

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

November 27, 1995

MEMORANDUM

FOR:

G. W. Cunningham, Technical Director

COPIES:

Board Members

FROM:

SUBJECT:

Savannah River Site (SRS) — In-Tank Precipitation (ITP) Review of Cycle 1 Testing (November 8, 1995)

1. **Purpose:** This trip report documents a review by the Defense Nuclear Facilities Safety Board's (Board) technical staff (D. Lowe and J. Roarty) on November 8, 1995, regarding In-Tank Precipitation (ITP) flammability issue resolution program.
2. **Summary:** The Radioactive Operations Commissioning Test Program (ROCTP) is in progress at ITP. The large benzene release rates are again observed, but are now attributed to the mixing action of the four submerged mixing pumps. There is no observable release during washing operations indicating that "trapped" benzene is not the benzene release mechanism. These conclusions are preliminary, but it appears that the turbulent shear during pump mixing of the waste solution produces a uniform benzene release from the liquid. Westinghouse Savannah River Company (WSRC) is conducting additional in-tank tests and plans to conduct laboratory experiments to determine the benzene release mechanism.
3. **Background:** In 1983, a test was conducted in Tank 48 to determine the effectiveness of the sodium tetraphenylborate (NaTPB) precipitation process. Coincident with the introduction of wash water, four pumps were started to mix the solution. A significant release of benzene was observed which was postulated to be due to the release of benzene "trapped" in the excess NaTPB solids as they were dissolved. This "trapped" benzene phenomena were also observed in some University of Florida experiments, therefore, the 1983 test observations were attributed to "trapped" benzene. However, recent laboratory tests have failed to confirm this hypothesis, as the observed benzene releases are 2-3 orders of magnitude less than the values observed in the 1983 test.
4. **Discussion:**
 - a. **Radioactive Operations Commissioning Test Program:** The test program is in progress at ITP with Batch 1 complete. The tests conducted during Batch 1 have yielded some unanticipated results. The large benzene release rates are again observed, but are now attributed to the mixing action of the four submerged mixing pumps (i.e., release rate less for one pump operating than four pumps operating, and when pump speed is decreased the release rate is correspondingly decreased). There is no observable release during washing operations indicating that "trapped" benzene is not the benzene release mechanism. These conclusions are preliminary, but it appears that the turbulent shear during pump mixing of the waste solution produces a uniform benzene release from the liquid surface.

WSRC is conducting additional in-tank tests and plans to conduct laboratory experiments to determine the benzene release mechanism.

The two instrument poles located at geometrically opposite ends of the tank are indicating uniform vapor space temperature and concentration profiles. This implies that the tank headspace is well-mixed. However, during these tests the lowest sample point was 21 inches above the surface. In future tests, the instrument poles will be lowered to within five inches in order to determine if a benzene rich layer is formed near the surface.

The benzene release rates are greater than expected during non-wash operations, but WSRC stated that they are still operating within their safety envelope. The potential safety implications of these new findings are being studied by WSRC. Additional testing is required to determine the mechanism and ensure that controls are adequate. If the benzene release mechanism turns out to be pump operation, then additional controls may be required (e.g., interlock to shutdown pumps on loss of ventilation and purging, additional controls to prevent inadvertent pump operation, etc.) and some controls may be relaxed (e.g., controls on water additions).

- b. ***Benzene Generation Rate Test Results:*** The experimental program is ongoing at Georgia Institute of Technology with 4 of 10 barrel tests complete. There is no evidence of the "trapped" benzene phenomena during recent Savannah River Technology Center (SRTC) bench-scale tests, Georgia Institute of Technology barrel-size tests, or full-scale testing at ITP. WSRC is adjusting the barrel experimental program as additional information is obtained from the in-tank testing.
- c. ***Analytical Effort:*** Little progress has been made in the 3-D analytical code effort. The code is still not predicting the dynamic response of purge flow. An extension of the contract on code development is underway as this effort affords the only means for investigating local benzene stratification (vertical or radial) away from the two instrument locations.