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Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

Operated by Nuclear Management Company LLC

September 19, 2000
NG-00-1501

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station 0-P1-17
Washington, DC 20555-0001

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Technical Specification Change Request (TSCR-014) – Increase Standby Liquid Control Minimum Boron Concentration

File: A-117

In accordance with the Code of Federal Regulations, Title 10, Sections 50.59 and 50.90, the Nuclear Management Company, LLC (NMC) hereby requests revision to the Technical Specifications (TS) for the Duane Arnold Energy Center (DAEC). This submittal requests revising the Standby Liquid Control (SLC) boron solution requirements to ensure a minimum boron concentration of 660 parts per million (ppm) in the reactor.

The SLC system is designed to inject a quantity of boron that produces a minimum boron concentration of 600 ppm in the reactor core. DAEC TS Surveillance Requirements (SR) require the available volume and concentration of the boron solution in the SLC tank to fall within the limits of TS Figure 3.1.7-1. Figure 3.1.7-1 consists of a graph of acceptable volume and concentration values which would result in a minimum boron concentration of 600 ppm in the reactor. This TS Change Request proposes replacing Figure 3.1.7-1 with a similar graph, however, the new graph will consist of acceptable volume and concentration values which would result in a minimum boron concentration of 660 ppm in the reactor.

Beginning with Cycle 18, the DAEC plans to pursue the use of advanced fuel designs, increased power level and extended cycle length. A minimum boron concentration of 660 ppm in the reactor is sufficient to initiate and maintain reactor subcriticality for an equilibrium core of GE 14 fuel, operating at 1912 MWth with 24 month cycles and bounds all currently planned future core designs. A General Electric analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II), NEDE 24011-P-A, provides the basis for the increase in minimum boron concentration. A summary of that analysis is included as Attachment 5.

A001

This application has been reviewed by the DAEC Operations Committee and the Safety Committee. A copy of this submittal, along with the evaluation of No Significant Hazards Consideration, is being forwarded to our appointed state official pursuant to 10 CFR Section 50.91.

The DAEC plans to begin loading GE-14 fuel during Refuel Outage 17 scheduled to begin in April, 2001. Therefore, to ensure implementation prior to the scheduled start of Cycle 18, we request approval of this application no later than April 15, 2001 with a 30 day implementation period.

Should you have any questions regarding this matter, please contact this office.

This letter is true and accurate to the best of my knowledge and belief.

Nuclear Management Company, LLC

By Gary Van Middlesworth
Gary Van Middlesworth
DAEC Site General Manager

State of Iowa
(County) of Linn

Signed and sworn to before me on this 19th day of September, 2000,
by Gary Van Middlesworth.

Nancy S. Franck
Notary Public in and for the State of Iowa

NANCY S. FRANCK

9-28-01
Commission Expires

Attachments:
1) Evaluation Of Change Pursuant To 10 CFR Section 50.92
2) Safety Assessment
3) Proposed Change TSCR-014 To The Duane Arnold Energy Center Technical Specifications
4) Environmental Consideration
5) Basis For Increased Minimum Boron Concentration

cc: L. B. Swenzinski (w/a)
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J. Dyer (Region III) (w/a)
D. McGhee (State of Iowa) (w/a)
NRC Resident Office (w/a)

EVALUATION OF CHANGE PURSUANT TO 10 CFR SECTION 50.92

Background:

The safety objective of the Duane Arnold Energy Center (DAEC) Standby Liquid Control (SLC) system is to provide a backup method, independent of the control rods, to initiate and maintain reactor subcriticality as the nuclear system cools. Maintaining subcriticality ensures that the fuel barrier is not threatened by overheating in the improbable event that not enough of the control rods can be inserted to counteract the positive reactivity effects of a colder moderator.

The SLC system is designed to inject a quantity of boron that produces a minimum boron concentration of 600 parts per million (ppm) in the reactor core. An additional 25% of that quantity of boron is also injected to compensate for imperfect mixing, leakage and volume in other small piping connected to the reactor.

The design of the SLC system complies with the 10 CFR 50.62 requirements for Anticipated Transients Without Scram (ATWS). The current SLC boron solution design basis concentration requirement bounds that required for the ATWS rule. Thus, the SLC system will continue to comply with the 10 CFR 50.62 requirements when the use of advanced fuel designs, increased power level and extended cycle lengths are realized.

DAEC Technical Specifications (TS) Surveillance Requirement (SR) 3.1.7.1 requires that the available volume of boron solution in the SLC tank be within the limits of TS Figure 3.1.7-1. SR 3.1.7.5 requires the concentration of boron in solution be within the limits of Figure 3.1.7-1. Figure 3.1.7-1 consists of a graph of acceptable volume and concentration values which produce a minimum boron concentration of 600 ppm in the reactor. This TS Change Request replaces Figure 3.1.7-1 with a similar graph, however, the new graph will consist of acceptable volume and concentration values which would result in a minimum boron concentration of 660 ppm in the reactor. A General Electric analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II), NEDE 24011-P-A, provides the basis for the increase in minimum boron concentration. This analysis assumes DAEC operation with an equilibrium core of GE-14 fuel, operating at 1912 MWth with 24 month cycles, and bounds all planned future core designs.

A minor change to the title of Figure 3.1.7-1 is also proposed. Figure 3.1.7-1 is currently titled "GROSS VOLUME OF SOLUTION IN TANK". However, as discussed in the TS BASES, the gross volume in the tank is not available for injection into the reactor since the tank outlet is located above the bottom of the tank to prevent system plugging. During performance of the TS SR 3.1.7.1, the available volume (i.e., not the gross volume) must meet the requirements of Figure 3.1.7-1. Therefore, to correct a potential inconsistency, Figure 3.1.7-1 will be retitled "AVAILABLE VOLUME OF SOLUTION IN TANK" to be

consistent with the requirements of SR 3.1.7.1 as well as the TS BASES.

The TS BASES will also require revision to reflect the above changes. The BASES pages have been marked up and are included for information only. They will be revised per the TS BASES Control Program of TS 5.5.10, as part of implementation of the final approved License Amendment.

Nuclear Management Company, LLC, Docket No. 50-331
Duane Arnold Energy Center, Linn County, Iowa
Date of Amendment Request: September 19, 2000

Description of Amendment Request:

This proposed TS amendment will revise the SLC boron solution requirements to ensure a minimum boron concentration of 660 ppm in the reactor. This will be accomplished by replacing TS Figure 3.1.7-1.

An editorial change to the title of Figure 3.1.7-1 from "GROSS VOLUME OF SOLUTION IN TANK" to "AVAILABLE VOLUME OF SOLUTION IN TANK" is also proposed for clarity.

Basis for proposed No Significant Hazards Consideration:

The Commission has provided standards (10 CFR Section 50.92(c)) for determining whether a significant hazards consideration exists. A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

After reviewing this proposed amendment, we have concluded:

1. The proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The current TS SRs ensure acceptable SLC boron solution volume and concentration values which produce a minimum boron concentration of 600 ppm in the reactor. This proposed amendment revises the boron solution requirements to ensure a minimum boron concentration of 660 ppm in the reactor. A minimum boron concentration of 660 ppm in the reactor is sufficient to initiate and maintain reactor subcriticality as the nuclear system cools. The DAEC is currently pursuing the use of GE-14 fuel, power uprate to 1912 MWth and extended cycle length. Increasing the minimum boron concentration to 660 ppm in the reactor will provide adequate shutdown margin for these future core designs. A General Electric analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II),

NEDE 24011-P-A, provides the basis for the increase in minimum boron concentration. This analysis assumes DAEC operation with an equilibrium core of GE-14 fuel, operating at 1912 MWth with 24 month cycles and bounds all planned future core designs.

The concentration requirement of the SLC boron solution will continue to comply with the requirements of 10 CFR 50.62(c)(4).

The proposed editorial change to the title of TS Figure 3.1.7-1 provides clarity only and does not alter performance of TS SR 3.1.7.1 and SR 3.1.7.5.

Therefore, this proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

   Ensuring a minimum boron concentration of 660 ppm in the reactor will result in an increase in the acceptable minimum volume of boron solution in the SLC tank. The tank can accept the increased volume of boron solution. The tank low and high level alarms will be altered; these alarms alert the operator to take action in the event boron solution volume is decreasing or increasing, respectively. Increasing the volume in the SLC tank and increases to the low and high level alarm setpoints will have no effect on operator actions to maintain system operability. Revising the SLC boron solution requirements to ensure a minimum boron concentration of 660 ppm in the reactor cannot create a new or different kind of accident.

   The proposed editorial change to the title of TS Figure 3.1.7-1 provides consistent wording between the Figure, TS SR 3.1.7.1 and the TS BASES to avoid potential inconsistencies when determining the tank volume acceptability.

   Therefore this proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed amendment will not involve a significant reduction in a margin of safety.

   DAEC TS SRs ensure SLC boron solution volume and concentration values which produce a minimum boron concentration of 600 ppm in the reactor. This proposed amendment revises SLC boron solution requirements to ensure a minimum boron concentration of 660 ppm in the reactor. A boron concentration of 660 ppm in the reactor is sufficient to initiate and maintain reactor subcriticality as the nuclear system cools. The DAEC is currently pursuing the use of GE-14 fuel, power uprate to 1912 MWth and extended cycle length. A General Electric (GE) analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II), NEDE 24011-P-A, provides the basis for the increase in minimum

boron concentration. GE's analysis demonstrated that at a minimum boron concentration of 600 ppm in the reactor, the SLC shutdown margin was marginal with respect to the TS requirement for shutdown margin. At a minimum boron concentration of 660 ppm in the reactor, sufficient margin is maintained such that TS Section 3.1.1 will be met under all anticipated conditions. The GE analysis assumes DAEC operation with an equilibrium core of GE-14 fuel, operating at 1912 MWth with 24 month cycles and bounds all planned future core designs.

The concentration requirement of the SLC boron solution will continue to comply with the requirements of 10 CFR 50.62(c)(4).

The SLC system is designed to inject a quantity of boron that produces a minimum boron concentration of 600 ppm in the reactor. An additional 25% of that quantity of boron is also injected to compensate for imperfect mixing, leakage and volume in other small piping connected to the reactor. This margin will be maintained such that an additional 25% of the quantity of boron required to achieve a minimum boron concentration of 660 ppm in the reactor will also be injected. Therefore, this proposed amendment will not involve a significant reduction in a margin of safety.

The proposed editorial change to the title of TS Figure 3.1.7-1 provides consistent wording between the Figure, TS SR 3.1.7.1 and the TS BASES to avoid potential inconsistencies when determining tank volume acceptability.

Based upon the above, we have determined that the proposed amendment will not involve a significant hazards consideration.

Local Public Document Room Location: Cedar Rapids Public Library, 500 First Street SE, Cedar Rapids, Iowa 52401.

Attorney for Licensee: Al Gutterman; Morgan, Lewis & Bockius, 1800 M Street NW, Washington, D.C. 20036-5869.

SAFETY ASSESSMENT

By letter dated September 19, 2000, the Nuclear Management Company, LLC (NMC) submitted a request for revision of the Technical Specifications for the Duane Arnold Energy Center (DAEC). The DAEC Standby Liquid Control (SLC) system is designed to inject a quantity of boron that produces a minimum boron concentration of 600 parts per million (ppm) in the reactor. The proposed amendment will revise the SLC boron solution requirements to ensure a minimum boron concentration of 660 ppm in the reactor. This will be accomplished by revising TS Figure 3.1.7-1.

Background:

The safety objective of the SLC system is to provide a backup method, independent of the control rods, to initiate and maintain reactor subcriticality as the nuclear system cools. Maintaining subcriticality thus ensures that the fuel barrier is not threatened by overheating in the improbable event that not enough of the control rods can be inserted to counteract the positive reactivity effects of a colder moderator.

The SLC system is designed to inject a quantity of boron that produces a concentration of 600 ppm of boron in the reactor core. An additional 25% of that quantity of boron is also injected to compensate for imperfect mixing, leakage and volume in other small piping connected to the reactor.

The design of the SLC system complies with the 10 CFR 50.62 requirements for Anticipated Transients Without Scram (ATWS). The current SLC boron solution design basis concentration requirement bounds that required for the ATWS rule. Thus, the SLC system will continue to comply with the 10 CFR 50.62 requirements when the use of advanced fuel designs, increased power level and extended cycle lengths are realized.

DAEC TS Surveillance Requirement (SR) 3.1.7.1 requires that the available volume of boron solution in the SLC tank be within the limits of TS Figure 3.1.7-1. SR 3.1.7.5 requires the concentration of boron in solution be within the limits of Figure 3.1.7-1. Figure 3.1.7-1 consists of a graph of acceptable volume and concentration values which produce a minimum boron concentration of 600 ppm in the reactor. This TS Change Request proposes replacing Figure 3.1.7-1 with a similar graph, however, the new graph will consist of acceptable volume and concentration values which would result in a minimum boron concentration of 660 ppm in the reactor.

A minor change to the title of Figure 3.1.7-1 is also proposed. Figure 3.1.7-1 is currently titled "GROSS VOLUME OF SOLUTION IN TANK". However, as discussed in the TS BASES, the gross volume in the tank is not available for injection into the reactor since the tank outlet is located above the bottom of the tank to prevent system plugging. During performance of the TS SR 3.1.7.1, the available volume (i.e., not the gross volume) must meet the requirements of Figure 3.1.7-1. Therefore, to correct a potential inconsistency, Figure 3.1.7-1 will be retitled "AVAILABLE VOLUME OF SOLUTION IN TANK."

Basis for Change:

A minimum boron concentration of 660 ppm in the reactor is sufficient to initiate and maintain reactor subcriticality as the nuclear system cools. The DAEC is currently pursuing a power uprate to 1912 MWth as well as the use of GE-14 fuel and extended cycle length. Increasing the minimum boron concentration to 660 ppm in the reactor will provide adequate shutdown margin for these future core designs. A General Electric analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II), NEDE 24011-P-A, provides the basis for the increase in minimum boron concentration. This analysis assumes DAEC operation with an equilibrium core of GE-14 fuel, operating at 1912 MWth with 24 month cycles and bounds all planned future core designs.

The concentration requirement of the SLC boron solution will continue to comply with the requirements of 10 CFR 50.62(c)(4).

Therefore, we have concluded that the proposed amendment to the DAEC TS is acceptable.

PROPOSED CHANGE TSCR-014 TO THE DUANE ARNOLD ENERGY CENTER TECHNICAL SPECIFICATIONS

The holders of license DPR-49 for the Duane Arnold Energy Center (DAEC) propose to amend the Technical Specification Surveillance Requirement and BASES by deleting the referenced pages and replacing them with new pages. These changes to Surveillance Requirement (SR) 3.1.7 and its BASES reflect the proposed Technical Specifications (TS) amendment. The changes affect the SR and BASES for the Standby Liquid Control System.

SUMMARY OF TS CHANGES:

Page	Description of Change
3.1-23	Revise acceptable boron solution concentration and volume requirements of Figure 3.1.7-1. Retitle Figure 3.1.7-1 as "AVAILABLE VOLUME OF SOLUTION IN TANK"

SUMMARY OF TS BASES CHANGES (for information only):

Page	Description of Change
B 3.1-39	Revise description of minimum boron concentration to 660 parts per million. Editorial changes made to enhance clarity of the additional 25% boron added to the SLC tank.

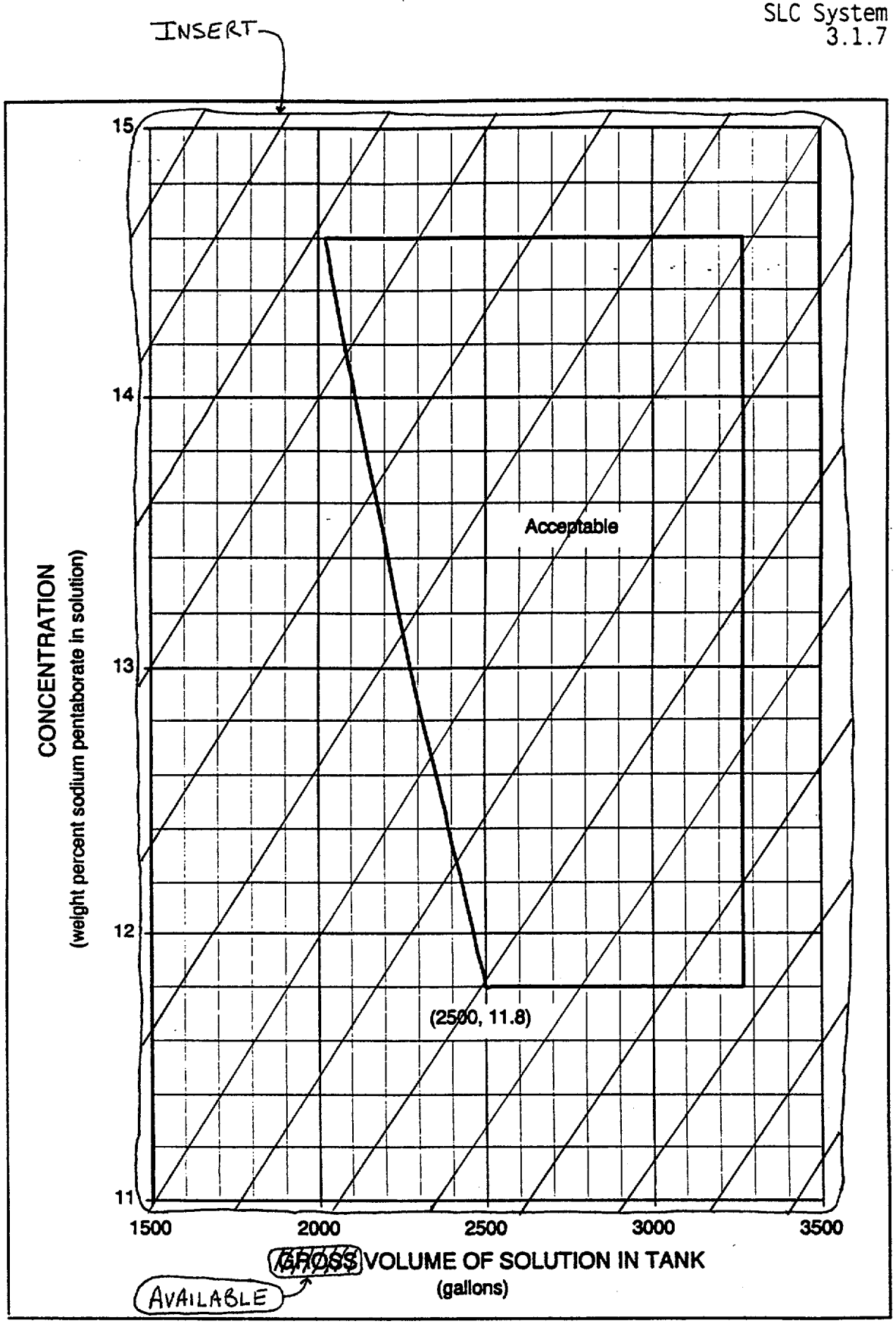
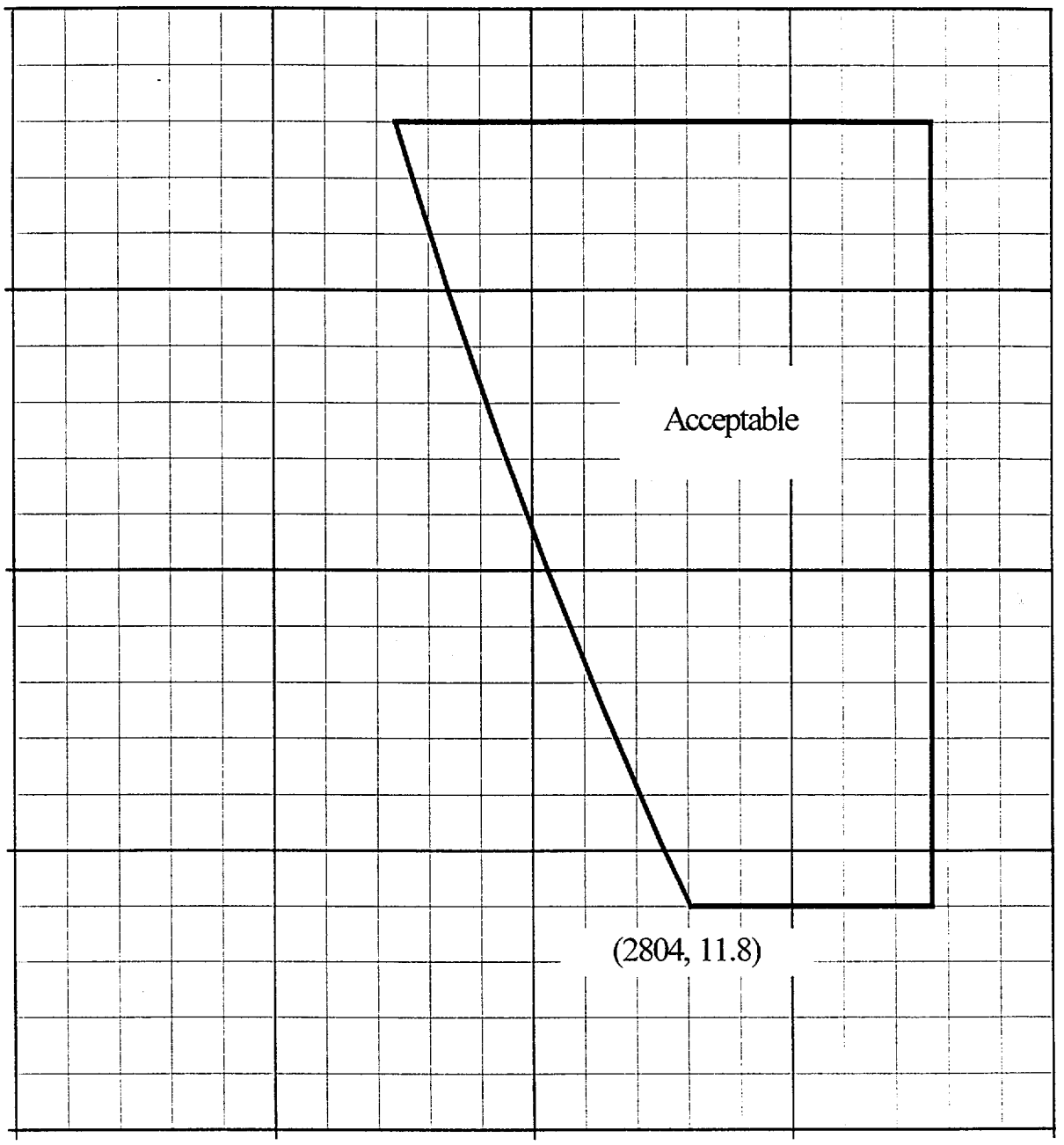


Figure 3.1.7-1 (page 1 of 1)
Sodium Pentaborate Solution Volume
Versus Concentration Requirements

INSERT FOR T.S. Figure 3.7.1-1



B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Standby Liquid Control (SLC) System

BASES

BACKGROUND

The SLC System is designed to provide the capability of bringing the reactor, at any time in a fuel cycle, from full power and minimum control rod inventory (which is at the peak of the xenon transient) to a subcritical condition with the reactor in the most reactive, xenon free state without taking credit for control rod movement. In addition, the SLC System is relied upon to satisfy the requirements of 10 CFR 50.62 (Ref. 1) on Anticipated Transient Without Scram (ATWS).

The SLC System consists of a boron solution storage tank, two positive displacement pumps, two explosive valves that are provided in parallel for redundancy, and associated piping and valves used to transfer borated water from the storage tank to the reactor pressure vessel (RPV). The borated solution is discharged near the bottom of the core shroud, where it then mixes with the cooling water rising through the core. A smaller tank containing demineralized water is provided for testing purposes.

APPLICABLE SAFETY ANALYSES

The SLC System is manually initiated from the main control room, as directed by the emergency operating procedures, if the operator believes the reactor cannot be shut down, or kept shut down, with the control rods. The SLC System is used in the event that enough control rods cannot be inserted to accomplish shutdown and cooldown in the normal manner. The SLC System injects borated water into the reactor core to add negative reactivity to compensate for all of the various reactivity effects that could occur during plant operations. To meet this objective, it is necessary to inject a quantity of boron, using both SLC pumps, which produces a concentration of 660 ppm of natural boron, in the reactor coolant at 70°F. To compensate for additional potential leakage and imperfect mixing in the reactor system, an amount of boron equal to 25% of the amount cited above is added (Ref. 2). The volume versus concentration limits in Figure 3.1.7-1 and the temperature versus concentration limits in Figure 3.1.7-2 are calculated

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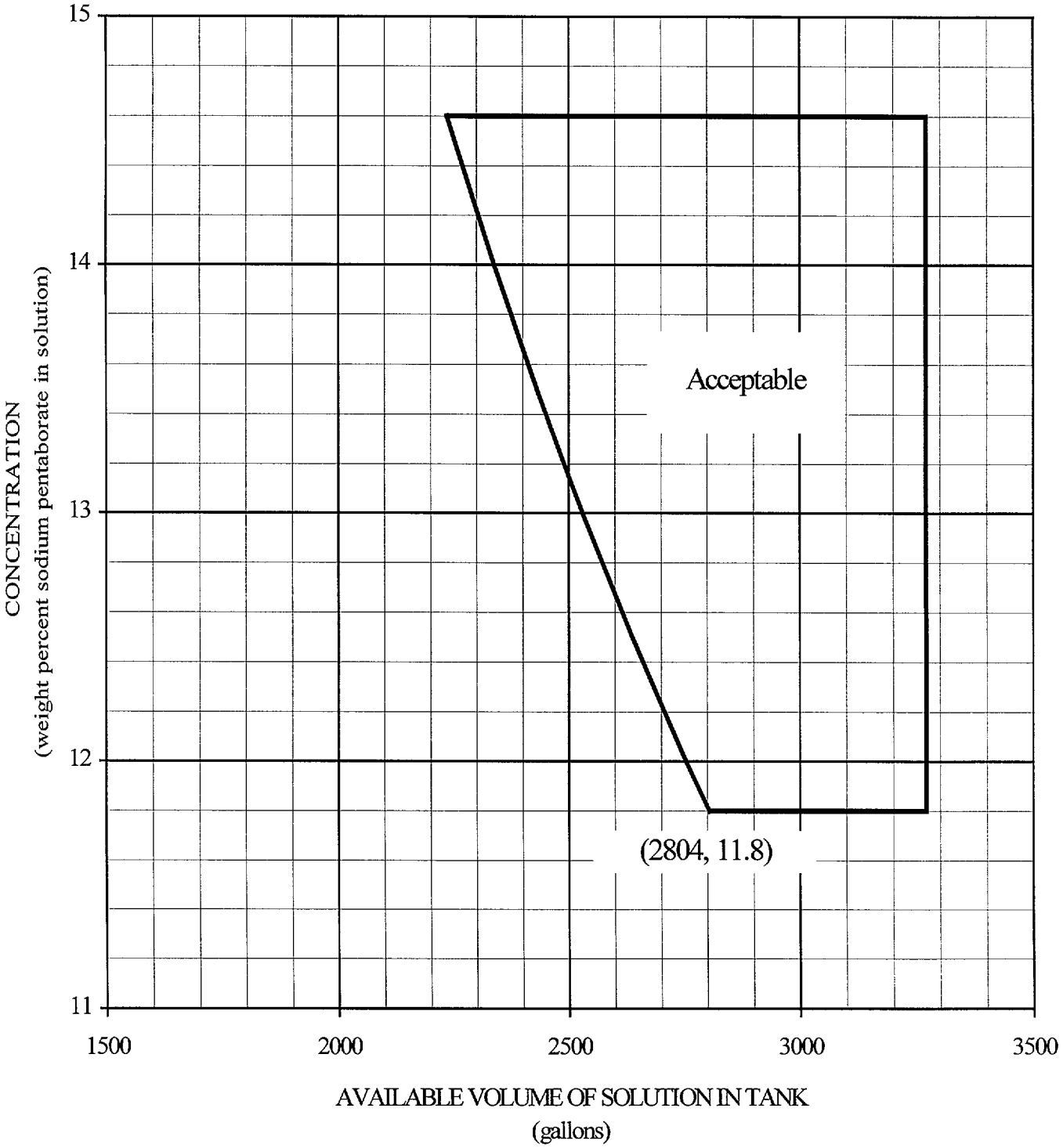

Figure 3.1.7-1 (page 1 of 1)
Sodium Pentaborate Solution Volume
Versus Concentration Requirements

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Standby Liquid Control (SLC) System

BASES

BACKGROUND

The SLC System is designed to provide the capability of bringing the reactor, at any time in a fuel cycle, from full power and minimum control rod inventory (which is at the peak of the xenon transient) to a subcritical condition with the reactor in the most reactive, xenon free state without taking credit for control rod movement. In addition, the SLC System is relied upon to satisfy the requirements of 10 CFR 50.62 (Ref. 1) on Anticipated Transient Without Scram (ATWS).

The SLC System consists of a boron solution storage tank, two positive displacement pumps, two explosive valves that are provided in parallel for redundancy, and associated piping and valves used to transfer borated water from the storage tank to the reactor pressure vessel (RPV). The borated solution is discharged near the bottom of the core shroud, where it then mixes with the cooling water rising through the core. A smaller tank containing demineralized water is provided for testing purposes.

APPLICABLE SAFETY ANALYSES

The SLC System is manually initiated from the main control room, as directed by the emergency operating procedures, if the operator believes the reactor cannot be shut down, or kept shut down, with the control rods. The SLC System is used in the event that enough control rods cannot be inserted to accomplish shutdown and cooldown in the normal manner. The SLC System injects borated water into the reactor core to add negative reactivity to compensate for all of the various reactivity effects that could occur during plant operations. To meet this objective, it is necessary to inject a quantity of boron, using both SLC pumps, which produces a concentration of 660 ppm of natural boron, in the reactor coolant at 70°F. To compensate for potential leakage and imperfect mixing in the reactor system, an additional amount of boron equal to 25% of the amount cited above is added (Ref. 2). The volume versus concentration limits in Figure 3.1.7-1 and the temperature versus concentration limits in Figure 3.1.7-2 are calculated

(continued)

ENVIRONMENTAL CONSIDERATION

10 CFR Section 51.22(c)(9) identifies certain licensing and regulatory actions which are eligible for categorical exclusion from the requirement to perform an environmental assessment. A proposed amendment to an operating license for a facility requires no environmental assessment if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant hazards consideration; (2) result in a significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and (3) result in a significant increase in individual or cumulative occupational radiation exposure. The Nuclear Management Company, LLC (NMC) has reviewed this request and determined that the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9). Pursuant to 10 CFR Section 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the amendment. The basis for this determination follows:

Basis

The change meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9) for the following reasons:

1. As demonstrated in Attachment 1 to this letter, the proposed amendment does not involve a significant hazards consideration.

2. There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite. The proposed amendment revises the Standby Liquid Control boron solution requirements to ensure a minimum boron concentration of 660 parts per million in the reactor. The SLC tank is equipped with a high level alarm which provides protection against tank overflow. In the unlikely event the SLC tank would overflow, the overflow would be contained in a curbed area without a drain. Therefore, no significant change in the types or significant increase in the amounts of any effluents will be released offsite.

3. There is no significant increase in individual or cumulative occupational radiation exposure. The proposed amendment will revise the Standby Liquid Control boron solution requirements to ensure a minimum boron concentration of 660 parts per million in the reactor. Since boron does not contribute to radiation exposure, this change will not significantly increase individual or cumulative occupational radiation exposure.

BASIS FOR INCREASED MINIMUM BORON CONCENTRATION

A General Electric (GE) analysis, using the approved methods described in Revision 14 of General Electric Standard Application for Reactor Fuel (GESTAR II), NEDE 24011-P-A, provides the basis for the increase in minimum boron concentration.

This analysis concluded that the current Standby Liquid Control (SLC) system minimum boron concentration of 600 parts per million (ppm) in the reactor, at 20°C is insufficient to satisfy the SLC system shutdown margin design requirement. As stated in the BASES of the Duane Arnold Energy Center (DAEC) Technical Specifications (TS) 3.1.7 (Standby Liquid Control System), "The SLC System injects borated water into the reactor core to add negative reactivity to compensate for all of the various reactivity effects that could occur during plant operations. To meet this objective, it is necessary to inject a quantity of boron, using both SLC pumps, which produces a concentration of 600 ppm of natural boron, in the reactor coolant at 70°F." The GE analysis identified that an increase in the capability of the SLC system would be required in order to ensure adequate SLC system shutdown margin for the equilibrium core of GE-14 fuel, operating at 1912 MWth with 24 month cycles. Due to the higher uranium enrichment in the GE-14 fuel necessary to achieve the longer cycle length and the power uprated energy, the minimum boron concentration of 600 ppm in the reactor must be increased to 660 ppm to maintain the SLC system design basis, as stated in the TS BASES above. This increase in minimum boron concentration is bounding for the upcoming cycle, which utilizes GE-10, GE-12 and GE-14 fuel designs, and for all currently planned future core designs.

GE's analysis demonstrated that at a minimum boron concentration of 600 ppm in the reactor, the SLC shutdown margin was marginal (0.4%Δk/k) with respect to the TS requirement for shutdown margin (TS 3.1.1) of 0.38%Δk/k. At a minimum boron concentration of 660 ppm in the reactor, sufficient margin is maintained (> 1.0%Δk/k) such that TS 3.1.1 will be met under all anticipated conditions, as stated in the BASES 3.1.7.