The Secretary of Energy
Washington, DC 20585

file 90-3

August 10, 1990

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
600 E Street, N.W.
Suite 675
Washington, D.C. 20004

Dear Mr. Chairman:

On March 27, 1990, you transmitted four recommendations regarding future programs for monitoring single-shell high-level radioactive waste storage tanks at Hanford. On May 16, 1990, I responded and accepted your recommendations. Enclosed is the implementation plan which describes actions being taken to implement your recommendations, along with our schedule for these activities.

As you know, a number of additional actions are underway to resolve the safety concerns regarding combustible gas generation and accumulation in Hanford tanks, particularly Tank 101-SY. An important near-term effort is to safely sample and analyze the tank contents. This is essential to determining the appropriate actions to resolve and eliminate the concern. We will keep you informed as we proceed.

Sincerely,

James D. Watkins
Admiral, U.S. Navy (Retired)

Enclosures

IMPLEMENTATION PLAN IN RESPONSE TO DEFENSE NUCLEAR FACILITIES SAFETY BOARD RECOMMENDATIONS OF MARCH 27, 1990

INTRODUCTION

On March 27, 1990, John T. Conway, Chairman of the Defense Nuclear Facilities Safety Board (DNFSB), submitted a letter to James D. Watkins, Secretary of Energy, concerning the susceptibility of Hanford's old single-shell, high-level waste tanks to an explosion. Included in this letter were four recommendations.

This plan lists the recommendations with a brief narrative discussion and then describes the implementing actions. The schedule for these actions is shown in the attached milestone chart.

DNFSB RECOMMENDATION #1

That a study be undertaken of the possible chemical reactions that could be the source of heat generation locally or globally in the single-shell tanks, thereby elevating the temperature to a value where explosive ferrocyanide reactions can take place rapidly.

Discussion:

DOE concurs that additional study is needed. There are several chemicals in the Hanford tanks that are potentially reactive under certain mixtures and temperatures. The potential for these chemicals to react uncontrollably or explosively has been the subject of several studies. Additional work is in progress to assess the potential chemical reactions between cesium nickel ferrocyanide, sodium nitrate, sodium nitrite, and potential catalysts/initiators; and testing on the radiation stability of ferrocyanide compounds and the energetics of ferricyanide is planned. A broader evaluation of single-shell tank waste stability is also in progress, and areas needing additional study will be identified.

The studies have not yet identified any rapid chemical reactions that are likely to occur under the current and expected tank temperatures and conditions.

Implementation Plan for Recommendation #1

In 1976 and 1977, the results of experimental tests and studies of the stability of organics and salt cakes in the waste tanks were issued, and in 1984 and 1985, the stability of organic complexants in the waste tanks was investigated and reported. These studies addressed the chemicals in the single-shell tanks considered to be of concern and recommended additional work to assess the potential chemical reactions between cesium nickel ferrocyanide, sodium nitrate, sodium nitrite, and potential catalysts/initiators. This work, begun in 1988, is focussed to identify the minimum temperature for a

reaction, the minimum temperature for an explosion, and the sensitivity to shock, friction, or spark. At the completion of the currently planned tests, the results will be made available for independent review, and the need for any additional work to better understand the ferrocyanide-nitrate/nitrite reaction mechanism will be determined. Also, a review for other potential chemical reactions, including potential organic decomposition products or radiation degradation products, will be performed. Additional reaction testing may be identified from this review. (Action 1)

The DNFSB consultants recommended testing the radiation stability of ferrocyanide compounds and the energetics of ferricyanide which will be initiated in FY 1991. (Actions 2 and 3)

A comprehensive single-shell tank characterization program is underway with the analysis of two core samples from each single-shell tank to be completed by September 1998. The characterization of the waste samples includes a thermal analysis to identify the onset of a chemical reaction. If unusual exothermic reactions are identified, further work will be performed to evaluate the potential hazards.

As stated in the discussion, a broader evaluation of single-shell tank waste stability is also in progress. This evaluation will summarize previous studies and current waste tank conditions related to waste stability. Areas needing additional study will be identified. (Action 4)

DNFSB RECOMMENDATION #2

That the DOE develop a program for continuous monitoring of those conditions in the single-shell tanks that can serve to indicate development of conditions indicating an onset of instability in their contents. These conditions might include such features as abnormal temperatures in local areas, physical deformation of the surface of the waste, or unusual components (including hydrogen) in the vapor space gas in the tanks.

Discussion:

There currently exist numerous continuous monitoring systems on the double-shell tanks and fewer such systems on the single-shell tanks.

The unexpected rise in tank temperature would be the principal indicator of waste instability in single-shell tanks, and temperature measuring improvements will be made first on the tanks of primary concern, those containing ferrocyanide. The accuracy of the currently installed thermocouples will be determined and additional thermocouple trees will be installed in several locations within at least one tank to determine if there are localized hot spots. The need for additional thermocouples in other tanks will be based on these findings. Other devices to detect increased temperature in local areas are also being investigated. With regard to monitoring for tank vapor space gas flammability, continuous hydrogen monitors will be installed on selected tanks, and sampling will be done on all tanks.

Implementation Plan for Recommendation #2

The accuracy of the thermocouples in the ferrocyanide tanks will be determined and a deficiency correction plan prepared. (Action 5)

Additional thermocouple trees will be installed in several locations within at least one tank containing ferrocyanide to determine if there are localized hot spots. The need for additional thermocouples in other tanks will be based on the findings in the first tank. (Action 6)

Thermal modelling and infrared mapping of the waste surface to detect increased temperature in local areas is being investigated. Either periodic or continuous infrared monitoring will be implemented as appropriate. (Action 7)

Additional flammable gas sampling and installation of continuous monitors on selected tanks is planned. This is part of the Safety Improvement Plan for tanks which may have hydrogen. In the interim, requirements have been established to assure that vapor space gas measurements are taken and analyzed before work is initiated in any tank. (Action 8)

DNFSB RECOMMENDATION #3

That the instruments used in monitoring the tanks be provided with alarm indicators at a location where decisions can be made and action taken to start a series of measures to neutralize a perceived abnormality.

Discussion:

DOE concurs that those conditions which warrant continuous monitoring also warrant alarm indicators at a location where decisions can be made and actions taken to respond to the alarm. Many monitoring actions, such as drywell readings, benchmark surveys of tank dome structures, in-tank photography, manual readings of waste surface levels, etc., are accomplished manually on established frequencies and as such are not well suited for automated alarms. The existing tank surveillance procedures provide for review of the data, criteria for identifying off-normal measurements, and actions to be taken if preestablished limits are approached or exceeded. Following the additional monitoring measures discussed in the response to Recommendation #2 above, the monitoring frequency, need for alarms, and alarm locations will be determined and additional alarms installed as needed.

Implementation Plan for Recommendation #3

Actions to install additional alarms and select the alarm locations will be determined following the additional monitoring measures discussed in the responses to Recommendation #2 above. Instruments that monitor continuously will have alarms. A plan for installation of additional alarms will be completed by the end of January 1991 and furnished to the DNFSB. (Action 9)

DNFSB RECOMMENDATION #4

That an action plan be developed for the measures to be taken to neutralize the conditions that may be signaled by alarms.

Discussion:

The existing tank surveillance systems specify corrective actions if preestablished limits are approached or exceeded. As additional monitoring measures are put in place, recovery actions necessary to correct an abnormal situation would be developed as well. The current contingency plans for response to an increasing ferrocyanide tank temperature will be reviewed and revised if needed. Action plans responding to other alarms or unusual surveillance readings will also be reviewed for completeness.

Implementation Plan for Recommendation #4

A review of the current contingency plans for response to an increasing ferrocyanide tank temperature was conducted, and the plan will be revised. Action plans responding to other alarms or unusual surveillance readings will also be reviewed. As the results of work on chemical stability and flammable gas issues identify other parameters warranting monitoring, then additional action plans will be prepared and forwarded to the DNFSB. (Action 10)

Milestone Chart

(Calendar Year)