembly and control rod assembly from 15" above the fuel storage rack, is to bound other loads.

Prohibiting loads greater than 2,500 pounds or loads at heights that would exceed the kinetic energy impact limit allows flexibility in the movements of fuel and other relatively light loads, while providing reasonable assurance that the consequences of a fuel handling accident will not be exceeded.

3/4.9.8 RESIDUAL HEAT REMOVAL AND COOLANT CIRCULATION

The requirement that at least one residual heat removal (RHR) loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effect of a boron dilution incident and prevent boron stratification.

The requirement to have two RHR loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange ensures that a single failure of the operating RHR loop will not result in a complete loss of residual heat removal capability. With the reactor vessel head removed and 23 feet of water above the reactor pressure vessel flange, a large heat sink is available for core cooling. Thus, in the event of a failure of the operating RHR loop, adequate time is provided to initiate emergency procedures to cool the core.

3/4.9.9 CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment vent and purge penetrations will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.

3/4.9.10 and 3/4.9.11 WATER LEVEL - REACTOR VESSEL AND STORAGE POOL

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the accident analysis. Water level above the vessel flange in MODE 6 will vary as the reactor vessel head and the system internals are removed. The 23 feet of water are required before any subsequent movement of fuel assemblies or control rods.

3/4.9.12 STORAGE POOL VENTILATION SYSTEM

The limitations on the storage pool ventilation system ensure that all radioactive material released from an irradiated fuel assembly will be filtered through the HEPA filters and charcoal adsorber prior to discharge to the atmosphere. The OPERABILITY of this system and the resulting iodine removal capacity are consistent with the assumptions of the accident analyses.

The 1980 version of ANSI N510 is used as a testing guide. This standard, however, is intended to be rigorously applied only to systems which, unlike the storage pool ventilation system, are designed to ANSI N509 standards. For the specific case of the air-aerosol mixing uniformity test required by ANSI N510 as a prerequisite to in-place leak testing of charcoal and HEPA filters, the air-aerosol uniform mixing test acceptance criteria were not rigorously met. For this reason, a statistical correction factor will be applied to applicable surveillance test results where required.

The spent fuel storage pool exhaust ventilation system is designed to maintain a minimum negative pressure of 1/8" water gauge with system flow through the charcoal adsorber banks and supply fans off. To support this function, the crane bay roll-up door and the south door of the auxiliary building crane bay, located on the 609-foot elevation of the auxiliary building, must be closed. However, they may be opened during these operations under administrative control. If the crane bay door needs to be opened during fuel movement, an example of an administrative control might be to station an individual at the door who would be in communication with personnel in the spent fuel pool area and could close the door when passage through the door was completed or in the event of an emergency. For the south door of the auxiliary building crane bay, an example of an administrative control might be to require the door to be reclosed after normal ingress and egress of personnel or material, or to station an individual at the door if the door needs to remain open for an extended period of time.

Should the doors become blocked or stuck open while under administrative control, Technical Specification requirements will not be considered to be violated provided the Action Statement requirements of Specification 3.9.12 are expeditiously followed, i.e., movement of fuel within the storage pool or crane operation with loads over the pool is expeditiously suspended.

3/4.3.1 and 3/4.3.2 PROTECTIVE AND ENGINEERED SAFETY FEATURES (ESF) INSTRUMENTATION

The OPERABILITY of the protective and ESF instrumentation systems and interlocks ensure that 1) the associated ESF action and/or reactor trip will be initiated when the parameter monitored by each channel or combination thereof exceeds its setpoint, 2) the specified coincidence logic is maintained, 3) sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance, and 4) sufficient system functional capability is available for protective and ESF purposes from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundance and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses.

Protection has been provided for main feedwater system malfunctions in MODES 3 and 4. This protection is required when main feedpumps are aligned to feed steam generators in MODES 3 and 4. The availability of feedwater isolation on high-high steam generator level terminates the addition of cold water to the steam generators in any main feedwater system malfunction. The total volume that can be added to the steam generators by the main feedwater system in MODES 3 and 4 is limited by this safeguards actuation and the fact that feedwater isolation on low T_{avg} setpoint coincident with reactor trip can only be cleared above the low-low steam generator level trip setpoint.

The restrictions associated with bypassing ESF trip functions below either P-11 or P-12 provide protection against an increase in steam flow transient and are consistent with assumptions made in the safety analysis.

The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

The measurement of response time at the specified frequencies provides assurance that the protective and ESF action function associated with each channel is completed within the time limit assumed in the accident analyses.

Response time may be demonstrated by any series of sequential, overlapping or total channel test measurements provided that such tests demonstrate the total channel response time as defined. Sensor response time verification may be demonstrated by either 1) in place, onsite or offsite test measurements or 2) utilizing replacement sensors with certified response times.

REACTOR TRIP SYSTEM RESPONSE TIME testing is only required for those functional units specified in UFSAR Table 7.2-6, "Reactor Trip System Instrumentation Response Times." ENGINEERED SAFETY FEATURES RESPONSE TIME testing is only required for those functional units specified in UFSAR Table 7.2-7, "Engineered Safety Features Response Times." These response time limits were previously included in the Technical Specifications but were relocated to the UFSAR by license amendments 202 (U1) and 187 (U2).

3/4.3.3.6 POST-ACCIDENT INSTRUMENTATION

The OPERABILITY of the post-accident instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables during and following an accident. The allowable out-of-service time for the Refueling Water Storage Tank (RWST) level channels is required to provide the overall reliability to support the manual transfer from injection to recirculation following an accident. The bypassing of the Residual heat Removal (RHR) pump trip from the RWST low level, with a level channel out-of-service, ensures that the RHR pump will be available to meet its Engineered Safety Features (ESF) Function of injecting water into the core. The loss of RHR pump protection will be mitigated by the operator's action to switch from injection to recirculation using the approved Emergency Operating Procedure which causes the RHR pump suction to be realigned well before the RHR pump trip setpoint. The associated RHR pump can be considered OPERABLE with the RWST level channel out-of-service once the trip function has been by-passed since the pump would be available to fulfill its ESF function.

The containment water level switches are considered components of the Containment Water Level channels listed in Tables 3.3-10 and 4.3-10 and are subject to the same MODE applicability, action statement, and surveillance requirements as the containment water level loops.

3/4.3.3.7 Deleted.

3/4.3.3.9 EXPLOSIVE GAS MONITORING INSTRUMENTATION

This instrumentation includes provisions for monitoring the concentrations of potentially explosive gas mixtures in the Waste Gas Holdup System. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria specified in Section 11.3 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant.

3/4.4.6 REACTOR COOLANT SYSTEM LEAKAGE

3/4.4.6.1 LEAKAGE DETECTION SYSTEMS

The RCS leakage detection systems required by this specification are provided to monitor and detect Reactor Coolant PRESSURE BOUNDARY LEAKAGE. Leakage detection systems meet the criteria previously established for leak detection systems when utilizing leak-before-break. Specifically, at least one leakage detection system with a sensitivity capable of detecting an unidentified leakage rate of one gpm in four hours should be OPERABLE.

3/4.4.6.2 OPERATIONAL LEAKAGE

Industry experience has shown that while a limited amount of leakage is expected from the RCS, the unidentified portion of this leakage can be reduced to a threshold value of less than 1 gpm. This threshold value is sufficiently low to ensure early detection of additional leakage.

The 10 GPM IDENTIFIED LEAKAGE limitations provides allowance for a limited amount of leakage from known sources whose presence will not interfere with the detection of UNIDENTIFIED LEAKAGE by the leakage detection systems.

3/4.5.1 ACCUMULATORS (Continued)

allowed completion times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

If more than one accumulator is inoperable, the plant is in a condition outside the accident analysis; therefore, LCO 3.0.3 must be entered immediately.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two independent ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

If a safety injection cross-tie valve is closed to perform maintenance, safety injection would be limited to two lines assuming the loss of one safety injection subsystem through a single failure consideration. The resulting lowered flow requires a decrease in THERMAL POWER to limit the peak clad temperature within acceptable limits in the event of a postulated small break LOCA. Stroking the valve to verify OPERABILITY or to fill the accumulators while in the appropriate ACTION statement is acceptable.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The limitation for a maximum of one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all charging pumps and safety injection pumps, except the required OPERABLE charging pump, to be inoperable below 152°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analysis are met and that subsystem OPERABILITY is maintained. Surveillance requirements for removal of power to the operators of valves listed in 4.5.2a ensure the valves are single failure proof in accordance with Branch Technical Position 18, Application of the Single Failure Criterion to Manually-Controlled, Electrically-Operated Valves. The reviewed and approved methodology for removal of power to these eight valves is by locking out control power. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration,* (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analysis, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analysis.

* Observing these limits while flow balancing the SI pumps in the injection mode will ensure they are not exceeded in the recirculation mode (RHR pumps providing a suction pressure boost) due to the higher system resistance resulting from splitting of the SI trains when in the recirculation lineup.

3/4.6.1.4 INTERNAL PRESSURE

The limitations on containment internal pressure ensure that 1) the containment structure is prevented from exceeding its design negative pressure differential with respect to the outside atmosphere of 8 psig and 2) the containment peak pressure does not exceed the design pressure of 12 psig during LOCA conditions.

The maximum peak pressure resulting from a LOCA event, which includes 0.3 psig for initial positive containment pressure, is documented in UFSAR Chapter 14.

3/4.6.1.5 AIR TEMPERATURE

The limitations on containment average air temperature ensure that 1) the containment air mass is limited to an initial mass sufficiently low to prevent exceeding the design pressure during LOCA conditions and 2) the ambient air temperature does not exceed that temperature allowable for the continuous duty rating specified for equipment and instrumentation located within containment.

The containment pressure transient is sensitive to the initially contained air mass during a LOCA. The contained air mass increases with decreasing temperature. The lower temperature limit of 60°F will limit the calculated peak pressure to less than the containment design pressure of 12 psig, as documented in UFSAR Chapter 14. The upper temperature limit influences the peak accident temperature slightly during a LOCA; however, this limit is based primarily upon equipment protection and anticipated operating conditions. Both the upper and lower temperature limits are consistent with the parameters used in the accident analyses.

3/4.6.1.6 CONTAINMENT VESSEL STRUCTURAL INTEGRITY

This limitation ensures that the structural integrity of the containment will be maintained comparable to the original design standards for the life of the facility. Structural integrity is required to ensure that (1) the steel liner remains leak tight and (2) the concrete surrounding the steel liner remains capable of providing external missile protection for the steel liner and radiation shielding in the event of a LOCA. A visual inspection in conjunction with Type A leakage tests is sufficient to demonstrate this capability.

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

3/4.6.2.2 SPRAY ADDITIVE SYSTEM

The OPERABILITY of the spray additive system ensures that sufficient NaOH is added to the containment spray in the event of a LOCA. The limits on NaOH minimum volume and concentration ensure that 1) the iodine removal efficiency of the spray water is maintained because of the increase in pH value, and 2) corrosive effects on components in the containment are minimized. These assumptions are consistent with the iodine removal efficiency assumed in the accident analyses.

The contained water volume limit includes an allowance for water not usable because of tank discharge location or other physical characteristics.

Surveillance Requirement 4.6.2.2.d is performed by verifying a water flow rate $\geq$ 45 gpm and $\leq$ 60 gpm from the spray additive tank test line to each containment spray system with the spray pump operating on recirculation with a pump discharge pressure $\geq$ 230 psig.

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA.

The opening of containment purge and exhaust valves and locked or sealed closed containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing a qualified individual, who is in constant communication with control room, at the valve controls, (2) instructing this individual to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside the containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL (continued)

Confidence in system OPERABILITY is demonstrated by surveillance testing. Since many igniters are inaccessible at power, surveillance testing in MODE 1 is limited to measurement of igniter current when the DIS is energized by groups. Measured currents are compared with baseline data for the group.

Igniter temperature measurement for all igniters can only be performed during shutdown and is performed every 18 months. This testing energizes all igniters and confirms the ability of each igniter to obtain a surface temperature of at least 1700°F. This temperature is conservatively above the temperature necessary to ignite hydrogen mixtures at concentrations near the lower flammability limit. Test experience indicates that individual igniter failures are generally total failures and do not involve the inability to reach the required temperature when an igniter is drawing normal amperage. This observed failure mode provides reasonable confidence that an igniter failing to reach the required temperature would also be detected by reduced group current measurements during the MODE 1 surveillances. Therefore the 18 month frequency for actual temperature measurements is acceptable.

3/4.6.5 ICE CONDENSER

The requirements associated with each of the components of the ice condenser ensure that the overall system will be available to provide sufficient pressure suppression capability to limit the containment peak pressure transient to less than 12 psig during LOCA conditions.

3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA, 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA, 4) contain sufficient water to maintain adequate sump inventory, and 5) result in a post-LOCA sump pH within the allowed range. These conditions are consistent with the assumptions used in the accident analyses.

The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a design basis accident and the additional heat loads that would enter containment during several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators.

Over the course of a fuel cycle, sublimation reduces the weight of ice in the ice condenser. For the ice condenser to be considered OPERABLE, the minimum as-found ice weight of 1144 pounds per ice basket, for those ice baskets selected for weighing per the surveillance requirements, must be present at the end of a fuel cycle. An instrument measurement error allowance is included in the required minimum ice basket weight. To account for loss due to sublimation, a conservative average ice bed sublimation of 10% over an eighteen-month period is used. The beginning-of-cycle, or as-left ice basket weight, is adjusted accordingly to assure the LCO limit will be met at the end of each fuel cycle.

The containment subcompartment analysis assumes a uniform 15% blockage of the ice condenser flow channels, utilizing the most restrictive area within the 48 foot height of the ice bed, which are the lattice frame elevations. The analysis conservatively assumes that the restricted area at the lattice frames, further reduced by 15%, exists over the entire 48 foot height of the ice bed. The containment subcompartment analysis lumps the 24 ice condenser bays into six groups for analysis purposes. The 3/8" criterion for frost or ice accumulation in a flow channel provides an indicator of the ice condenser condition. The lattice frame thickness is 3/8" and, therefore, this dimension provides a convenient visual comparison reference during flow passage inspections. More than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser and would require additional flow passage inspection and engineering assessment to ensure that the 15% blockage assumed in containment subcompartment analysis is met.

3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

3/4.6.5.3 ICE CONDENSER DOORS

The OPERABILITY of the ice condenser doors and the requirement that they be maintained closed ensures 1) that the reactor coolant system fluid released during a LOCA will be diverted through the ice condenser bays for heat removal and 3) that excessive sublimation of the ice bed will not occur because of warm air intrusion.

3/4.6.5.4 INLET DOOR POSITION MONITORING SYSTEM

The OPERABILITY of the inlet door position monitoring system ensures that the capability is available for monitoring the individual inlet door position. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

3/4.6.5.5 DIVIDER BARRIER PERSONNEL ACCESS DOORS AND EQUIPMENT HATCHES

The requirements for the divider barrier personnel access doors and equipment hatches being closed and OPERABLE ensure that a minimum bypass steam flow will occur from the lower to the upper containment compartments during a LOCA. This condition ensures a diversion of the steam through the ice condenser bays that is consistent with the LOCA analyses.

3/4.6.5.6 CONTAINMENT AIR RECIRCULATION SYSTEMS

The OPERABILITY of the containment air recirculation systems ensures that following a LOCA 1) the containment atmosphere is circulated for cooling by the spray system, 2) the accumulation of hydrogen in localized portions of the containment structure is minimized, and 3) sufficient ice melt, from the ice condenser, occurs to meet the minimum containment sump volume requirements for switchover to recirculation.

3/4.6.5.7 and 3/4.6.5.8 FLOOR AND REFUELING CANAL DRAINS

The OPERABILITY of the ice condenser floor and refueling canal drains ensures that following a LOCA, the water from the melted ice and containment spray system has access for drainage back to the containment lower compartment and subsequently to the sump. This condition ensures the availability of the water for long term cooling of the reactor during the post accident phase.

3/4.7.5 CONTROL ROOM EMERGENCY VENTILATION SYSTEM

The OPERABILITY of the control room EMERGENCY ventilation system ensures that the control room will remain habitable for operations personnel during and following all credible accident conditions. The OPERABILITY of this system in conjunction with control room design provisions is based on limiting the radiation exposure to personnel occupying the control room to 5 rem or less whole body, or its equivalent. This limitation is consistent with the requirements of General Design Criteria 19 of Appendix "A", 10 CFR 50.

The Unit 2 control room emergency ventilation system operates automatically on a Safety Injection Signal from either Unit 1 or Unit 2. The automatic start from Unit 1 is only available when the Unit 1 ESF actuation system is active in modes 1 through 4 in Unit 1.

The Limiting Condition for Operation requires two independent control room heating and cooling systems. Each cooling system requires a functional air handling unit and associated cooling water supply. Cooling water is provided from a chilled water unit. At the design maximum essential service water (ESW) supply temperature of 86°F, a chilled water unit will maintain the control room temperature below 95°F. Cooling water may also be supplied directly by ESW when ESW supply temperature is ≤ 65°F.

The control room ventilation system normally maintains the control room at temperatures at which control room equipment is qualified for the life of the plant. Continued operation at the Technical Specification limit is permitted since the portion of time the temperature is likely to be elevated is small in comparison to the qualified life of the equipment at the limit.

Each control room cooling system can maintain control room temperature ≤ 102°F during accident conditions with the control room isolated. At control room temperatures of ≤ 102°F, vital control room equipment remains within its manufacturer's recommended operating temperature range.

The OPERABILITY of the A.C. and D.C power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criteria 17 of Appendix "A" to 10 CFR 50.

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the accident analyses and are based upon maintaining at least one of each of the onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source.

Surveillance requirement 4.8.1.1.1.a ensures proper circuit continuity for the offsite A.C. power sources and the associated distribution system by verifying correct breaker alignment and indicated power availability. The 7-day frequency is adequate since information is available to the control room to alert operators, and the offsite transmission network has been analyzed to ensure adequacy with minimum predicted low voltage occurrences.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the facility status.

Specific surveillance requirements (SRs) of SR 4.8.1.2 may be delayed one time until just prior to the first entry into MODE 4 following the extended outage that commenced in 1997. The delay is permitted to recognize the significant ongoing maintenance to safety systems and components that would be required to be OPERABLE solely to support the referenced surveillances. The delay recognizes the reduced decay heat load and reduced fission product activities resulting from the extended shutdown and consequently the small benefit from performing the surveillances prior to the next entry into MODE 4. It is the intent that these SRs must still be capable of being met, but actual performance is not required until the required safety systems are ready to support entry into MODE 4.

The AB and CD station battery systems provide a reliable source of continuous power for supply and control of plant loads such as switchgear and annunciator control circuits, static inverters, valve control centers, emergency lighting and motor control centers. The design duty cycles of these batteries are composite load profiles resulting from the combination of the three hour Loss Of Coolant Accident/Loss Of Offsite Power battery load profiles and the four hour Station Blackout battery load profiles.

The train N station battery system provides an independent 250 volt DC power supply for power and control of the turbine driven auxiliary feedwater pump train. The limiting conditions of operation for the train N battery are consistent with the requirements of the auxiliary feedwater system. The surveillance requirements for the train N battery system are consistent with the requirements of the AB and CD station batteries. The train N battery loads are derived from equipment in the turbine driven auxiliary feedwater pump train and battery sizing is consistent with the functional requirements of these components. Simulated loads for battery tests are loads equivalent to measured actual loads.

Removal of accumulated water as required by 4.8.1.1.2.b.2 is performed by drawing the contents off the bottom of the tank until acceptable results are obtained for either a tape test or a water and sediment test. An acceptable result for the water and sediment content is a measured value less than 0.05 percent volume.

The "proper color" criterion of Surveillance Requirement 4.8.1.1.2.c.3 ensures the translucence of the fuel oil sample will allow observation of water or sediment when analyzed in accordance with ASTM D4176-82. Fuel oil is considered to have proper color if it measures less than or equal to five per ASTM D1500. The addition of visible dyes to fuel oil may interfere with the ASTM D1500 analysis.

The sample specified in 4.8.1.1.2.c.4 is sent offsite for testing. A serious attempt will be made to meet the 31-day limit on the offsite tests; however, if for some reason this limit is not met (e.g., if the sample is lost or broken or if the results are not received in 31 days), the diesel generators should not be considered inoperable. If the sample is lost, broken, or fails the offsite tests and the new oil has already been put into the storage tank, the offsite tests will be performed on a sample taken from the storage tank. If the results on the subsequent storage tank sample are not within specified limits, the diesel generators should be considered OPERABLE and the out-of-spec properties should be returned to within specification as soon as possible.

If the monthly storage tank sample taken in accordance with Specification 4.8.1.1.2.d fails the particulate contamination test, the diesel generators should be considered OPERABLE and the contamination level should be restored to below 10 mg/liter as soon as possible.

The precision leak-detection test described in Surveillance Requirement 4.8.1.1.2.f.2 should be performed as described in NFPA (National Fire Protection Association) -329. As NFPA-329 is revised, the precision leak-detection test may be modified to incorporate changes to the test as described in the revisions to NFPA-329.

The minimum required diesel fuel oil volume is 43,240 gallons. This volume is consistent with operation of one diesel generator continuously for 7 days at rated load, as recommended in Regulatory Guide 1.137, entitled "Fuel Oil System for Standby Diesel Generators." The Technical Specifications require a minimum of 46,000 gallons of fuel. The 46,000 gallons is an indicated volume. This amount includes margin for characteristics such as location of the tank discharge pipes and slope of the tanks.

3/4.9.6 MANIPULATOR CRANE OPERABILITY

The OPERABILITY requirements for the manipulator cranes ensure that: 1) manipulator cranes will be used for movement of control rods and fuel assemblies, 2) each crane has sufficient load capacity to lift a control rod or fuel assembly, and 3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

3/4.9.7 CRANE TRAVEL - SPENT FUEL STORAGE BUILDING

The restriction on movement of loads in excess of 2,500 lbs. over other fuel assemblies in the storage pool ensures that, in the event of a dropped load, 1) the activity release will be limited to that contained in a single fuel assembly, and 2) any possible distortion of fuel in the storage racks will not result in a critical array. The 2,500-lb. load restriction is based on the combined nominal weight of a fuel assembly, a control rod assembly, and an associated fuel handling tool. Release of activity from a single fuel assembly is consistent with the assumption for the analysis for a fuel handling accident.

The restriction on movements of loads in excess of the impact energy limit, which is based on the kinetic energy of a dropped fuel assembly and control rod assembly from 15" above the fuel storage rack, is to bound other loads.

Prohibiting loads greater than 2,500 pounds or loads at heights that would exceed the kinetic energy impact limit allows flexibility in the movements of fuel and other relatively light loads, while providing reasonable assurance that the consequences of a fuel handling accident will not be exceeded.

3/4.9.8 RESIDUAL HEAT REMOVAL AND COOLANT CIRCULATION

The requirement that at least one residual heat removal (RHR) loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effect of a boron dilution incident and prevent boron stratification.

The requirement to have two RHR loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange ensures that a single failure of the operating RHR loop will not result in a complete loss of residual heat removal capability. With the reactor vessel head removed and 23 feet of water above the reactor pressure vessel flange, a large heat sink is available for core cooling. Thus, in the event of a failure of the operating RHR loop, adequate time is provided to initiate emergency procedures to cool the core.

3/4.9.9 CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment vent and purge penetrations will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.

3/4.9.10 and 3/4.9.11 WATER LEVEL - REACTOR VESSEL AND STORAGE POOL

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the accident analysis. Water level above the vessel flange in MODE 6 will vary as the reactor vessel head and the system internals are removed. The 23 feet of water are required before any subsequent movement of fuel assemblies or control rods.

3/4.9.12 STORAGE POOL VENTILATION SYSTEM

The limitations on the storage pool ventilation system ensure that all radioactive material released from an irradiated fuel assembly will be filtered through the HEPA filters and charcoal adsorber prior to discharge to the atmosphere. The OPERABILITY of this system and the resulting iodine removal capacity are consistent with the assumptions of the accident analysis.

The 1980 version of ANSI N510 is used as a testing guide. This standard, however, is intended to be rigorously applied only to systems which, unlike the storage pool ventilation system, are designed to ANSI N509 standards. For the specific case of the air-aerosol mixing uniformity test required by ANSI N510 as a prerequisite to in-place leak testing of charcoal and HEPA filters, the air-aerosol uniform mixing test acceptance criteria were not rigorously met. For this reason, a statistical correction factor will be applied to applicable surveillance test results where required.

The spent fuel storage pool exhaust ventilation system is designed to maintain a minimum negative pressure of 1/8" water gauge with system flow through the charcoal adsorber banks and supply fans off. To support this function, the crane bay roll-up door and the south door of the auxiliary building crane bay, located on the 609-foot elevation of the auxiliary building, must be closed. However, they may be opened during these operations under administrative control. If the crane bay door needs to be opened during fuel movement, an example of an administrative control might be to station an individual at the door who would be in communication with personnel in the spent fuel pool area and could close the door when passage through the door was completed or in the event of an emergency. For the south door of the auxiliary building crane bay, an example of an administrative control might be to require the door to be reclosed after normal ingress and egress of personnel or material, or to station an individual at the door if the door needs to remain open for an extended period of time.

ATTACHMENT 2 TO C0601-07

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6-13b (Deleted)	210	12/28/98
6-13c (Deleted)	210	12/28/98
6-14	226	10/10/00
6-15	226	10/10/00
6-16 (Deleted)	210	12/28/98
6-17 (Deleted)	210	12/28/98
6-18 (Deleted)	210	12/28/98
6-19 (Deleted)	210	12/28/98
6-20 (Deleted)	210	12/28/98
6-21 (Deleted)	210	12/28/98
6-22 (Deleted)	210	12/28/98
6-23 (Deleted)	175	12/10/95

ATTACHMENT 3 TO C0601-07

REVISED CORE OPERATING LIMITS REPORT

Unit 1 Cycle 17, Revision 0

Unit 2 Cycle 12, Revision 2

Donald C. Cook Nuclear Plant
Unit 1 Cycle 17

Core Operating Limits Report
Revision 0

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for Donald C. Cook Nuclear Plant Unit 1 Cycle 17 design has been prepared in accordance with the requirements of Technical Specification 6.9.1.9.

The Technical Specifications affected by this report are listed below:

3/4.1.1.4	Moderator Temperature Coefficient
3/4.1.3.1	Movable Control Assemblies Group Height
3/4.1.3.3	Rod Drop Time
3/4.1.3.4	Shutdown Rod Insertion Limits
3/4.1.3.5	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference (AFD)
3/4.2.2	Heat Flux Hot Channel Factor ($F_Q(Z)$)
3/4.2.3	Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)
3/4.2.6	Allowable Power Level (APL)

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specifications 6.9.1.11.

2.1 Moderator Temperature Coefficient (Specification 3/4.1.1.4)

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO-MTC shall be less positive than the value given in Figure 1.

The EOL/ARO/RTP-MTC shall be less negative than -4.54×10^{-4} $\Delta k/k/°F$.

This limit is based on a T_{avg} program with HFP T_{avg} of 554.0 - 558.0 °F.

Where: ARO stands for All Rods Out
BOL stands for Beginning of Cycle Life
EOL stands for End of Cycle Life
RTP stands for Rated Thermal Power
HFP stands for Hot Full Thermal Power

2.1.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to $-3.84 \times 10^{-4} \Delta k/k/°F$ at a vessel average temperature of 554.0 – 558.0 °F.

2.2 Rod Drop Time Drop Height (Specification 3/4.1.3.3)

2.2.1 All rods shall be dropped from 225 steps.

2.3 Shutdown Rod Insertion Limit (Specification 3/4.1.3.4)

2.3.1 The shutdown rods shall be withdrawn to 225 steps.

2.4 Control Rod Insertion Limits (Specifications 3/4.1.3.5 and 3/4.1.3.1)

2.4.1 The control rod banks shall be limited in physical insertion as shown in Figure 2.

2.4.2 Successive Control Banks shall overlap by 97 steps. The sequence for Control Bank withdrawal shall be Control Bank A, Control Bank B, Control Bank C and Control Bank D.

2.5 Axial Flux Difference (AFD) (Specification 3/4.2.1)

2.5.1 The Allowable Operation Limits are provided in Figure 3.

2.5.2 The AFD target band during base load operations is +3%, -3% (not applicable for this cycle).

2.5.3 The AFD target band is +5%, -5% for a cycle average accumulated burnup ≥0.0 MWD/MTU.

2.6 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specification 3.2.2)

$$F_Q(Z) \leq \frac{CF_Q}{P} * K(Z) \qquad \text{for } P > 0.5$$

$$F_Q(Z) \leq 2 * CF_Q * K(Z) \qquad \text{for } P \leq 0.5$$

where: $P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

2.6.1 $CF_Q = 2.15$ for Westinghouse Fuel.

2.6.2 K(Z) is provided in Figure 4 for Westinghouse Fuel.

2.7 Nuclear Enthalpy Rise Hot Channel Factor - $F^N_{\Delta H}$ (Specification 3/4.2.3)

$F^N_{\Delta H} \leq CF_{\Delta H} * (1 + PF_{\Delta H} *(1-P))$

where: $P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

2.7.1 $CF_{\Delta H}$ = 1.49 for Westinghouse Fuel.

2.7.2 $PF_{\Delta H}$ = 0.3

2.8 Allowable Power Level - APL (Specification 3.2.6)

$$APL = \text{min over Z for } \frac{CF_Q * K(Z)}{F_Q(Z) * V(Z) * F_P} \text{ x } 100\%$$

2.8.1 V(Z) is provided in Table 1 for ±5% AFD target band

2.8.2 CF_Q and K(Z) are provided in COLR Sections 2.6.1 and 2.6.2, respectively

2.8.3 The following table shows F_P values which correspond to F_Q margin decreases that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to adjust APL as per Surveillance Requirement 4.2.6.2. A 1.02 penalty factor shall be used at all cycle burnups that are outside this range when F_Q is increasing.

Burnup (MWD/MTU)	Penalty Multiplier
1713	1.0200
1855	1.0211
1997	1.0250
2139	1.0283
2282	1.0308
2424	1.0327
2566	1.0338
2708	1.0343
2850	1.0342
2992	1.0335
3134	1.0324
3276	1.0309
3418	1.0291
3560	1.0271
3703	1.0250
3845	1.0229
3987	1.0211
4129	1.0200

The burnup range only covers where F_P exceeds 1.02. Linear interpolation is adequate for intermediate cycle burnups.

FIGURE 1

MODERATOR TEMPERATURE COEFFICIENT (MTC)

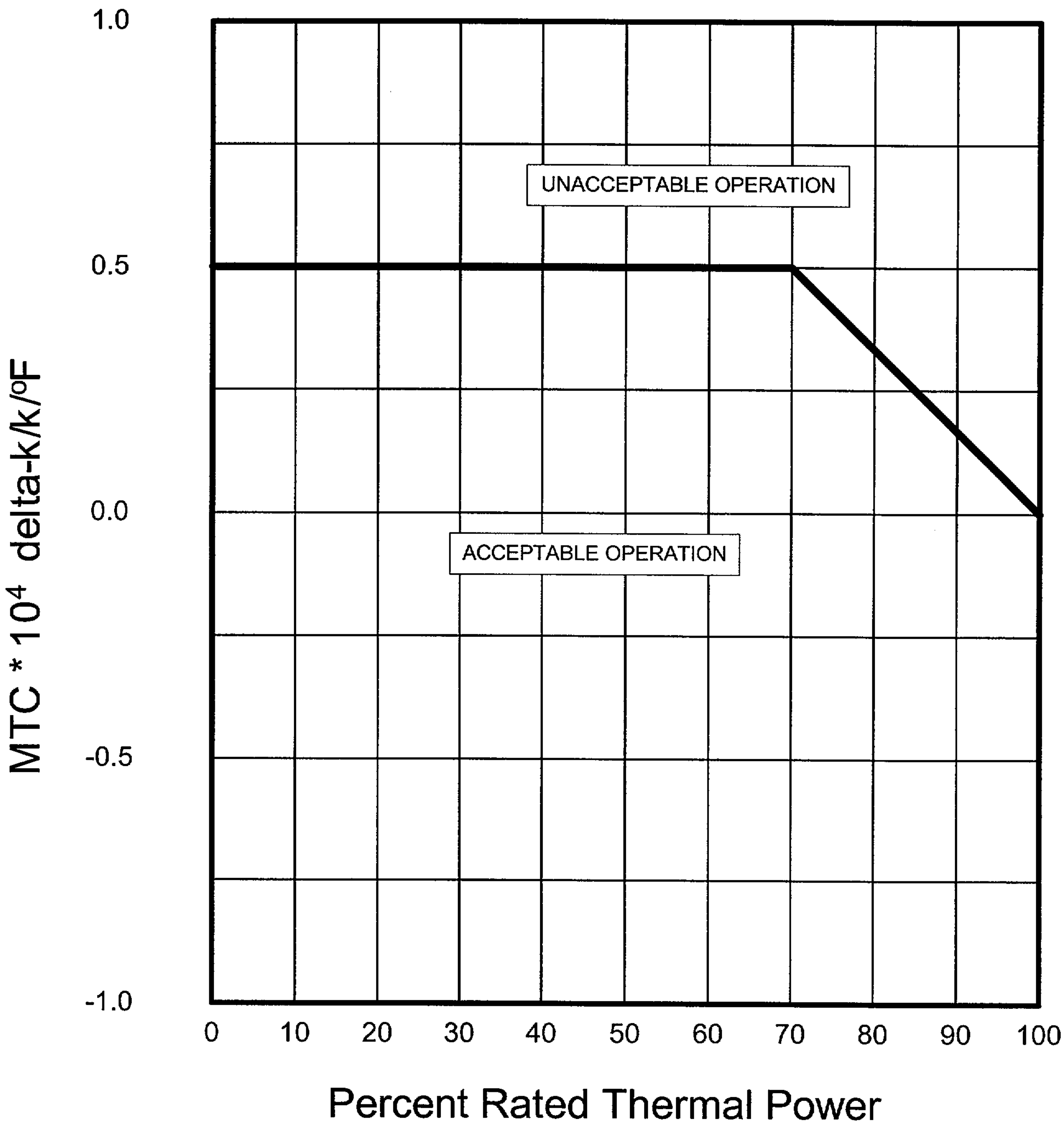

FIGURE 2

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

(FOUR LOOP OPERATION)

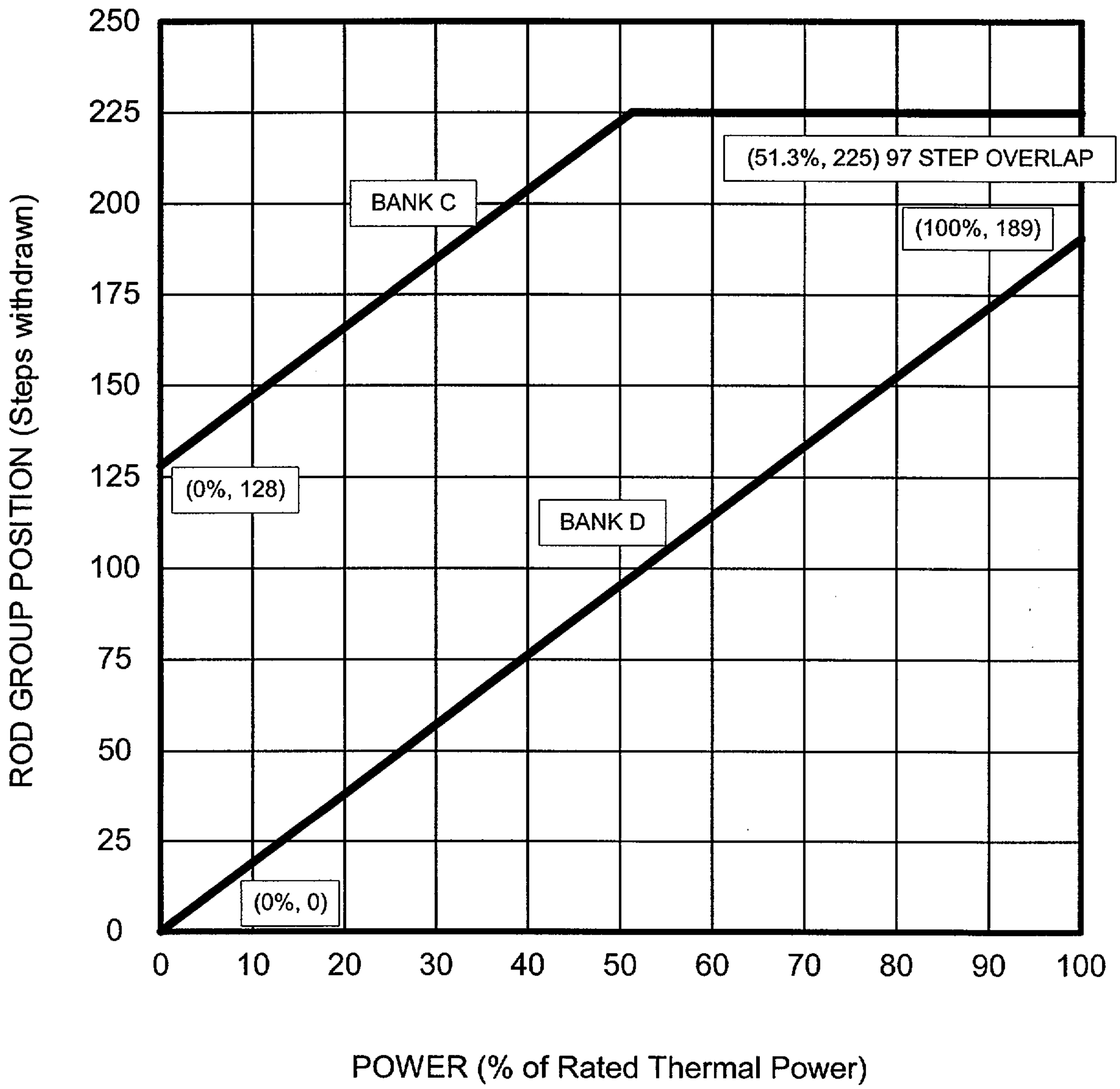

FIGURE 3

AXIAL FLUX DIFFERENCE AS A FUNCTION OF RATED THERMAL POWER

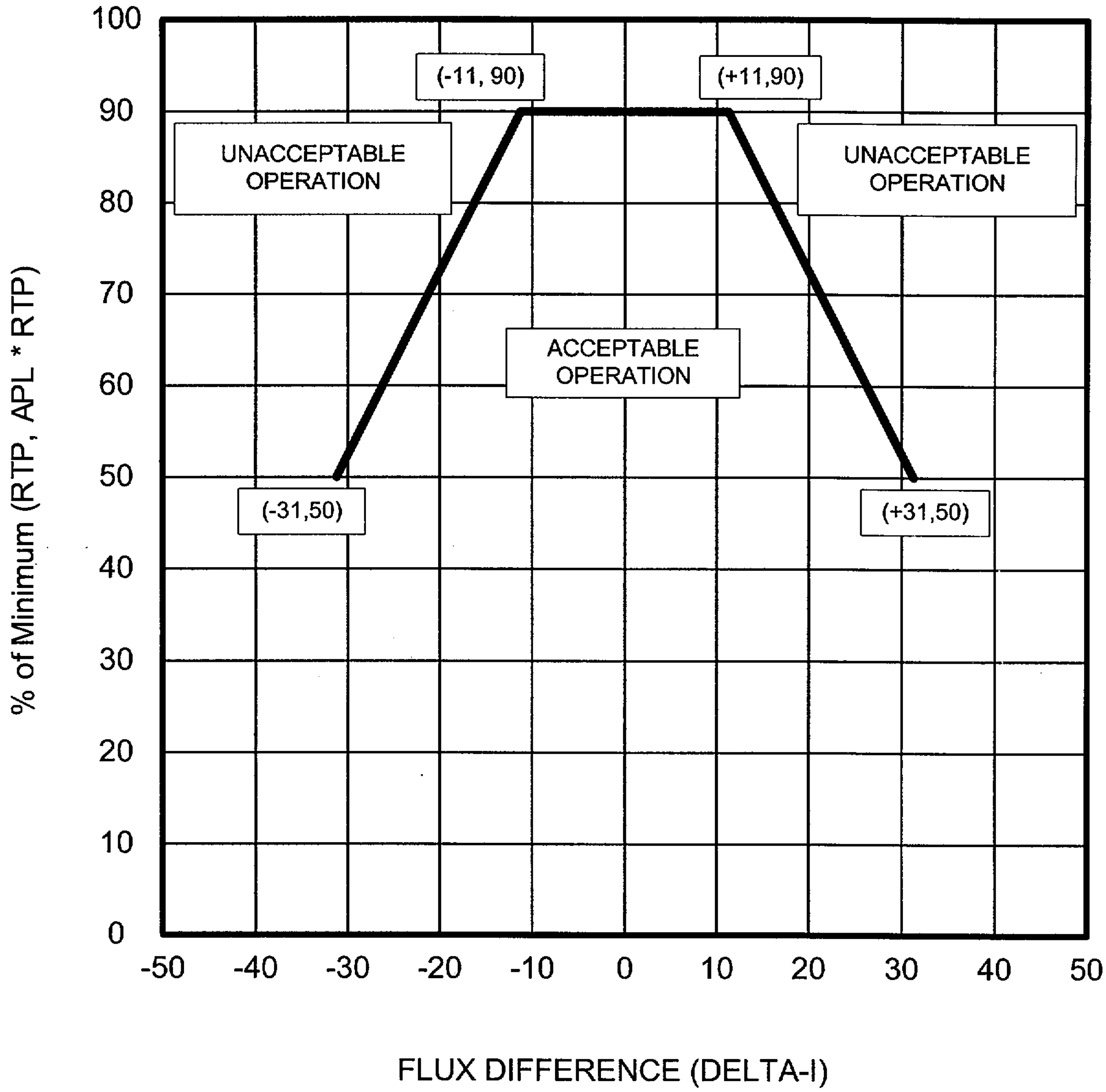

FIGURE 4

K(Z) – NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

(FOR WESTINGHOUSE FUEL)

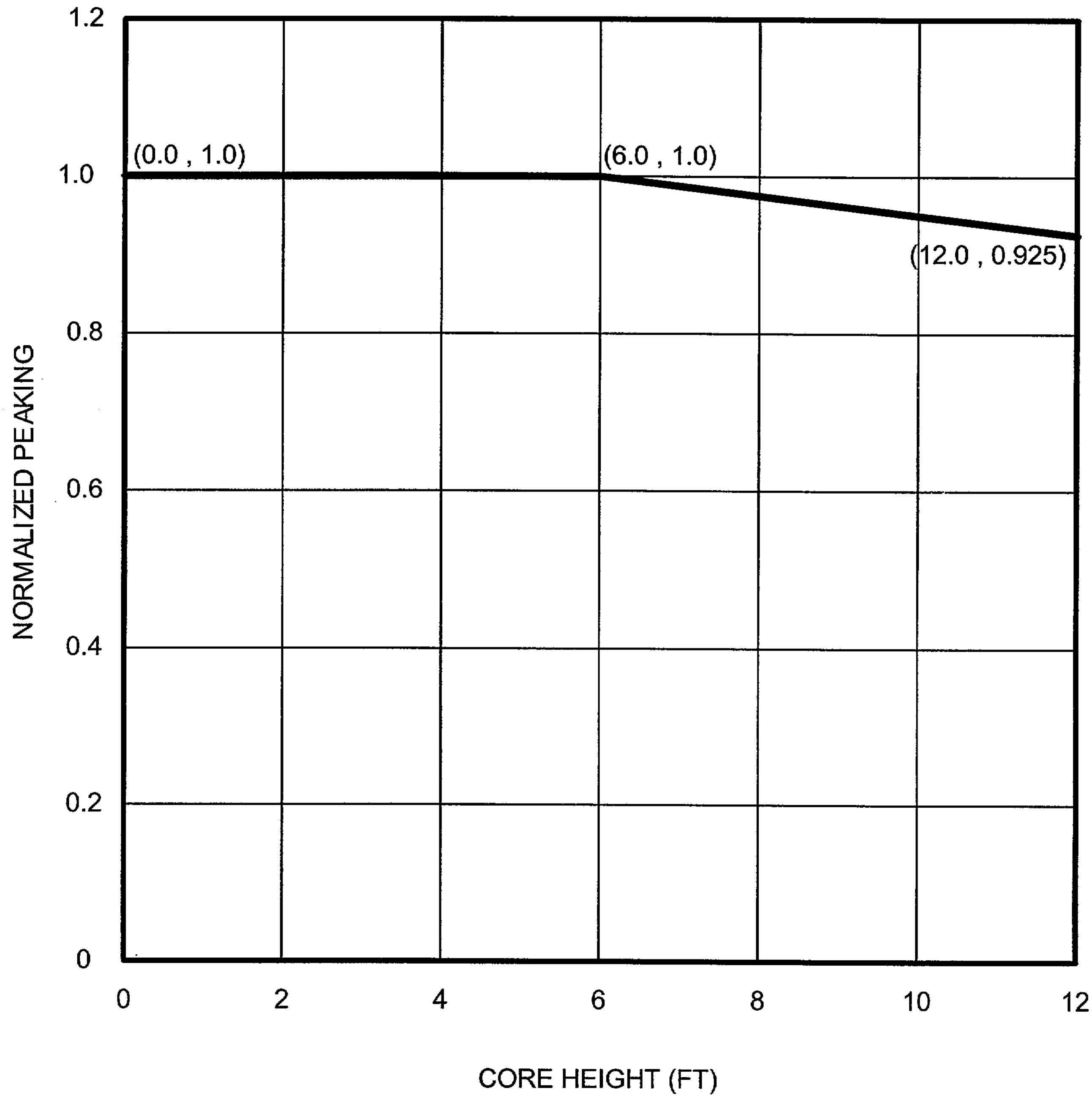

TABLE 1

DONALD C. COOK UNIT 1 CYCLE 17

V(Z) FUNCTION

	Height	Burnup (MWD/MTU)											
PT	(FT.)	150.	1000.	2000.	4000.	6000.	8000.	10000.	12000.	14000.	16000.	18000.	19442.
1	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	0.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2000	1.1043	1.1041	1.1040	1.1044	1.1057	1.1077	1.1105	1.1142	1.1187	1.1240	1.1290	1.1323
8	1.4000	1.1033	1.1032	1.1033	1.1039	1.1052	1.1071	1.1098	1.1132	1.1174	1.1222	1.1267	1.1298
9	1.6000	1.1021	1.1021	1.1023	1.1031	1.1044	1.1063	1.1088	1.1120	1.1157	1.1200	1.1240	1.1268
10	1.8000	1.1006	1.1008	1.1011	1.1020	1.1033	1.1052	1.1074	1.1102	1.1135	1.1172	1.1207	1.1231
11	2.0000	1.0989	1.0991	1.0995	1.1006	1.1020	1.1037	1.1057	1.1081	1.1108	1.1139	1.1167	1.1187
12	2.2000	1.0969	1.0973	1.0978	1.0989	1.1003	1.1018	1.1036	1.1055	1.1077	1.1100	1.1123	1.1139
13	2.4000	1.0946	1.0951	1.0957	1.0970	1.0983	1.0997	1.1011	1.1026	1.1042	1.1058	1.1073	1.1085
14	2.6000	1.0922	1.0928	1.0935	1.0948	1.0960	1.0972	1.0983	1.0994	1.1003	1.1012	1.1021	1.1028
15	2.8000	1.0897	1.0904	1.0911	1.0924	1.0936	1.0945	1.0953	1.0958	1.0962	1.0963	1.0965	1.0968
16	3.0000	1.0872	1.0879	1.0887	1.0900	1.0910	1.0917	1.0921	1.0921	1.0918	1.0912	1.0908	1.0905
17	3.2000	1.0848	1.0855	1.0863	1.0875	1.0884	1.0889	1.0890	1.0887	1.0879	1.0868	1.0859	1.0854
18	3.4000	1.0832	1.0837	1.0842	1.0851	1.0857	1.0861	1.0863	1.0862	1.0858	1.0852	1.0847	1.0844
19	3.6000	1.0831	1.0831	1.0830	1.0831	1.0834	1.0839	1.0845	1.0854	1.0864	1.0877	1.0889	1.0896
20	3.8000	1.0841	1.0835	1.0829	1.0822	1.0821	1.0826	1.0837	1.0855	1.0880	1.0911	1.0939	1.0957
21	4.0000	1.0856	1.0846	1.0836	1.0824	1.0820	1.0826	1.0841	1.0866	1.0900	1.0944	1.0983	1.1009
22	4.2000	1.0871	1.0858	1.0845	1.0828	1.0823	1.0829	1.0848	1.0878	1.0921	1.0976	1.1025	1.1057
23	4.4000	1.0884	1.0868	1.0853	1.0832	1.0826	1.0832	1.0853	1.0889	1.0940	1.1005	1.1062	1.1100
24	4.6000	1.0896	1.0879	1.0862	1.0841	1.0835	1.0843	1.0866	1.0906	1.0961	1.1031	1.1093	1.1134
25	4.8000	1.0905	1.0888	1.0871	1.0849	1.0843	1.0852	1.0877	1.0919	1.0978	1.1053	1.1119	1.1163
26	5.0000	1.0912	1.0894	1.0877	1.0855	1.0849	1.0859	1.0885	1.0930	1.0991	1.1070	1.1140	1.1186
27	5.2000	1.0917	1.0898	1.0880	1.0858	1.0853	1.0863	1.0891	1.0937	1.1001	1.1081	1.1153	1.1201
28	5.4000	1.0918	1.0899	1.0881	1.0859	1.0854	1.0865	1.0893	1.0940	1.1005	1.1087	1.1160	1.1208
29	5.6000	1.0915	1.0896	1.0879	1.0857	1.0852	1.0863	1.0892	1.0939	1.1004	1.1086	1.1160	1.1208
30	5.8000	1.0908	1.0890	1.0873	1.0851	1.0846	1.0857	1.0886	1.0933	1.0997	1.1078	1.1151	1.1199
31	6.0000	1.0897	1.0879	1.0863	1.0842	1.0837	1.0848	1.0876	1.0921	1.0984	1.1064	1.1135	1.1181
32	6.2000	1.0881	1.0864	1.0848	1.0827	1.0823	1.0833	1.0860	1.0903	1.0964	1.1040	1.1108	1.1153
33	6.4000	1.0861	1.0844	1.0828	1.0809	1.0804	1.0814	1.0839	1.0881	1.0939	1.1012	1.1078	1.1121
34	6.6000	1.0839	1.0822	1.0806	1.0785	1.0780	1.0790	1.0815	1.0857	1.0916	1.0989	1.1055	1.1098
35	6.8000	1.0818	1.0799	1.0780	1.0756	1.0747	1.0755	1.0780	1.0822	1.0882	1.0959	1.1027	1.1072
36	7.0000	1.0785	1.0772	1.0761	1.0746	1.0744	1.0754	1.0777	1.0812	1.0861	1.0923	1.0978	1.1014
37	7.2000	1.0770	1.0766	1.0764	1.0763	1.0769	1.0780	1.0798	1.0822	1.0852	1.0889	1.0923	1.0945
38	7.4000	1.0792	1.0790	1.0788	1.0786	1.0789	1.0796	1.0806	1.0821	1.0840	1.0863	1.0884	1.0898
39	7.6000	1.0805	1.0804	1.0803	1.0802	1.0803	1.0806	1.0812	1.0819	1.0829	1.0840	1.0851	1.0858
40	7.8000	1.0814	1.0814	1.0814	1.0814	1.0813	1.0813	1.0812	1.0811	1.0810	1.0809	1.0808	1.0803
42	8.2000	1.0819	1.0815	1.0811	1.0804	1.0800	1.0799	1.0799	1.0803	1.0808	1.0816	1.0823	1.0827
43	8.4000	1.0812	1.0809	1.0805	1.0801	1.0798	1.0799	1.0801	1.0807	1.0815	1.0826	1.0835	1.0841
44	8.6000	1.0801	1.0801	1.0802	1.0805	1.0809	1.0816	1.0825	1.0835	1.0848	1.0862	1.0876	1.0885
45	8.8000	1.0815	1.0814	1.0813	1.0815	1.0821	1.0831	1.0844	1.0863	1.0885	1.0911	1.0936	1.0952
46	9.0000	1.0842	1.0840	1.0838	1.0839	1.0846	1.0857	1.0875	1.0898	1.0927	1.0961	1.0992	1.1013
47	9.2000	1.0864	1.0864	1.0866	1.0874	1.0885	1.0901	1.0921	1.0946	1.0975	1.1008	1.1040	1.1061
48	9.4000	1.0891	1.0896	1.0901	1.0915	1.0931	1.0950	1.0971	1.0996	1.1023	1.1053	1.1081	1.1101
49	9.6000	1.0938	1.0943	1.0950	1.0964	1.0980	1.0999	1.1019	1.1042	1.1066	1.1093	1.1118	1.1136
50	9.8000	1.0984	1.0990	1.0996	1.1011	1.1027	1.1045	1.1065	1.1086	1.1109	1.1134	1.1158	1.1175
51	10.0000	1.1027	1.1032	1.1039	1.1054	1.1070	1.1088	1.1107	1.1128	1.1151	1.1176	1.1199	1.1216
52	10.2000	1.1068	1.1073	1.1080	1.1095	1.1111	1.1128	1.1147	1.1168	1.1189	1.1212	1.1235	1.1250
53	10.4000	1.1105	1.1111	1.1118	1.1133	1.1149	1.1166	1.1183	1.1202	1.1222	1.1244	1.1264	1.1279
54	10.6000	1.1139	1.1144	1.1151	1.1165	1.1180	1.1197	1.1214	1.1233	1.1253	1.1275	1.1295	1.1310
55	10.8000	1.1168	1.1173	1.1180	1.1193	1.1208	1.1224	1.1242	1.1260	1.1280	1.1302	1.1323	1.1337
56	11.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	12.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Top and bottom 10% of core excluded as per Technical Specifications.

Donald C. Cook Nuclear Plant
Unit 2 Cycle 12

Core Operating Limits Report
Revision 2

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for the Donald C. Cook Nuclear Plant Unit 2 Cycle 12 has been prepared in accordance with the requirements of Technical Specification 6.9.1.9.

The Technical Specifications affected by this report are listed below:

3/4.1.1.4	Moderator Temperature Coefficient (MTC)
3/4.1.3.1	Movable Control Assemblies Group Height
3/4.1.3.4	Rod Drop Time
3/4.1.3.5	Shutdown Rod Insertion Limit
3/4.1.3.6	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference (AFD)
3/4.2.2	Heat Flux Hot Channel Factor ($F_Q(Z)$)
3/4.2.3	Nuclear Enthalpy Hot Channel Factor - ($F^N_{\Delta H}$)
3/4.2.6	Allowable Power Level (APL)

2.0 OPERATING LIMITS

The cycle-specific parameter limits listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.9.1.9.

2.1 Moderator Temperature Coefficient (Technical Specification 3/4.1.1.4)

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO-MTC shall be less positive than or equal to the value given in Figure 1.

The EOL/ARO/RTP-MTC shall be less negative than or equal to -4.40E-4 $\Delta k/k/°F$.

This limit is based on a T_{avg} program with HFP vessel T_{avg} of 571.5 °F to 576.5 °F
where:

ARO stands for All Rods Out
BOL stands for Beginning of Cycle Life
EOL stands for End of Cycle Life
RTP stands for Rated Thermal Power
HFP stands for Hot Full Thermal Power

2.1.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to -3.50E-4 $\Delta k/k/°F$ at a HFP vessel T_{avg} of 571.5 °F to 576.5 °F

2.2 Rod Drop Time Drop Height (Specification 3/4.1.3.4)

2.2.1 All rods shall be dropped from 225 steps.

2.3 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.3.1 The shutdown rods shall be withdrawn to at least 225 steps.

2.4 Control Rod Insertion Limits (Specifications 3/4.1.3.6 and 3/4.1.3.1)

2.4.1 The control rod banks shall be limited in physical insertion as shown in Figure 2.
2.4.2 Successive Control Banks shall overlap by 97 steps. The sequence for Control Bank withdrawal shall be Control Bank A, Control Bank B, Control Bank C, and Control Bank D.

2.5 Axial Flux Difference (Specification 3/4.2.1)

2.5.1 The Allowable Operation Limits are provided in Figure 3.
2.5.2 The Axial Flux Difference (AFD) target band during base load operations is +3%, -3% (not applicable for this cycle).
2.5.3 The AFD target band is +5%, -5% for a cycle average accumulated burnup $\geq$0.0 MWD/MTU.

2.6 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specification 3.2.2)

$$F_Q(Z) \leq \frac{CF_Q}{P} * K(Z) \qquad \text{for } P > 0.5$$

$$F_Q(Z) \leq 2 * CF_Q * K(Z) \qquad \text{for } P \leq 0.5$$

where: $$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

2.6.1 $CF_Q = 2.335$
2.6.2 K(Z) is provided in Figure 4

2.7 Nuclear Enthalpy Rise Hot Channel Factor – $F^N_{\Delta H}$ (Specification 3/4.2.3)

$$F^N_{\Delta H} \leq CF_{\Delta H} * (1 + PF_{\Delta H} *(1-P))$$

where: $P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

2.7.1 $CF_{\Delta H} = 1.56$
2.7.2 $PF_{\Delta H} = 0.3$

2.8 Allowable Power Level - APL (Specification 3.2.6)

$$APL = \text{min over Z for } \frac{CF_Q * K(Z)}{F_Q(Z) * V(Z) * F_P} \times 100\%$$

2.8.1 V(Z) is provided in Table 1 for ± 5% AFD target band

2.8.2 CF_Q and K(Z) are provided in COLR Sections 2.6.1 and 2.6.2, respectively

2.8.3 The following table shows F_P values which correspond to F_Q margin decreases that are greater than 2% per 31 Effective Full Power Days (EFPD). These values shall be used to adjust APL as per Surveillance Requirement 4.2.6.2. A 1.02 penalty factor shall be used at all cycle burnups that are outside this range.

Cycle Burnup (MWD/MTU)	F_P Penalty Multiplier
0	1.0404
150	1.0404
311	1.0563
472	1.0583
633	1.0567
794	1.0548
955	1.0524
1116	1.0494
1277	1.0459
1438	1.0418
1599	1.0374
1760	1.0326
1921	1.0275
2082	1.0224
2243	1.0200

The burnup range only covers where F_P exceeds 1.02. Linear interpolation is adequate for intermediate cycle burnups.

Figure 1
MODERATOR TEMPERATURE COEFFICIENT (MTC) LIMITS

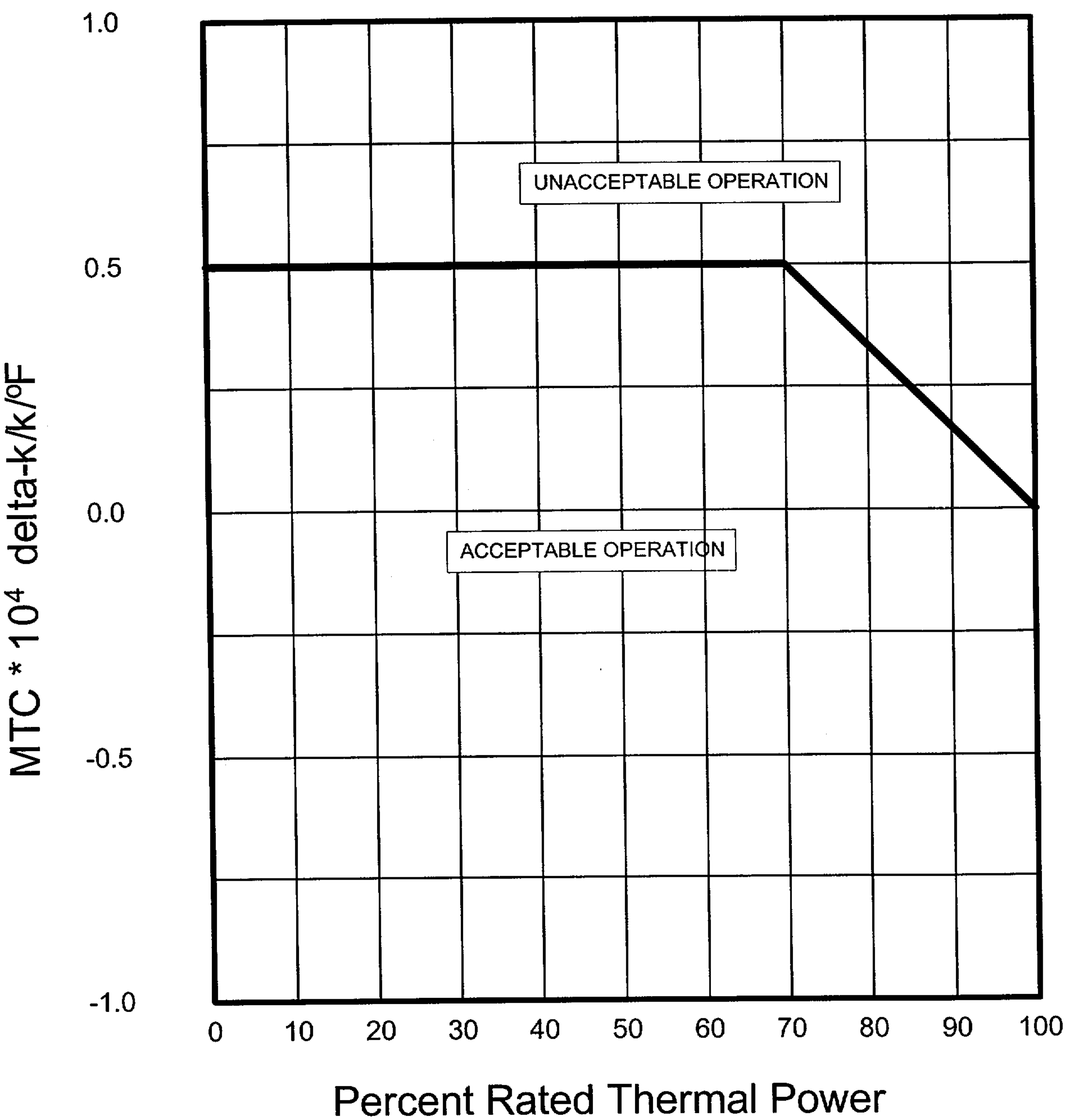

Figure 2
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER FOUR-LOOP OPERATION

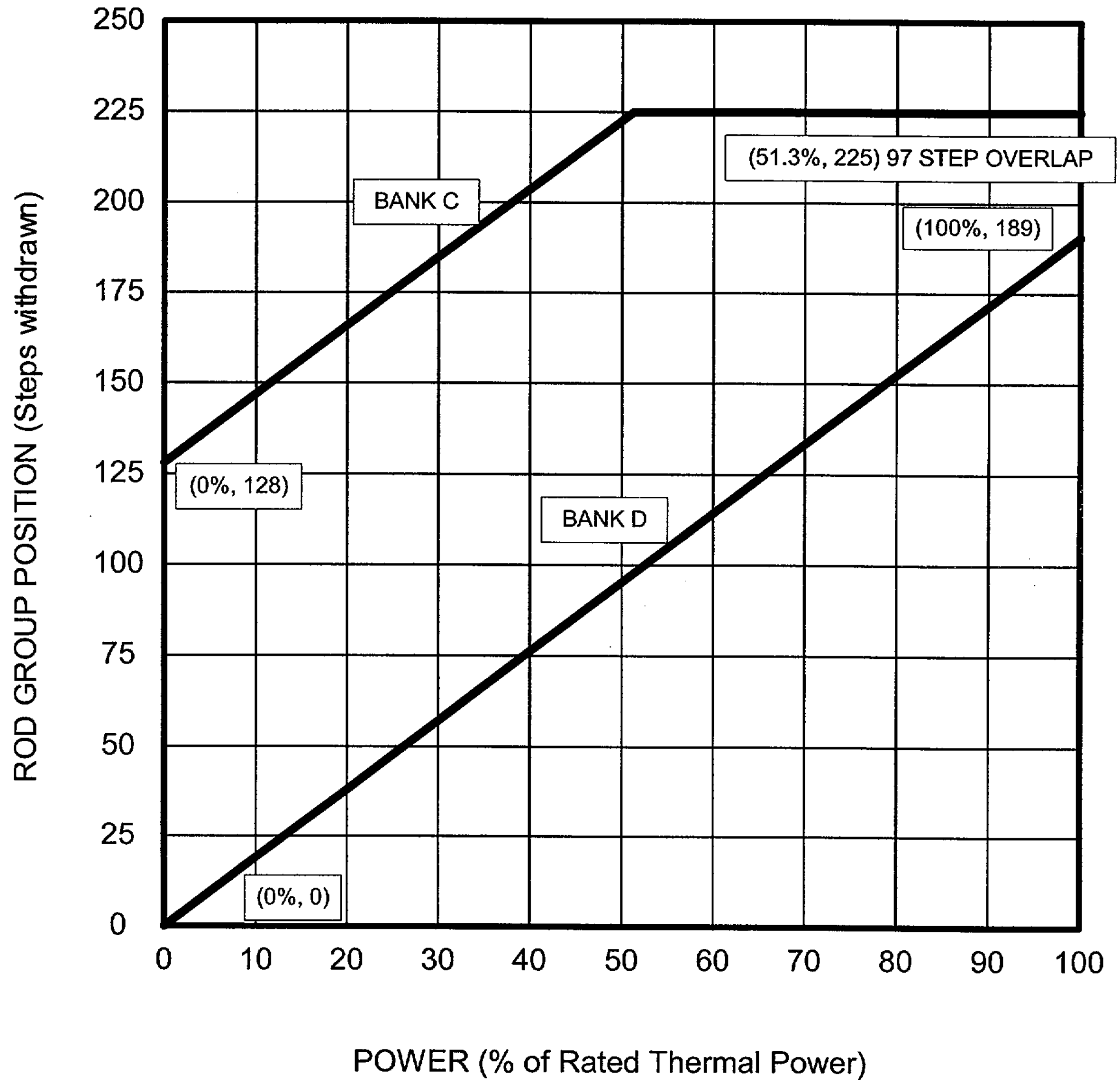

Figure 3
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER (RTP)

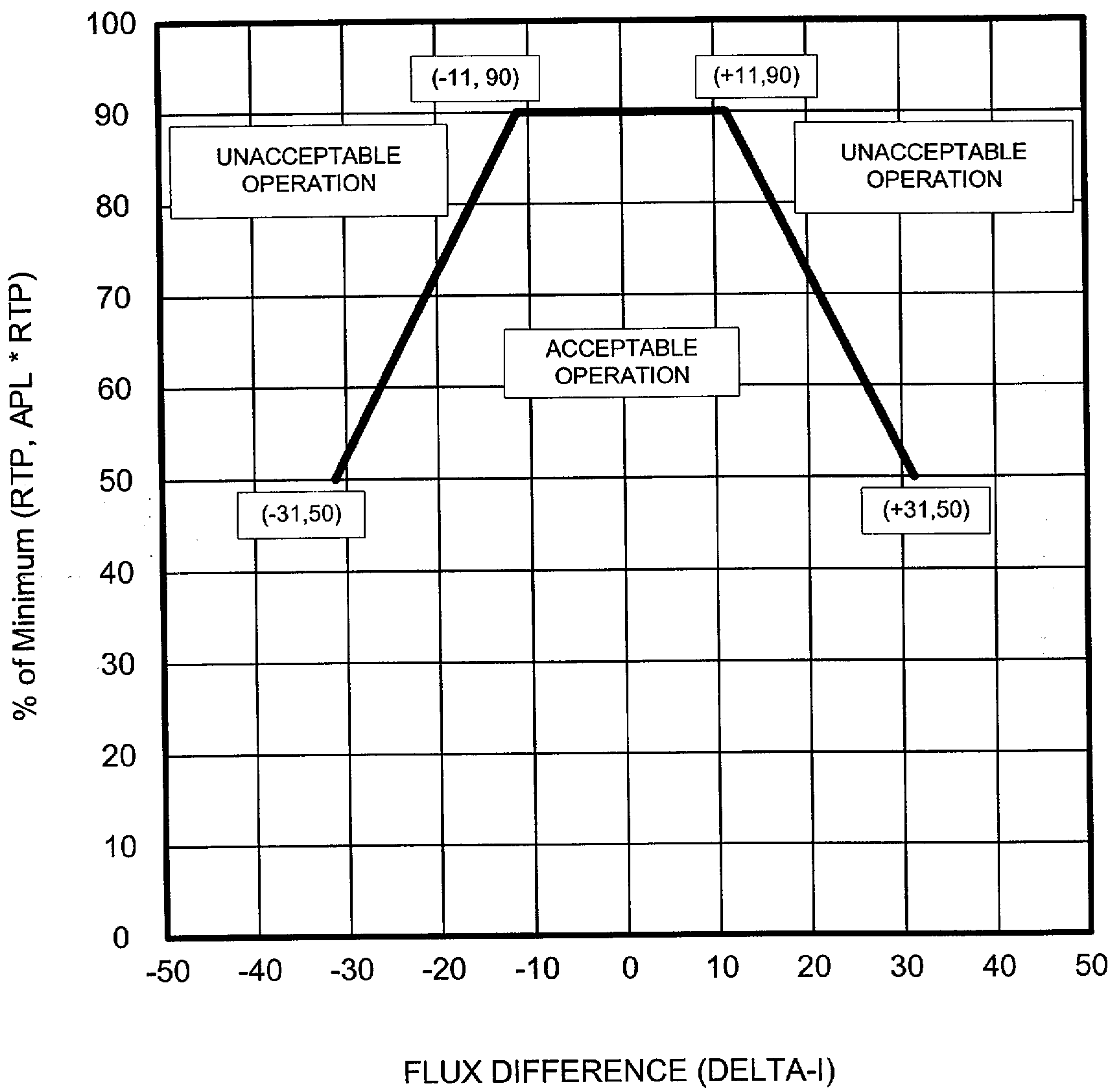

Figure 4
K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

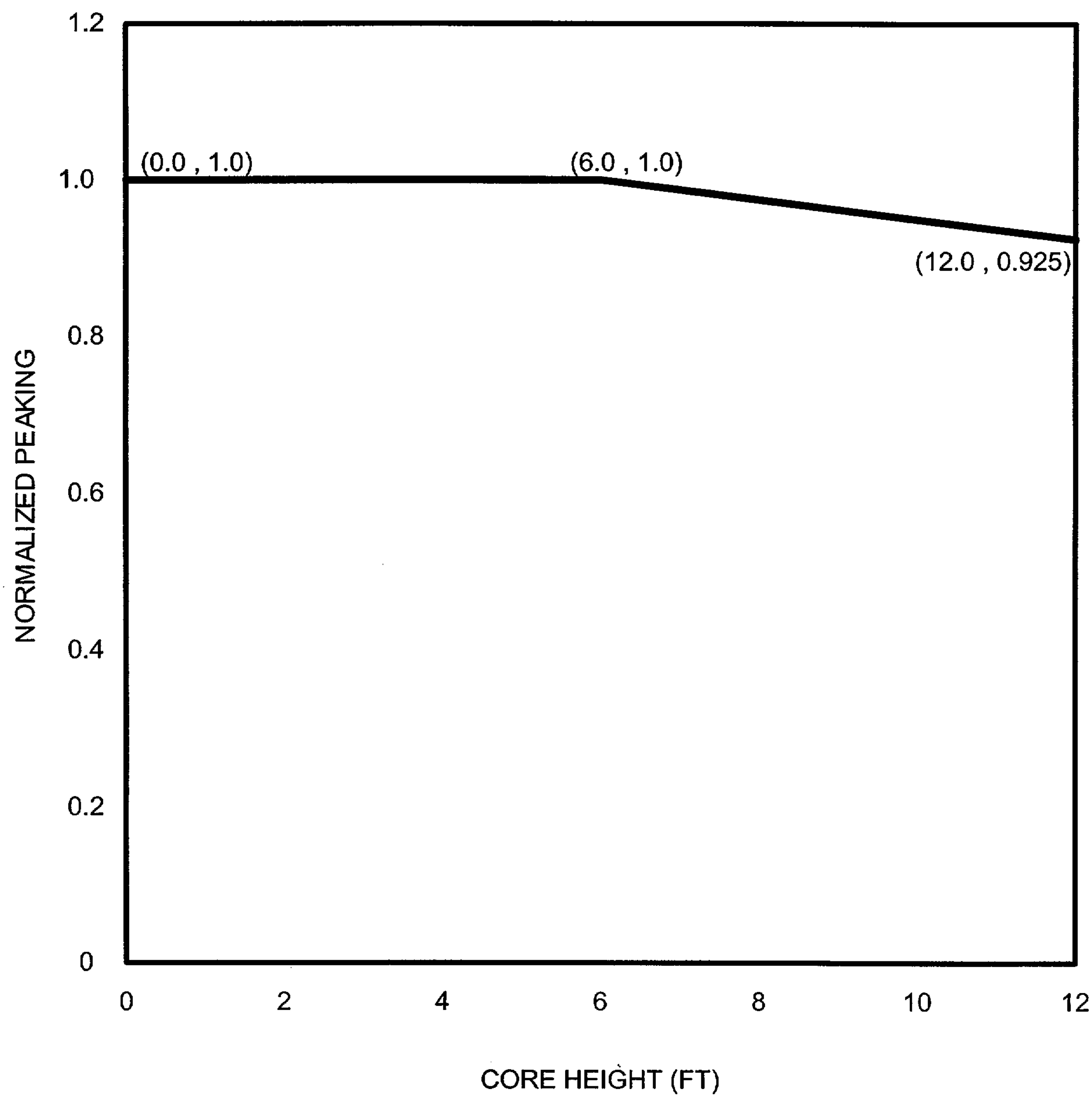

Table 1
Donald C. Cook Unit 2 Cycle 12
IRI Mitigation LP, 3411 MWt, As-Burned Cycle 11
V(Z) Function

	Height	Burnup (MWD/MTU)												
PT	(FT.)	150	1000	2000	3000	4000	6000	8000	10000	12000	14000	16000	18000	22860
1	.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2000	1.1070	1.0976	1.0888	1.0831	1.0811	1.0857	1.0968	1.1090	1.1184	1.1255	1.1316	1.1382	1.1560
8	1.4000	1.1062	1.0976	1.0896	1.0845	1.0827	1.0871	1.0973	1.1087	1.1174	1.1240	1.1298	1.1360	1.1525
9	1.6000	1.1051	1.0975	1.0903	1.0857	1.0842	1.0883	1.0977	1.1081	1.1161	1.1221	1.1274	1.1330	1.1481
10	1.8000	1.1037	1.0970	1.0908	1.0869	1.0856	1.0893	1.0978	1.1070	1.1141	1.1195	1.1242	1.1292	1.1426
11	2.0000	1.1020	1.0963	1.0911	1.0878	1.0868	1.0902	1.0975	1.1055	1.1117	1.1164	1.1204	1.1246	1.1362
12	2.2000	1.0999	1.0954	1.0912	1.0887	1.0879	1.0909	1.0970	1.1037	1.1089	1.1127	1.1160	1.1194	1.1289
13	2.4000	1.0976	1.0943	1.0912	1.0893	1.0888	1.0913	1.0963	1.1016	1.1056	1.1086	1.1110	1.1135	1.1207
14	2.6000	1.0951	1.0929	1.0908	1.0897	1.0896	1.0916	1.0953	1.0992	1.1021	1.1041	1.1056	1.1071	1.1118
15	2.8000	1.0922	1.0912	1.0903	1.0899	1.0900	1.0916	1.0941	1.0965	1.0983	1.0994	1.1002	1.1008	1.1035
16	3.0000	1.0893	1.0894	1.0896	1.0899	1.0903	1.0914	1.0926	1.0936	1.0942	1.0943	1.0941	1.0936	1.0936
17	3.2000	1.0862	1.0874	1.0886	1.0896	1.0902	1.0908	1.0908	1.0906	1.0905	1.0904	1.0902	1.0899	1.0895
18	3.4000	1.0842	1.0860	1.0878	1.0890	1.0897	1.0896	1.0886	1.0877	1.0877	1.0884	1.0895	1.0909	1.0928
19	3.6000	1.0844	1.0860	1.0874	1.0884	1.0886	1.0877	1.0861	1.0854	1.0865	1.0895	1.0937	1.0989	1.1072
20	3.8000	1.0854	1.0863	1.0871	1.0876	1.0874	1.0859	1.0843	1.0842	1.0867	1.0916	1.0985	1.1069	1.1208
21	4.0000	1.0865	1.0867	1.0869	1.0868	1.0863	1.0848	1.0837	1.0844	1.0882	1.0947	1.1035	1.1143	1.1324
22	4.2000	1.0875	1.0870	1.0866	1.0861	1.0855	1.0843	1.0841	1.0859	1.0909	1.0987	1.1089	1.1214	1.1430
23	4.4000	1.0883	1.0871	1.0861	1.0853	1.0846	1.0839	1.0847	1.0879	1.0940	1.1029	1.1142	1.1279	1.1522
24	4.6000	1.0889	1.0871	1.0854	1.0842	1.0835	1.0834	1.0853	1.0897	1.0969	1.1067	1.1190	1.1337	1.1605
25	4.8000	1.0896	1.0871	1.0848	1.0832	1.0824	1.0828	1.0857	1.0913	1.0995	1.1101	1.1232	1.1387	1.1676
26	5.0000	1.0902	1.0870	1.0841	1.0822	1.0813	1.0821	1.0860	1.0926	1.1016	1.1130	1.1266	1.1428	1.1734
27	5.2000	1.0904	1.0868	1.0834	1.0812	1.0802	1.0815	1.0862	1.0936	1.1033	1.1151	1.1292	1.1459	1.1777
28	5.4000	1.0903	1.0863	1.0826	1.0802	1.0792	1.0808	1.0861	1.0942	1.1044	1.1166	1.1309	1.1479	1.1806
29	5.6000	1.0899	1.0855	1.0816	1.0790	1.0779	1.0799	1.0857	1.0943	1.1048	1.1172	1.1317	1.1488	1.1819
30	5.8000	1.0890	1.0844	1.0801	1.0774	1.0764	1.0786	1.0849	1.0939	1.1047	1.1171	1.1315	1.1484	1.1815
31	6.0000	1.0877	1.0829	1.0784	1.0755	1.0745	1.0769	1.0837	1.0930	1.1038	1.1161	1.1303	1.1468	1.1794
32	6.2000	1.0859	1.0809	1.0763	1.0733	1.0723	1.0749	1.0819	1.0914	1.1022	1.1142	1.1279	1.1438	1.1757
33	6.4000	1.0836	1.0784	1.0737	1.0707	1.0697	1.0725	1.0797	1.0893	1.0998	1.1114	1.1245	1.1396	1.1702
34	6.6000	1.0807	1.0755	1.0706	1.0676	1.0666	1.0695	1.0768	1.0864	1.0967	1.1077	1.1199	1.1341	1.1631
35	6.8000	1.0770	1.0721	1.0677	1.0649	1.0639	1.0666	1.0735	1.0824	1.0920	1.1024	1.1140	1.1274	1.1547
36	7.0000	1.0762	1.0703	1.0650	1.0615	1.0604	1.0635	1.0711	1.0805	1.0896	1.0985	1.1080	1.1189	1.1422
37	7.2000	1.0784	1.0713	1.0646	1.0603	1.0588	1.0622	1.0708	1.0806	1.0890	1.0962	1.1031	1.1109	1.1292
38	7.4000	1.0810	1.0734	1.0663	1.0618	1.0603	1.0643	1.0737	1.0838	1.0915	1.0970	1.1016	1.1065	1.1202
39	7.6000	1.0831	1.0757	1.0687	1.0643	1.0629	1.0670	1.0763	1.0862	1.0933	1.0980	1.1016	1.1052	1.1167
40	7.8000	1.0848	1.0776	1.0708	1.0665	1.0652	1.0694	1.0785	1.0881	1.0946	1.0986	1.1013	1.1038	1.1134
41	8.0000	1.0861	1.0790	1.0724	1.0683	1.0670	1.0713	1.0803	1.0895	1.0955	1.0987	1.1004	1.1017	1.1090
42	8.2000	1.0869	1.0801	1.0737	1.0697	1.0685	1.0728	1.0816	1.0904	1.0958	1.0982	1.0990	1.0992	1.1046
43	8.4000	1.0872	1.0806	1.0744	1.0706	1.0696	1.0738	1.0824	1.0908	1.0955	1.0971	1.0969	1.0958	1.0989
44	8.6000	1.0870	1.0806	1.0747	1.0710	1.0700	1.0743	1.0827	1.0907	1.0948	1.0955	1.0942	1.0918	1.0925
45	8.8000	1.0864	1.0803	1.0747	1.0712	1.0704	1.0747	1.0830	1.0910	1.0955	1.0969	1.0965	1.0952	1.0977
46	9.0000	1.0872	1.0807	1.0747	1.0711	1.0704	1.0753	1.0846	1.0937	1.0991	1.1012	1.1014	1.1008	1.1050
47	9.2000	1.0897	1.0819	1.0746	1.0704	1.0696	1.0762	1.0882	1.0996	1.1059	1.1079	1.1071	1.1049	1.1082
48	9.4000	1.0920	1.0826	1.0740	1.0689	1.0682	1.0763	1.0908	1.1045	1.1120	1.1140	1.1126	1.1095	1.1125
49	9.6000	1.0962	1.0843	1.0733	1.0668	1.0656	1.0751	1.0927	1.1093	1.1182	1.1205	1.1187	1.1147	1.1181
50	9.8000	1.1004	1.0854	1.0714	1.0630	1.0611	1.0723	1.0936	1.1138	1.1246	1.1273	1.1250	1.1202	1.1242
51	10.000	1.1042	1.0873	1.0717	1.0622	1.0600	1.0722	1.0955	1.1178	1.1298	1.1329	1.1305	1.1254	1.1299
52	10.200	1.1078	1.0904	1.0743	1.0645	1.0622	1.0747	1.0986	1.1216	1.1339	1.1371	1.1348	1.1297	1.1346
53	10.400	1.1109	1.0930	1.0764	1.0662	1.0638	1.0766	1.1012	1.1248	1.1375	1.1409	1.1386	1.1335	1.1388
54	10.600	1.1135	1.0952	1.0782	1.0677	1.0653	1.0782	1.1033	1.1273	1.1403	1.1439	1.1417	1.1367	1.1424
55	10.800	1.1157	1.0970	1.0797	1.0691	1.0665	1.0796	1.1050	1.1294	1.1425	1.1461	1.1437	1.1386	1.1441
56	11.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.200	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.400	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.600	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.800	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	12.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000