



GE Energy

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MFN 06-239

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Subject: **Additional Information to Support Draft RAI 21.6-53**

In discussions regarding draft RAI 21.6-53, GE committed to provide material properties for the sodium pentaborate standby liquid control system (SLCS) injection liquid. This information is provided in Enclosure 1. This completes the requested information regarding draft RAI 21.6-53.

If you have any questions about the information provided here, please let me know.

Sincerely,

David H. Hinds  
Manager, ESBWR

D068

Enclosure:

1. MFN 06-239 – Material Properties for the Sodium Pentaborate Standby Liquid Control System Injection Liquid

cc: WD Beckner USNRC (w/o enclosures)  
AE Cabbage USNRC (with enclosures)  
LA Dudes USNRC (w/o enclosures)  
GB Stramback GE/San Jose (with enclosures)  
eDRF 0000-0056-0870

**ENCLOSURE 1**

**MFN 06-239**

**Material Properties for the Sodium Pentaborate  
Standby Liquid Control System Injection Liquid**

RAI 21.6-53 A (Draft)

*Material properties for the sodium pentaborate standby liquid control system (SLCS) injection liquid: ( $T$ ) (density as a function of temperature),  $C_p$  (specific heat capacity),  $k$  (thermal conductivity), ( $\mu$ ) (viscosity), and mass diffusivity. The staff needs the density as a function of temperature. If available, the staff would also prefer the other properties as a function of temperature.*

GE Response

The relative density (specific gravity) as a function of concentration at 80°F is provided in Figure 21.6-53-1. A good approximation of the specific gravity at other temperatures can be found by assuming that the change in the specific gravity of the solution with temperature is proportional to that of water. Though figure 21.6-53-1 is for sodium pentaborate with natural boron, the change in the density curve for ESBWR enriched boron is insignificant.

The specific heat capacity, thermal conductivity, viscosity and mass diffusivity of the sodium pentaborate should be approximated with the same properties of water or sodium pentaborate solution with natural boron. The SLCS injection solution is only 12.5 weight % of  $\text{Na}_2\text{B}_{10}\text{O}_{16} \times 10\text{H}_2\text{O}$ , which is only a small fraction sodium pentaborate. Using the requested properties of water will have a negligible difference in the calculation. GE will be modeling the injected solution as water in the ATWS CFD model.

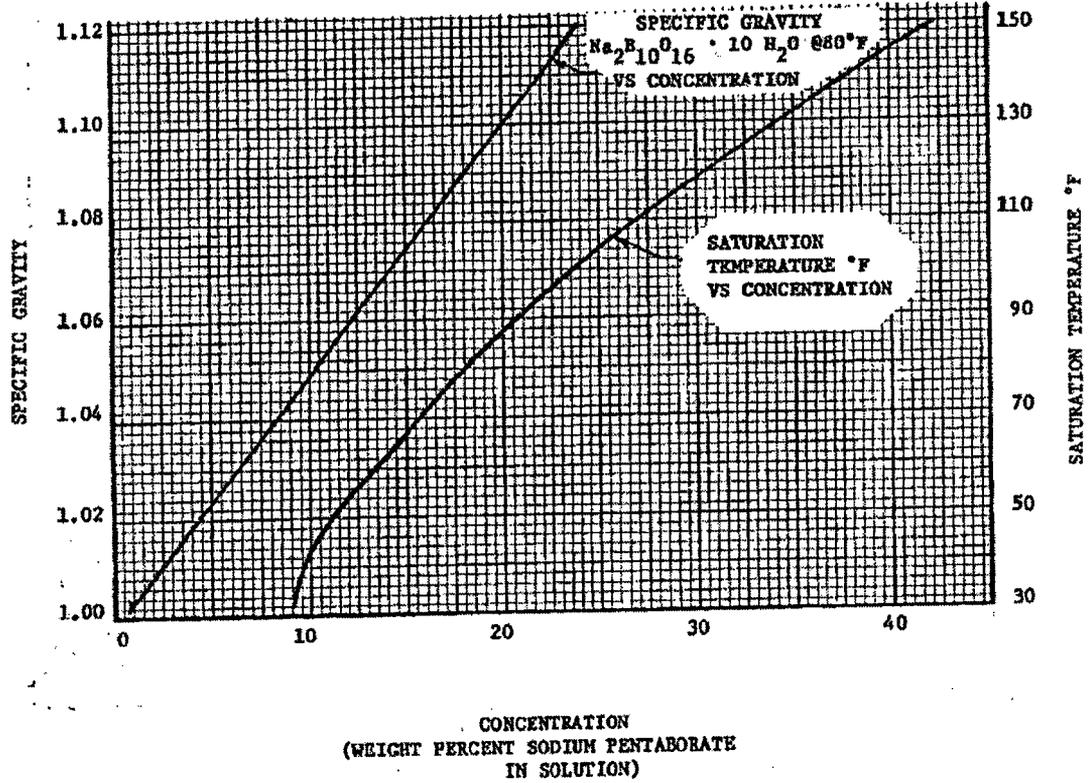


Figure 21.6-53-1 Density Curve of Sodium Pentaborate Solution