

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

October 6, 1993

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Richard E. Tontodonato

SUBJECT: Report on Efforts to Determine Whether Hanford Tank 241-SX-102 is Leaking, September 13, 1993

- 1. Purpose:** This memorandum provides the status of Westinghouse Hanford Company's (WHC's) efforts to determine whether Hanford high level waste tank 241-SX-102 is leaking, based on information obtained during the September 13-17, 1993 DNFSB technical staff trip to the Hanford Site.
- 2. Summary:** Based on reevaluation of liquid observation well (LOW) data for the past seven years, WHC and the Department of Energy - Richland Operations Office (DOE-RL) have concluded that the tank 241-SX-102 liquid level decrease is due to evaporation over many years. The historical method of evaluating LOW data was not sensitive to small changes in liquid level, and evaporation was overlooked until the level decrease eventually exceeded the criterion for declaring a leak. Because of this incident, WHC has begun applying more sensitive analysis techniques to LOW data from all tanks.
- 3. Background:** Tank 241-SX-102 is a million gallon high level waste tank, built in 1953-1954 in Hanford's 200 West Area. It is on the flammable gases watch list because WHC believes its contents are similar to tank 241-SY-101, which periodically releases flammable concentrations of hydrogen gas. This tank contains 543,000 gallons of high level wastes, including about 183,000 gallons of drainable interstitial liquid.

Because the waste in 241-SX-102 has a solid surface, liquid level is monitored using a liquid observation well (LOW) instead of the customary Food Instrument Corporation (FIC) conductivity gauge. A LOW is a drywell installed inside a waste tank, extending to within one inch of the tank bottom. Liquid level is measured by lowering a neutron source and detector down the LOW and locating the height where neutrons back-scattered by interstitial water are detected. LOW data consists of neutron count rates reported at 0.1 foot intervals as the neutron probe is lowered into the LOW.

On May 20, 1993 tank 241-SX-102 was declared an assumed leaker after LOW measurements indicated a sudden 0.3 foot liquid level decrease. Previous LOW measurements had indicated a stable liquid level, with measurements fluctuating between the established baseline and a 0.2 foot decrease. WHC responded by initiating actions to

remove all pumpable liquids from the tank and by reevaluating the LOW data to confirm whether a leak was occurring.

4. Discussion:

- a. Deficiencies in analysis methods. WHC reassessed the methods being used to evaluate LOW data and identified the following deficiencies:
 1. LOW data was not analyzed if inspection of a plot of neutron count rate versus height found no obvious changes from previous LOW plots. An extremely compressed scale was used on this plot (one inch = 7.6 feet), so small changes in liquid level were not detected. This is reflected in the LOW data recorded for tank 241-SX-102 prior to 1989, which shows a constant liquid level of 17.00 feet.
 2. Once the liquid level decreased enough to be noticeable on the compressed plot described above, a calculation was performed to estimate the actual liquid level. The liquid level was located by averaging the heights of points just above and just below the transition from dry waste (low neutron count rate) to wet waste (high neutron count rate). Since it was left to the analysts' judgement to pick points bracketing the transition from dry to wet wastes, this introduced variability in the estimated liquid level.
 3. A final and significant source of error in LOW data analysis was the use of the top of the LOW riser as the reference point for all measured heights. WHC checked the accuracy with which this reference was established, using the characteristic signal produced by the transition from soil to the tank's dome space. WHC found variations in the height of the tank dome relative to the reference point of up to 0.3 feet. Although small relative to the size of the tank, a 0.3 foot decrease in liquid level is sufficient to cause a tank to be declared an assumed leaker.
 4. The sources of error described in (2) and (3) above are reflected in the LOW data recorded for tank 241-SX-102 from 1989 to early 1993, which show liquid level fluctuating between the established baseline and a 0.2 foot decrease.
- b. Reevaluation of tank 241-SX-102 data. WHC has reevaluated the LOW data for tank 241-SX-102 for 1987 to the present. WHC has corrected previous sources of error by using the signal from the transition from soil to the tank dome space as the reference point for height and by locating the transition from dry to wet wastes using more sophisticated curve-fitting algorithms. These calculations indicate that the liquid level decrease is due to steady evaporation, not a sudden level decrease as recorded in the May 1993 LOW measurements. An evaporation study concluded that the evaporation

rate implied by this rate of liquid level decrease is reasonable for this tank, which has a waste temperature of 152°F. DOE-RL has agreed to remove this tank from the list of assumed leakers.

- c. Actions for other tanks. WHC is revising the procedures for LOW data analysis to incorporate the improved techniques developed for the tank 241-SX-102 effort. WHC stated that two of three curve-fitting techniques would be automated by the end of September 1993, and the third would be implemented once computers could be upgraded to run it. WHC also stated that the next generation of LOW measurement trucks would incorporate improvements such as a stabilized boom and better means of establishing the reference height for measurements, but new trucks will probably not be available until the end of FY 1994.
5. **Conclusion:** WHC has adequately demonstrated that the level decrease in tank 241-SX-102 is not due to a leak. WHC's actions to improve LOW data analysis will result in more sensitive leak detection for tanks with solid waste surfaces and will also reduce the likelihood of falsely declaring leakers based on LOW data.