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1&2	1	Cog. Eng. MW YOUNG	<i>T.M. Burke</i>	1/17/95	N2-01	S. GUTTENBERG	<i>S. Guttenberg</i>	1/24/95		1	1
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7. Abstract <p>Current FFTF Transition Project plans call for construction of a Sodium Storage Facility to store the plant sodium until it is processed either as product or waste. This report evaluates an alternative concept which would store the sodium in rail tank cars. It is concluded that utilizing a simple facility for offloading the FFTF sodium to standard industrial tank cars is not technically viable. Mitigation of potential radioactive sodium spills requires that the offload facility incorporate many of the features of the sodium storage facility. With these mitigation features incorporated, there is no significant cost or schedule advantage for the option of storing the FFTF sodium in tank cars when compared to the currently planned SSF. In addition, it is believed that the tank car option results in higher risk to project success because of unknowns associated with technical, regulatory, and public perception issues. It is therefore recommended that the project proceed with definitive design of the SSF.</p> <p style="text-align: center;">DISCLAIMER</p> <p>This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.</p>		
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AN ASSESSMENT OF THE VIABILITY OF STORING FFTF SODIUM IN TANK CARS

**T.M. Burke
M.W. Young**

December 1994

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I. INTRODUCTION AND SUMMARY

A. INTRODUCTION

Current FFTF Transition Project plans call for the construction of a Sodium Storage Facility (SSF) to store the plant sodium until it is processed either as product or waste. As the conceptual design of the SSF has matured, what was originally visualized as a simple steel framed sheet metal building covering several large tanks has grown into a complex, shielded, and seismically qualified structure that will cost about \$10,000,000 and will take about two years to design and construct. As a result of that growth, project participants have raised the following questions:

1. Can the sodium simply be transferred to standard tank cars and stored until needed at some location in a technically viable manner?
2. How do the schedule and costs for technically viable tank car offload and storage compare to those for the SSF?

To answer those questions a limited study of the technical issues associated with the tank car approach was conducted and is presented in this report.

B. SUMMARY

The results of the study indicate that construction of a simple loadout facility and use of standard tank cars is not technically viable. This is primarily because the consequences of a large radioactive sodium spill (i.e., the resulting radiological and chemical exposure to on and off-site personnel and the required cleanup) are judged to be unacceptable. The large spill is postulated to result from a failure of the tank wall (unisolable). It is not likely that tank cars could be designed to make such an event incredible. A loadout facility and storage site suitably designed and constructed for the use of standard tank cars would likely be comparable in cost and schedule to the SSF. Furthermore, significant technical, regulatory and public perception issues are likely to be associated with sodium storage in tank cars. The FFTF Transition Project should therefore proceed with the design and construction of the SSF.

II. DISCUSSION

A. TECHNICAL REQUIREMENTS

1. SPILL CONTAINMENT

It was concluded during the preparation of Reference 1 that a credible Design Basis Accident (DBA) for the SSF is the spill and burning of all the sodium (80,000 gal.) in one Clinch River Breeder Reactor Plant (CRBRP) tank in the SSF during transfer operations. Although extremely

unlikely, the credibility of this event was based on the leak probability reported for these tanks in the CRBRP Probabilistic Risk Assessment. While such a spill (unmitigated) would not result in an off-site radiation dose in excess of the radiological acceptance criteria, it was concluded that spill containment is required because of the enormous cleanup costs and because of the adverse public perception that a large radioactive sodium spill at Hanford would entail. In addition, the unmitigated spill was found to represent a moderate toxicological (sodium aerosol) hazard at the site boundary and a high hazard for the on-site worker. Based on these results, Reference 1 concluded that the SSF must contain Safety Class 2 systems, structures, and components (SSCs).

A standard industrial tank car will certainly have a leak probability at least as high as the high quality CRBRP tanks. Although the maximum leak volume would be smaller, it would still be large enough to present the same exposure and cleanup issues associated with an unmitigated leak from the CRBRP tanks. Therefore simple offloading of the FFTF sodium directly to standard industrial tank cars (without some form of spill mitigation) is unacceptable. Furthermore, experience suggests that sodium spills should be anticipated during the disconnection of the fill piping for a tank car. Although these spills would be expected to be relatively small, the anticipated nature of the event also suggests that some mitigation should be incorporated. Mitigation of a spill (e.g., limiting the spread of radioactive aerosols) is most effectively accomplished by enclosing the tanks in a reasonably tight building with secondary spill containment (e.g., a covered sump). This is the design approach adopted for the Sodium Storage Facility and the approach that would most likely be required for a tank car offload facility.

2. SHIELDING AND CAR STORAGE REQUIREMENTS

WHC-SD-GN-DGS-30011 (Radiological Design Guide) requires that new facilities be designed such that radiation exposure will be limited to 0.05 mrem/hr for routine access. This limit is derived from the requirements of DOE Order 6430.1A (General Design Criteria) for limiting on-site worker exposure. The radiation level of the primary sodium is such that the tank cars must be shielded or that FFTF plant access be severely restricted during transfer and cooldown operations due to the very large exclusion area that would be required without shielding.

In addition, facility worker radiation exposure would be expected to be higher during sodium transfer into unshielded tank cars than into the shielded SSF. The radiation levels of the primary sodium (100 mrem at the tank car surface) would require that a very large exclusion area (about 1050 ft. by 900 ft.) be fenced and controlled to limit dose rates to 0.05 mrem/hr during storage. No existing sites of that size with rail access have been identified and potential new sites would require at least 1/2 mile of new rail spur be constructed at a cost of about \$2,000,000 per mile. It is estimated that total site preparation costs would be about \$4,000,000.

3. OTHER CONSIDERATIONS

Other considerations further support the technical advantage of the Sodium Storage Facility as opposed to tank cars. For example, the tanks within the SSF are to be seismically qualified, consistent with the Safety Class 2 designation. While it is perhaps feasible to design the tank car offload facility to withstand a seismic event (e.g., by including seismic clamping of the cars), this adds considerably to the cost of the facility. In addition, there are likely to be negative regulatory and public perception reactions to the tank car concept. While these might be overcome, they are likely to require additional time and effort. On the other hand, the SSF design has undergone a thorough review and is expected to withstand the closest scrutiny.

B. SCHEDULE IMPACTS

The current SSF design has taken about 8 months to reach the point of project validation. While the tank car option could take advantage of that experience, it is estimated that the same degree of project maturity would take at least 6 months to achieve since two facilities (Loadout Facility and Storage Site) are required. It is believed that new standard tank cars could be delivered starting about 6 months after contract placement. The following tabulation summarizes the schedule estimates for the two facilities and shows that their completion dates are comparable to the January 1997 SSF schedule:

FACILITY>	LOADOUT FACILITY	STORAGE SITE
ACTIVITY		
FDC	3 MONTHS (4-1-95)	3 MONTHS (4-1-95)
CDR/PSE	3 MONTHS (7-1-95)	3 MONTHS (7-1-95)
DEFINITIVE DESIGN	10 MONTHS (5-1-96)	7 MONTHS (2-1-96)
PLACE CONTRACT/CONSTRUCT SITE	8 MONTHS (1-1-97)	8 MONTHS (10-1-96)

C. COST IMPACTS

It is believed that new standard tank cars could be purchased for about \$140,000 each for a total car cost of about \$2,000,000. The cost of the Loadout Facility has not been estimated but it would certainly be several million dollars since it must incorporate many of the design features incorporated in the Sodium Storage Facility (e.g., spill containment, shielding and seismic qualification). When the tank car, Loadout Facility and Storage Site costs are added, the total for the tank car storage option is likely to be comparable to the SSF projected cost.

III. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that utilizing a simple facility for offloading the FFTF sodium to standard industrial tank cars is not technically viable. Mitigation of potential radioactive sodium spills requires that the offload facility incorporate many of the features of the Sodium Storage Facility. With these mitigation features incorporated, there is no significant cost or schedule advantage for the option of storing the FFTF sodium in tank cars when compared to the currently planned SSF. In addition, it is believed that the tank car option results in higher risk to project success because of unknowns associated with technical, regulatory and public perception issues. It is therefore recommended that the project proceed with definitive design of the SSF.

IV. REFERENCES

1. PRELIMINARY SAFETY EVALUATION (PSE) FOR THE SODIUM STORAGE FACILITY AT FFTF, WHC-SD-FF-PSE-002 REVISION 0, SEPTEMBER 30, 1994.