EXHIBIT A

REACTIVITY CONTROL SYSTEMS

3/4.1.5 STANDBY LIQUID CONTROL SYSTEM

LIMITING CONDITION FOR OPERATION

3.1.5 The standby liquid control system shall be OPERABLE.

APPLICABILITY: OPERATIONAL CONDITIONS 1, 2, and 5*

ACTION:

a. In OPERATIONAL CONDITION 1 or 2:

1. With one pump and/or one explosive valve inoperable, restore the inoperable pump and/or explosive valve to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours.

2. With the standby liquid control system otherwise inoperable, restore the system to OPERABLE status within 8 hours or be in at least HOT SHUTDOWN within the next 12 hours.

b. In OPERATIONAL CONDITION 5*:

1. With one pump and/or one explosive valve inoperable, restore the inoperable pump and/or explosive valve to OPERABLE status within 30 days or insert all insertable control rods within the next hour.

2. With the standby liquid control system otherwise inoperable, insert all insertable control rods within 1 hour.

SURVEILLANCE REQUIREMENTS

4.1.5 The standby liquid control system shall be demonstrated OPERABLE:

a. At least once per 24 hours by verifying that:

1. The available volume and temperature of the sodium pentaborate solution is within the limits of Figures 3.1.5-1 and 3.1.5-2.

2. The heat tracing circuit is OPERABLE by determining the temperature of the pump suction piping to be greater than or equal to 65°F.

*With any control rod withdrawn. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2.

SURVEILLANCE REQUIREMENTS (Continued)

b. At least once per 31 days by:

1. Verifying the continuity of the explosive charge.

2. Determining that the available net weight of sodium pentaborate is greater than or equal to 1171 lbs and the concentration of boron in solution is within the limits of Figure 3.1.5-2 by chemical analysis.*

3. Verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

4. Starting both pumps and recirculating demineralized water to the test tank.

c. Demonstrating that, when tested pursuant to Specification 4.0.5, the minimum flow requirement of 41.2 gpm at a pressure of greater than or equal to 1220 psig is met.

d. At least once per 18 months during shutdown by:

1. Initiating one of the standby liquid control system loops, including an explosive valve, and verifying that a flow path from the pumps to the reactor pressure vessel is available by pumping demineralized water into the reactor vessel. The replacement charge for the explosive valve shall be from the same manufactured batch as the one fired or from another batch which has been certified by having one of that batch successfully fired. Both injection loops shall be tested in 36 months. No replacement squib valve shall be used that will exceed its shelf life or useful life, as applicable during its inservice period.

2. Verifying that the relief valve does not actuate during recirculation to the test tank.

3. Demonstrating that all heat traced piping is unblocked by pumping from the storage tank to the test tank and then draining and flushing the piping with demineralized water.**

4. Demonstrating that the storage tank heaters are OPERABLE by verifying the expected temperature rise of the sodium pentaborate solution in the storage tank after the heaters are energized.

*This test shall also be performed anytime water or boron is added to the solution or when the solution temperature drops below the limit of Figure 3.1.5-1.

**This test shall also be performed whenever both heat tracing circuits have been found to be inoperable and may be performed by any series of sequential, overlapping or total flow path steps such that the entire flow path is included.

EXHIBIT C

GENERAL ELECTRIC CO   TEL NO.   408 925 7341 Jan 26.87 11:50 P.07

GENERAL ELECTRIC CO.

Nuclear Energy Business Operations

ENGINEERING CALCULATION SHEET

NUMBER ______________ DATE 1/22/87

SUBJECT SHOREHAM SLCS ______ BY ______ SHEET ____ OF ____

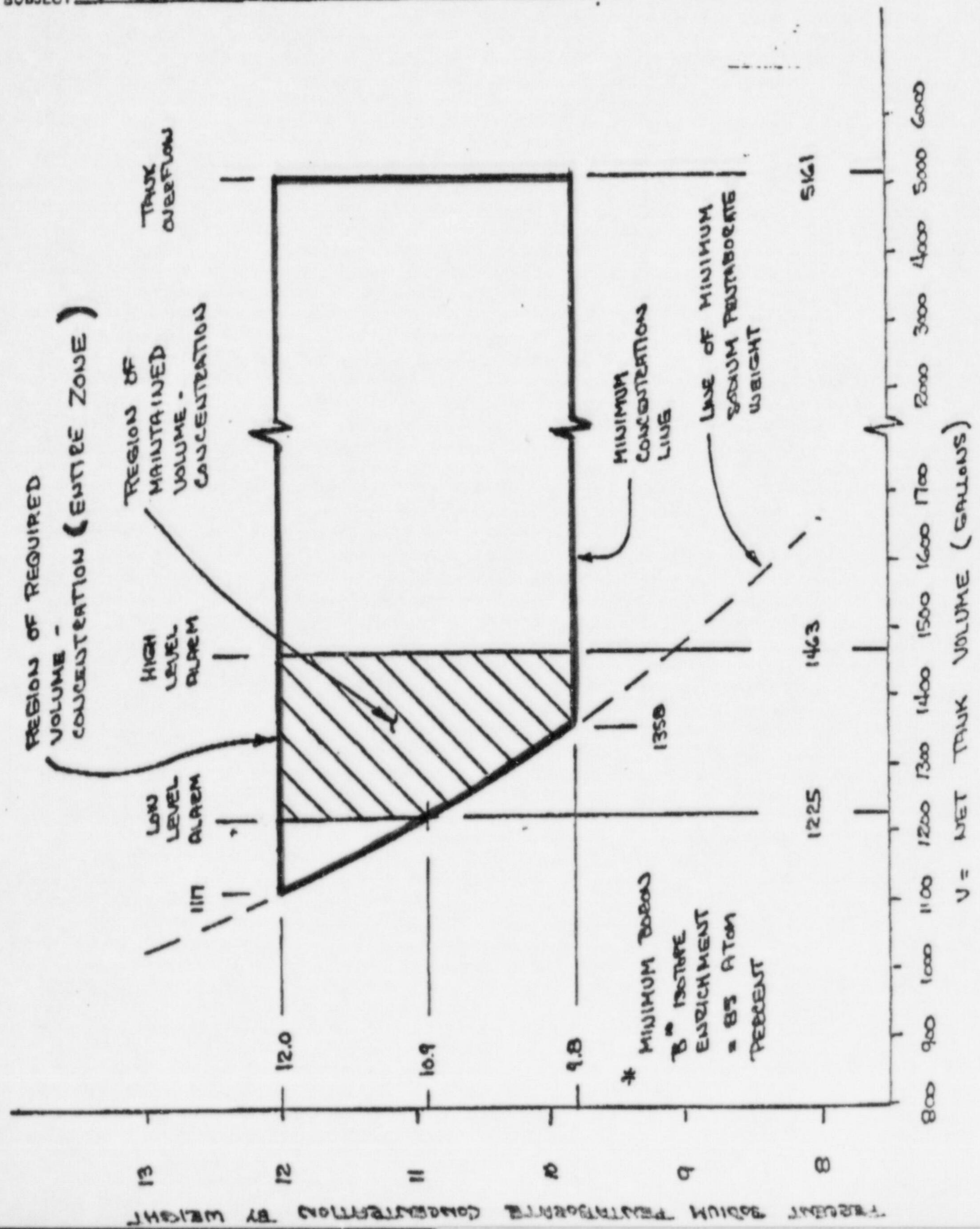

FIGURE 3.1.5-2 SODIUM PENTABORATE SOLUTION CONCENTRATION VS NET TANK VOLUME

3/4.1.5 STANDBY LIQUID CONTROL SYSTEM

The Standby Liquid Control System (SLC) provides a backup capability to bring the reactor from full power to a cold, xenon-free shutdown, assuming that the withdrawn control rods remain fixed in the rated power pattern. The generic system design bases requires the injection of a quantity of sodium pentaborate analytically equivalent to a concentration of 660 ppm of natural boron into the reactor core. The amount of sodium pentaborate available for injection into the reactor is the amount required to provide 660 ppm of natural boron in the 70°F moderator at water level 8, including the recirculation loops, and with the RHR shutdown cooling subsystem in operation. There is also an additional allowance equivalent to 165 ppm of natural boron in the moderator to account for imperfect mixing and leakage, resulting in a total required equivalence of 825 ppm.

With the use of enriched boron, the required boron concentration is reduced in proportion to the enrichment ratio. The ratio is expressed in terms of atom percent of boron-10 since only the B-10 isotope controls the reactor reactivity.

$$\text{Ratio} = \frac{\text{minimum B-10 isotopic enrichment in atom percent}}{\text{B-10 isotopic fraction in natural boron in atom percent}}$$

The fraction of B-10 isotope naturally occurring in boron is 19.78 atom percent. At an 85 atom percent enrichment level, 193 ppm of enriched boron is equivalent to the generic shutdown requirement of 825 ppm of natural boron.

The generic design basis of the SLC System provides a specified cold shutdown boron concentration in the reactor core. The SLC System was typically designed to inject the cold shutdown boron concentration in 90 to 120 minutes. The time requirement was selected to override the reactivity insertion rate due to cooldown following the xenon poison peak and the required pumping rate is 41.2 gpm.

The minimum storage volume of the solution is established to include the generic shutdown requirement and to allow for the portion below the pump suction nozzle that cannot be inserted. An additional allowance in the SLC storage volume is provided to account for storage tank instrument inaccuracy and drift. Even with the maximum specified instrument inaccuracy and drift, the required quantity of sodium pentaborate solution is always available for injection.

A normal quantity of 1,225 gallons of sodium pentaborate solution having a 10.9 percent concentration and 85 percent B-10 enrichment is required to meet the shutdown requirements. The temperature requirement for the sodium pentaborate solution and the pump suction piping is necessary to ensure that the sodium pentaborate remains in solution.

With redundant pumps and explosive injection valves and with a highly reliable control rod scram system, operation of the reactor is permitted to continue for short periods of time with the system inoperable or for longer periods of time with one of the redundant components inoperable.

BASES

3/4.1.5 STANDBY LIQUID CONTROL SYSTEM

Surveillance requirements are established on a frequency that assures a high reliability of the system. Once the solution is established, no deterioration of the boron-10 enrichment level is expected during system standby operation. The boron concentration will not vary unless more boron or water is added, thus a check on the temperature and volume once each 24 hours assures that the solution is available for use.

Replacement of the explosive charges in the valves at regular intervals will assure that these valves will not fail because of deterioration of the charges. Analyses have been performed and tests conducted that show when highly enriched boron is used in the SLC System, there will be sufficient mixing of the reduced volume, even at Emergency Procedure Guideline water levels between the top of the active fuel (TAF) and the Minimum Steam Cooling RPV Water Level to avoid core power oscillations.

The ATWS Rule (10CFR50.62) requires the addition of a new design requirement to the generic SLC System design basis. Changes to flow rate, solution concentration or boron enrichment, to meet the ATWS Rule must not invalidate the original system design basis. Paragraph (c)(4) of 10 CFR50.62 states that:

> "Each boiling water reactor must have a Standby Liquid Control System (SLCS) with a minimum flow capacity and boron content equivalent in control capacity to 86 gallons per minutes of 13 weight percent sodium pentaborate solution." (natural boron enrichment)

The described minimum system parameters (41.2 gpm, 9.8% concentration and 85 atom percent boron-10 enrichment) will ensure an equivalent injection capacity that is 200% of the ATWS Rule requirement for Shoreham. This enhanced mitigation capability increases the probability that the SLC System will be initiated in a timely manner, result in less severe primary containment transients and reduce the risk of offsite radiological consequences in excess of the 10CFR100 limits, due to the unlikely occurrence of an ATWS event.

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1. C. J. Paone, R. C. Stirn and J. A. Woolley, "Rod Drop Accident Analysis for Large BWR's", G.E. Topical Report NEDO-10527, March 1972
2. C. J. Paone, R. C. Stirn and R. M. Young, Supplement 1 to NEDO-10527, July 1972.
3. J. M. Haun, C. J. Paone and R. C. Stirn, Addendum 2, "Exposed Cores", Supplement 2 to NEDO-10527, January 1973.