[DOE LETTERHEAD]

April 28, 1994

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
Suite 700
625 Indiana Avenue, N.W.
Washington, D.C. 20004

Dear Mr. Conway:

This is a response to your letter of January 27, 1994, requesting information about the Hanford 105 K-East Basin encapsulation effort.

The enclosure provides a summary report addressing: (1) the alternatives that were considered in arriving at encapsulation, (2) the criteria used in making the selection, (3) additional systems engineering studies planned to ensure that personnel radiation exposure and the release of radionuclides to the environment are maintained at levels as low as is reasonably achievable, and (4) anticipated radiation doses and dose commitment from the proposed operation.

Preparations for encapsulation of the K-East Basin fuel are continuing. A pilot encapsulation run is planned and the Department of Energy (DOE) will perform an Operational Readiness Review to determine readiness to proceed with this p;lot run. The pilot run will constitute the initial phase of startup for fuel encapsulation. However, the pilot run will be limited and will focus on process and fuel characterization issues common to all storage alternatives since they all require some measure of fuel handling within the basin.

In parallel with the plans to ready the facility for encapsulation, DOE and its contractors are conducting a number of studies that will provide assessments of the alternatives to encapsulation. DOE management will evaluate the results of these studies, and should a substantial technical basis be identified for not proceeding with the proposed encapsulation or significantly altering the planned encapsulation procedures, then the encapsulation program will be redirected accordingly. The details of these studies and their schedules are addressed in the enclosure. Near-term milestones are:

5/31/94	Issue Status Update on DOE-Richland Operations Office (RL) Independent Engineering Study
5/31/94	Issue Draft Report on Westinghouse Hanford Company Systems Engineering Study
6/30/94	Issue Final Report on Westinghouse Hanford Company Systems Engineering Study

6/30/94	Initiate encapsulation of K-East Basin fuel (pilot run only; pending successful outcome of readiness reviews)
9/15/30	Issue Final Report on DOE-RL Independent Engineering Study
9/15/94	Complete Encapsulation Pilot Run
9/30/94	Evaluate results of studies and pilot run and redirect encapsulation efforts on or before this date as information becomes available

Please note, however, that the above dates for initiation and completion of the pilot run may change within the next few weeks. We anticipate a delay in proceeding with the encapsulation pilot run due to a number of issues. First and foremost is that the plant readiness process has surfaced a much larger number of administrative and physical problems than was expected.

To promote greater involvement of DOE-RL and to ensure that these actions are properly planned, implemented, and managed, Mr. James Daily, DOE-RL Director of the Nuclear Materials Division, has been assigned the responsibility for all spent fuel matters at the Hanford site.

Further details on these actions will be communicated in future reports and Defense Nuclear Facilities Safety Board (DNFSB) review meetings. Also, additional information related to the specific observations listed in the enclosure to your letter will be provided during review meetings with the DNFSB. The Department is dedicated to keeping the DNFSB informed of the progress in planning and implementing the clean-up and storage of spent nuclear fuel at Hanford.

Sincerely,

Thomas P. Grumbly
Assistant Secretary for
Environmental Management

Enclosure

K-EAST BASIN SPENT NUCLEAR FUEL STABILIZATION REPORT
OR THE DEFENSE NUCLEAR FACILITIES SAFETY BOARD (DNFSB)
APRIL 1994

PURPOSE

On November 16-18, 1993, a DNFSB team reviewed the environmental and safety aspects of the storage of spent fuel at the Hanford K-Basins'''. Subsequently, the DNFSB issued a letter''' requesting a report to address the following:

1. alternatives considered in arriving at the encapsulation process,

2. criteria used in making the selection,

3. additional systems engineering studies planned to ensure that personnel radiation exposure and the release of radionuclides to the environment are maintained at levels as low as is reasonably achievable, and

4. anticipated radiation doses and dose commitment from the proposed operation.

This report addresses these items.

INTRODUCTION

The 105-K East and West storage basins were originally designed to provide short-term storage of spent fuel prior to reprocessing at the Plutonium Uranium Extraction Plant (PUREX). Discharged fuel from the Single Pass Reactors or N-Reactor was placed into open-topped Mark O canisters designed to be compatible with the reprocessing system. The K-East Basin was reactivated in 1975 when PUREX was shut down and more storage was required for N-Reactor spent fuel storage. Open-top canisters continued to used as the fuel was expected to be stored for less than three years.

In 1983, the K-East Basin fuel was sorted to segregate weapons grade from non-weapons grade fuel using a method similar to the encapsulation process. Damaged fuel was frequently encountered and the process may have induced additional damage. Approximately 7 percent of the N-Reactor fuel is known to have cladding damage from discharge or subsequent handling. Limited inspections in 1992 indicate a much larger portion of the fuel inventory may be damaged. Continuous degradation from corrosion is occurring in much of the fuel. Because the corrosion product has a lower density than the fuel, it causes swelling thereby allowing more fuel to be exposed which in turn causes additional corrosion.

Corrosion products also slough off, fall to the bottom of the canister or basin, and form an inventory of sludge. When the K-West Basin was reactivated in 1985, the Mark O canister was redesigned to provide sealed containment for encapsulating the fuel. The seal on this Mark I version was later improved resulting in the Mark II design. As evidenced by the lack of a sludge

layer, better water quality, and lower dose rates in the K-West Basin, the Mark II canister has been shown to be effective in countering many of the consequences of fuel degradation.

There are currently 1,150 metric tonnes (MT) of N-Reactor fuel stored in 3,668 open-topped Mark 0, I, and II canisters in the K-East Basin. A comparable quantity (3,818 canisters) is stored in K-West Basin in capped Mark I and Mark II canisters. Since the startup of Hanford, approximately 52,000 MT of fuel has been loaded into 158,000 canisters. Hanford operations has had experience in encapsulating 1,637 MT of this fuel into approximately 4,900 canisters (some of these 4,900 were processed at PUREX).

The main objectives of the proposed encapsulation program are to mitigate the consequences of potential K-East Basin leakage to the environment by reducing the levels of radionuclides in the basin waters and to contain the fuel, reduce sludge dispersal, and reduce resin waste production from water filtration systems. The proposed action consists of transferring fuel from all open-topped canisters into new lidded Mark II canisters. This will prevent further release of radionuclides into the basin water and promote the eventual improvement of water quality by the filtration and ion-exchange systems.

The proposed fuel encapsulation is based on past procedures and will involve the following steps:

- empty fuel elements from existing open canisters onto an underwater dump table,
- transfer the fuel elements and larger pieces with the aid of tongs to the repackaging station and stack them in a canister loading jig,
- hydraulically insert fuel elements into a new Mark II canister,
- seal the new canister,
- collect fuel chips or pieces not transferred to the new canister and package parately into another canister, and
- pump sludge released in transfer activities to a special pit for later encapsulation.

Planning documents call for two complete sets of encapsulation equipment, one for K-East and another for K-West. To date, one set has been acquired and much of it is already installed in the K-East Basin Discharge Chute area where encapsulation is to take place. Functional testing of the process equipment is being performed as it is installed. A second set is being procured for installation in K-West. Encapsulation is expected to begin prior to receipt and installation of the second equipment set; therefore, initial on-the-job training will have to be performed at K-East on the existing equipment.

This training began March 28, 1994, and will involve three three-week sessions. Thirty-five operators, six managers, two Department of Energy (DOE) Richland Operations Office (RL) representatives and nine N-Reactor operators will be included in this training effort. Future

training and development will be moved to K-West once the encapsulation equipment is installed there. As new operators are hired or transferred from other Hanford activities, they will be appropriately trained. Only qualified personnel will be allowed to participate in the encapsulation operations.

The Hanford Tri-Party Agreement is a primary mechanism for stakeholder involvement at Hanford. Stakeholders are adamant that the source term near the Columbia River be reduced as soon as possible and this position is reflected in the latest revision of the agreement. Eight target dates pertain to the disposition of the K-Basins. Two dates of significance to encapsulation are: (1) June 1994, Initiate K-East Basin fuel encapsulation; and (2) December 2002, remove all fuel, sludge, and water from both the 105-K East and 105-K West Basins.

ALTERNATIVES CONSIDERED IN ARRIVING AT ENCAPSULATION

Although alternatives to encapsulation were discussed during the initial evaluation in 1989, no detailed analysis of these alternatives was performed. In 1990 when the decision was made to encapsulate, the facility was expected to continue operations for 20 more years and reprocessing was expected to resume at PUREX. Alternatives that were considered were overpacking and delaying the effort until better guidance could be established.

CRITERIA FOR SELECTING ENCAPSULATION

Initial Evaluation

Initially, encapsulation was chosen for the following primary reasons:

1. It was proven to work well at K-West Basin. Personnel exposures and resin waste are significantly less at K-West Basin. In the K-East Basin the background dose is between 5 to 35 mR/hr and it is less than 1 mR/hr in the K-West Basin.

2. Hanford had experience in this form of encapsulation. The technology existed, procedures were in place, and many operators were experienced in the process allowing for a relatively short training cycle.

3. It was consistent with the K-West Basin storage mode. Both basins would store material in a similar form and thereby simplify future handling.

4. An Environmental Assessment for the encapsulation process was issued in 1992. Changing the process requires a revision to the assessment as a minimum and may require a new assessment.

Subsequent Evaluation

In the latter part of 1993, the encapsulation process was reevaluated relative to three alternatives: (1) overpacking, (2) direct dry storage, and (3) deferring the activity until better guidance could

be obtained. Again, no detailed analysis was performed and the alternatives were qualitatively evaluated. The criteria considered included the following:

1. The alternative should involve demonstrated capability that could be used at Hanford. Extensive equipment upgrades and procedure development would not be acceptable.

2. The alternative should be readily available and consistent with near term discontinuance of spent nuclear fuels (SNF) storage at the K-Basins. Long design and analysis cycles would not be acceptable.

3. The alternative should be capable of being implemented with modest training of the K-Basin staff; that is, the alternative should not be so complicated or different such that extensive retraining would be required.

4. The alternative should offer total personnel exposure equal to or less than that produced by encapsulation.

5. The alternative should avoid introducing another handling step for the fuel to achieve interim storage.

6. The alternative should result in reduced sludge handling.

7. A safety basis should exist or be easily attainable for the alternative.

8. National Environmental Policy Act (NEPA) authorization should exist or be easily attainable for the alternative.

9. The alternative should not preclude nor significantly complicate the current listing of interim storage alternatives; that is, it should be compatible with the interim storage method.

Direct overpacking was appealing from the minimum operations handling standpoint. The canisters would be placed directly into an overpack container thereby minimizing canister handling. The overpack would have to be designed and tested and prototype procedure development would be required before initiating the process. Because of the reduced overall handling, the actual total dose to operations personnel might be less than that for encapsulation. However, the present basin storage racks cannot accommodate an overpack, causing a storage system redesign and installation. Overpacking, as is the case for encapsulation, requires additional handling of the fuel prior to interim storage. The potential dose savings in process operations may be well offset by the removal of the old racks and installation of the new design. A detailed dose assessment is required to adequately compare the personnel exposures for these two options.

The reference concept for long-term interim storage is based on dry storage. Within the dry storage option, there are numerous alternatives and packaging for confinement. Included in these uncertainties is the form the spent fuel must take for dry storage. While many dry storage systems

exist for commercial fuel, N-Reactor fuel has many unique properties not found in commercial fuel. For example, the pyrophoric characteristics of N-Reactor fuel requires analyses to determine what processing, if any, is required before it can be safely stored in a dry configuration. If dry storage is ultimately selected as the longterm interim storage method, going directly to dry storage would be an efficient alternative. These details must be settled before a dry storage process can be initiated.

Deferring the encapsulation until these uncertainties are resolved was the third alternative considered. Stakeholders, however, were very clear in their desire to reduce the source term near the river and limit the potential insult to the environment as expeditiously as possible. The time required to sort out all uncertainties could be significant, resulting in too much time passing before any action is taken.

Based on the evaluation, encapsulation remains the preferred method. Although the estimated dose for encapsulation is not the lowest of the alternatives studied to date, it is modest when compared to the potential release to the environment and the subsequent stakeholder reaction to such releases. Encapsulation allows the Hanford Site to meet stakeholder expectations and reduce the risk to the environment. Relative to the potential increased handling involved with encapsulation, a comparable quantity of fuel is already encapsulated at the K-West Basin and must also be handled during transfer to long-term interim storage.

ADDITIONAL ENGINEERING STUDIES

Several engineering studies will be conducted in parallel with preparations for implementing the planned fuel encapsulation process at the K-East Basin. These studies will investigate the viability of encapsulation and other alternatives for near-term fuel storage. The studies will be supported by initial fuel characterization efforts and a pilot run for the encapsulation process. The results of each of these activities will feed decisions to continue the baseline plan to encapsulate or to divert to alternate processes.

The principal engineering studies supporting encapsulation and alternative processes are summarized below:

As Low As Is Reasonablv Achievable (ALARA) Assessment

As the basis for the DOE Environmental Assessment, an assessment was performed in 1991 to verify that personnel exposures were ALARA. Subsequently, a joint Westinghouse Hanford Company and Pacific Northwest Laboratory team evaluated the process control based on current and contemporary ALARA practices. This study included an evaluation of the encapsulation process as well as the operations involved in handllng and changing the resin beds and sand filter. The final report was completed March 31, 1994, and will be forwarded to the DNFSB after review by DOE. Additional studies are planned to ensure personnel radiation exposure and the release of radionuclides to the environment are maintained to ALARA standards. These studies are being completed in conjunction with near-term K-Basins activities and to identify and assess options for long-term management of all fuel at the Hanford Site. Initial studies (e.g., a fuel

consolidation study and a dry fuel storage study) will be completed in FY 1994.

Westinqhouse Hanford Company Systems Engineering Study

An evaluation is being carried out by Westinghouse Hanford Company to assess dry storage options for N-Reactor fuel. The study uses a systems engineering approach and will include near-term alternatives to encapsulation. The alternatives include overpacks, encapsulation, canisters compatible with underwater dry storage, and delaying until interim dry storage can be implemented. The evaluation is based on minimizing life cycle exposures, costs and wastes versus timeliness for risk mitigation, and uses existing data and experience. The draft report is scheduled for completion in May of 1994.

Studies for long-term fuel management at the Hanford Site will be performed as part of the site-wide systems engineering activity. The architecture for the Hanford system is scheduled for completion in July 1994. The SNF systems engineering analysis will be consistent with the overall Hanford architecture and will form the framework for a technical baseline. Alternatives for long-term management include maintaining fuel storage at existing facilities, storage at a new dry fuel storage facility, storage of some fuels at a new wet fuel storage facility, consolidation of fuel storage with other Hanford material storage, and processing of fuel. The study will consider the fuel and facility lifecycle, including transportation, infrastructure (facility and personnel), characterization, ultimate disposition, and other factors.

DOE-RL Independent Engineering Studv

The DOE-RL independent engineering study will identify fuel dry storage alternatives for N-Reactor spent fuel and evaluate the requirements for these alternatives. The study will consider fuel conditioning, fuel packaging and shipping, conditioning facility, and storage facility options. The schedule for this work scope is as follows:

- Start Work - 4/08/94
- Provide Status Update - 5/31/94
- Provide Final Report - 9/15/94

Encapsulation Pilot Run

The pilot encapsulation run will constitute the initial phase of startup for fuel encapsulation. However, the pilot run will be limited and will focus on process and fuel characterization issues common to all storage alternatives since they all require some measure of fuel handling within the basin. Issues of interest include water turbidity resulting from fuel handling, radiation dose rates, adequacy of facility systems to control suspended sludge and radionuclides, and adequacy of fuel handling and processing equipment. The general physical condltion of the fuel will also be observed, helping to optimize subsequent destructive examination of fuels as part of the characterization effort. Only a small number of fuel canisters will be processed as needed to fulfill the pilot run test objectives. If the decision is made to proceed with fuel encapsulation, the data and experience attained will form the basis for any needed process modifications and for startup

of the production scale encapsulation process.

ANTICIPATED DOSE RATES FOR ENCAPSULATION

Individual personnel exposures will be maintained during encapsulation within the DOE-RL Hanford Site limit of two rem per year maximum. However, the new Westinghouse Hanford Company administrative maximum allowable annual limit has been lowered to 500 mrem. Throughout the entire encapsulation process, the sum of all personnel whole body exposures is presently estimated at 102 rem based on previous experience and calculations using existing data. Additional dose rate data will be attained during the pilot run. That, combined with the results of the Pacific Northwest Laboratory ALARA assessment discussed above, will form a basis for process modifications to reduce doses. It will also be used to calculate accurate anticipated dose rates for full-scale encapsulation or for alternate processes.

CONCLUSIONS

DOE recognizes that historically the removal of all fuel from the K-Basins has not been part of the program planning for either the contractor or the Department. Priorities at the Hanford Site have been reevaluated and significant organizational changes within Westinghouse Hanford Company have been made to better address the K-Basin issues. Examinations of encapsulation, its alternatives, and the interim storage options are ongoing to identify feasible approaches for improving processes, operations, and to develop the best options. An integrated systems engineering approach and a strong safety basis (including addressing stakeholder concerns) will support the final decisions. With the results of these studies and the knowledge gained during the encapsulation pilot run, DOE management will reevaluate the encapsulation process as currently planned and redirect the efforts accordingly.

REFERENCES

1. Memorandum, D. Burnfield, Defense Nuclear Facilities Safety Board, to G. W. Cunningham, Defense Nuclear Facilities Safety Board, "Review of K-Basins at Hanford," dated January 12, 1994.

2. Letter, J. T. Conway, Defense Nuclear Facilities Safety Board, to T. P. Grumbly, Assistant Secretary for Environmental Restoration and Waste Management, Department of Energy, dated January 27, 1994.

3. Hanford Federal Facility Agreement and Consent Order, Tri-Party Agreement, January 1994.

[DNFSB LETTERHEAD]

January 27, 1994

The Honorable Thomas P. Grumbly
Assistant Secretary for Environmental
Restoration and Waste Management
Department of Energy
Washington, D.C. 20585

Dear Mr. Grumbly:

Enclosed for your consideration and action, where appropriate, are a number of observations contained in a trip report concerning environmental and safety review aspects of the storage of spent fuel at the Hanford K-Basins. These observations were developed by members of the Defense Nuclear Facilities Safety Board (Board) staff, and were based on reviews of available documents and discussions with Department of Energy (DOE) staff and contractor personnel at Hanford on November 16-18, 1993. Subsequent to that review, in November 1993, the DOE Office of Environment, Safety, and Health issued the Spent Fuel Working Group Report on the inventory and storage of DOE's spent nuclear fuel. That report indicated that the K-East Basin was among those "with most significant vulnerabilities." The report also advised that "the encapsulation plan warranted management attention to ensure that dose to workers is minimized and that contingencies are reviewed."

Based on the observations in these two reports, and pursuant to 42 USC 2286b(d), the Board requests that DOE provide a report describing the activities to be used to stabilize the degraded spent fuel stored in the K-East Basin at Hanford and a systematic engineering evaluation of these activities. This report should discuss: 1) the engineering alternatives, if any, that were considered in arriving at the planned encapsulating approach; 2) the criteria used in making the selection; 3) such additional systems engineering studies planned to assure that the actions required to address the fuel corrosion problem in K-East Basin will maintain both the exposure of personnel to ionizing radiation and radioactive material, and the release of radionuclides to the environment, as low as is reasonably achievable; and 4) anticipated radiation doses and dose commitment from the proposed operation.

The Board requests the report be submitted within 60 days of receiving this letter. If you need further information, please let me know.

Sincerely,

John Conway
Chairman

c: The Honorable Tara O'Toole, EH-l
The Honorable Victor H. Reis, DP-l

Ms. Jill Lytle, EM-30
Mr. Mark Whitaker, Acting EH-6

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

January 12, 1994

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: D. Burnfield

SUBJECT: Review of K-Basins at Hanford

1. Purpose: This memorandum documents the Defense Nuclear Facilities Safety Board (DNFSB) technical staff trip to the Hanford Site to review the K-Basins. The review was conducted during November 16-18, 1993 by F. Bamdad, D. Burnfield and M. Helfrich.

2. Summary: The following observations were noted during the tour of the K-East Basin and discussions with site personnel:

   a. A systematic, integrated engineering approach has not been used in the development of plans for the disposition of the spent fuel currently stored in the K-Basins.

   b. There appears to be a lack of involvement by DOE's Richland Operations Office (DOE-RL). DOE-RL relies on a contractor to provide leadership and oversight at these facilities.

   c. In addition, the DNFSB staff believes that the leak detection system in combination with the groundwater monitoring program is insufficient to adequately detect and track potential basin leaks. Based on the concentrations of radionuclides found in the monitoring wells adjacent to the basin, the DNFSB believes that the basins may be leaking radioactively contaminated water to the environment at an undetermined flow rate (<2000 liters per day).

   d. Expended ion exchange modules are buried as low level waste although they contain resins which are highly contaminated with transuranic elements. The modules are large concrete containers which have steel piping attached. The resin is not being stabilized by adding adsorbent, grout or other similar material.

      Commercial burial grounds would require similar resins to be stabilized and buried in high integrity containers.

3. Discussion: Discussions between the Westinghouse Hanford Company (WHC) staff and the DNFSB staff resulted in the DNFSB staff making four significant observations as noted above. Additional discussion is contained in Attachment 1.

a. Systems Engineering Approach: The WHC staff agreed that an integrated systems engineering approach had not been used to develop the plan of action for the disposition of the seriously corroded fuel stored in the K-Basins. The fuel in the K-East Basin is known to be seriously corroded while the fuel in the K-West Basin has not been evaluated for several years. A new WHC management team was recently assigned to these facilities. In discussions with the DNFSB staff, this team stated that an engineering review of basin operations has recently been performed, but did not reflect a true systems engineering analysis of the processes.

In this area, it was noted that the safety analysis report, as modified to review the proposed fuel encapsuladon, does not adequately address worker health and safety or the release of radionuclides to the environment during planned operations.

b. DOE Technical Vigilance: There appears to be minimal DOE-RL attention to the K-Basin issues. For exarnple, the K-Area does not currently have a full time DOE employee acting as the Facility Representative, although a Facility Representative was assigned in the past. The Facility Representative position has been effectively vacant for several months and has been assigned to a DOE contractor. In a recent review, the Office of Nuclear Safety (EH-10) indicated that neither DOE-RL nor WHC fully understood the potential problems associated with these facilities. A new hire has been selected to fll the Facility Representative role and will be on board soon; however, the technical training planned for this individual consists only of the standard training provided to the operators of the facility. No additional technical training, such as is provided to Facility Representatives at other facilities (e.g., Rocky Flats), is planned for this individual.

A safety evaluation report was prepared by WHC to review potential problems with the re-encapsulation of the fuel. DOE-RL provided no technical review of this report.

c. Basin Leakage: The DNFSB staff believes the basin may be leaking radionuclides to the environment and that such a leak would not necessarily be detected by the leak detection system or detected and tracked by the groundwater program at the 100-K area.

The minimum leak detection sensitivity of the equipment at the basin is approximately 2000 liters per day. With the current isotopic concentrations present in the basin water (large variances have been noted in the past) one might expect a potential release rate of approximately 2x104 micro curies/day of strontium-90, cesium-137, and tritium, and 2X102 micro curies/day of plutonium isotopes. In addition, other isotopes (such as antimony-125) are present in the basin water in smaller concentrations. (By comparison, the activity in the basin water at the ICPP 603 facility at Idaho National Engineering Laboratory is much less, with a total activity of approximately 6x105 micro curies.)

Seven groundwater monitoAng wells have been installed around the K-East basin. Tritium, carbon-14, and antimony-125 are present in monitoAng wells downgradient of the facility. Tritium levels in two of the wells are in excess of the EPA dnnking water standard. Although the carbon-14, and to a certain extent the tritium, may be aKributed to other nearby sources, an alternative source for the antimony can not be identified.

Overall, the groundwater monitoring program has never been able to identify conclusively the sources of the contaminants found in the wells and therefore would not be able to detect and track releases from the basin. Additionally, it should be noted that tritium has been observed seeping into the Columbia River, although it is not evident that this tritium is coming from the basins and where is no clear indicator of its source.

d. Filtration Systems: The K-East Basin has two filtration systems; one system passes the basin water through a large sand filter and two ion exchange modules. Although these modules become loaded with high concentrations of transuranic materials, they are able to be buried as low level waste because the calculation for the concentration of transuranic wastes allows the weight of the concrete module containers to be included as a part of the waste matrix. The resin is not stabilized by the addition of adsorbents or grout. Commercial burial grounds (e.g., Barnwell) would require the resin to be stabilized and to be buried in high integrity containers. The DNFSB staff is concerned that the burial of these modules may not meet the standards required for similar material in commercial bunal grounds.

4. Future Staff Action: The issues discussed in this report will continue to be followed by the DNFSB staff. The staff considers that future actions will be centered on monitonng the progress in resolving the basin issues.

Additional Supporting Discussion

Attachment 1

1. Tour of the facility: Facility housekeeping has improved markedly since May 1993, although it is still considereld lcss than satisfactory by WHC.

2. Meetings with site personnel: The meetings were divided into three general topic areas: monitoring and surveillance (including air emissions and liquid discharges and leaks), water chemistry of the basin, and safety analyses.

   a. Monitoring and surveillance. Discussions concerning this topic included the basis of the environmental protection program (including modeling) and its results.

      1. The K-East Basin has four roof exhausts, none of which has HEPA filters; composite samples are taken at each of the exhausts. Control of radioactive air emissions is effected through an administrative control on radioactive concentrations in the basin water. This method has been accepted by the State of Washington regulators as compliant with the requirements of 40 CFR Part 61, Subpart H, National Emissions Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities.

      2. There have been at least two leaks from the K-East Basin; one in the late 1970's and one in February 1993. WHC states that the first leak appears to have been fixed as a result of facility action, while the second appears to have stopped on its own. However, leak detection equipment at the basin is only capable of detecting leaks greater than 2000 liters/day, and the facility, using an ultrasonic device, is only capable of locating leaks greater than 3800 liters/day. The state department of health requires Hanford to report leaks in excess of 25 gallons/hr (approximately 2000 liters/day).

      3. There are four groundwater monitoring wells located down-gradient from the K-East Basin; they were installed after the first major leak in 1979. Three additional wells have been installed recently; one monitoring well located up-gradient and two closer to Columbia River. These wells are about 90 feet deep. The water table in that area is 70 to 80 feet below the surface.

         Two of the down-gradient wells (K-27 and K-30), located about 50 feet from the K-East Basin, have shown constant elevated tritium levels of 50,000 to 1,500,000pCi/liter (drinking water allowable limit is 20,000 pCill), which appear to be the result of relatively low volume leakage." Well K-30, which has the highest levels, showed a gradual increase from 1984 to May 1993, and then declined to about 300,000 pCi/l. Another source for tritium in this well is K-Reactor condensate effluent discharged

into a French drain near the basin, which would account for the C-14 levels found in the well (the basin does not contain significant amounts of C-14); however, other well-water charactertics (particularly the ratio of tritium to C-14, which is higher than cxpected) indicate that the French drain is not the sole source of tritium in the well. Addidonally, antimony (which is an indicator for basin water, as opposed to effluent discharged to the French drain) has been found in Well K-27; the concentradon of antimony has been decreasing at the same rate as half-life decay.

b. Water chemistry. Discussions on this topic were focussed on the chemistry of the basin water (including corrosion) and the operation of the sand filter and ion exchange units.

1. The operating safety requirements (OSRs) for the K-East and K-West Basins only contain limits on releases to the environment; they do not specify active control of the radioactive water chemistry (i.e., mitigation as opposed to prevention).

2. A program was established to measure the rate of corrosion in the basin; however, each year the coupons were removed, tested, and replaced with new coupons. Results of these studies have shown that corrosion of new metal has decreased over the last ten years. However, this method of testing does not provide a good representation of how material that was previously in the basin is perfoming.

3. Knowledge of the water chemistry is based on the current basin conditions; there does not appear to be any understanding of the impact of encapsulation, which will dramatically increase the concentration of radioisotopes in the basin water and will therefore impact the operation of the water treatment units (sand filters, ion exchange columns and modules).

4. Waste generated as a result of the operation of the ion exchange columns has been classified as transuranic (TRU) waste, while waste generated from the operation of the ion exchange modules has been classified as low-level waste, a similar if not identical operation. This difference in classification appears to be based solely on the weight of the ion exchange module (a concretc monolith), which has been factored in to reduce the calculated curie per gram ratio below the level used to differentiate between low-levd and TRU wastes. If this classification is challenged and reversed, then modules which have been stored as category 3 (retrievable) low-level waste will have to be retrieved and repackaged as TRU waste.

c. Safety analyses. In addition to introductory discussions on the status of the safety analysis report for the basins and unresolved safety questions (USQs) associated with basin operations, issues associated with the sequence of fuel movements and

the design review of the encapsulation process were also discussed.

1. The approved Safety Analysis Report (SAR) for the Basins was written in 1975; a Safety Evaluation Report was written for the encapsulation process to supplement the SAR, and it concluded that the SAR bounds this process. The Basins have been categorized as a High Hazard Pacility, however, the required implementation plan for DOE Order 5480.23, Nuclear Safety analysis Reports, has not been approved. Current plans are to take the old spent fuel that is stored mostly in open bottom canisters, move it to a working table under water, dump the fuel on the table, scoop the relativdy degraded fuel into new canisters, seal them and store the canisters back in the original open canister positions in the pool. There does not appear to be a program in place for dealing with the sludge in the pool (12 to 16 inches deep), or for long-term handling of the fuel. The decay heat from the fuel stored in the basin is only about 65 kW; and it appears that considerations should be given to dry storage of this severely degraded fuel and the cleanup of the potentially leaking pool. DOE-RL stated that encapsulation of the fuel is planned to reduce further fuel degradation and contamination of the water. However, DOE does not seem to have a plan for dealing with this issue on a long-term basis.

2. WHC stated that the sequence of fuel movements is being revised based on accountability and ALARA concerns. The major objective of the revisions is to better secure fuel and to minimize sludge generation, since sludge containment technology is not currently fully developed.

3. An independent review of the encapsulation process was recently commissioned by the WHC basin management and, although not yet issued formally, draft issues deal with the generation of TRU waste, technology for dealing with the sludge, and the method of removing fuel from the open containers (i.e.,dumping the contents on the table). Recommendations will probably include redefinition of the objectives for encapsulation, expansion of ALARA considerations, and consideration of the impact of the change in water quality on the consequences of accidents or earthquakes.

4. There appear to be several issues related to criticality concerns in the KEast Basin. The old spent fuel from the Single Pass Reactor, which may have had higher enrichment than the fuel from the N-Reactor, is apparently also stored in K-East Basin with minimal additional administrative controls. The sludge in the pool appears not to have been characterized properly. WHC is currently in the process of identifying a technically justifiable method of sampling and testing the sludge for characterization of the fissile material contents. The original criticality analysis of the Basin was performed based on fuel assemblies being intact within the canisters. There are currently broken spent fuel pieces mixed with the sludge. The DNFSB

staff requested the documents supporting the criticality analysis for internal review.

MEMORANDUM

DATE: April 8, 1994

REPLY TO
ATTN OF: AMW:JRH/94-AMW-032

SUBJECT: ENCAPSULATION OF SPENT NUCLEAR FUEL

TO: J.E. Lytle, Deputy Assistant Secretary
for Waste Management, EM-30, HQ

Reference: Memorandum, J.R. Hunter, RL, to J.E. Lytle, HQ, K-Basin Encapsulation Readiness Review Assessment, Letter No. 94-FTB-44, dated March 21, 1994.

My staff has been working with Westinghouse Hanford Company (WHC) to prepare for the subject activity currently scheduled to start by June 30, 1994 as committed in a Tri-Party Agreement Target Milestone.

I previously informed you, in the referenced memorandum, based on the moderate risk and low complexity of the encapsulation activity within the KE-Basin facility, an Operational Readiness Assessment as prescribed in DOE Order 5480.31, was the appropriate level of review and the RL Manager was the appropriate approval authority. I also proposed in the memorandum, that the review team be a joint RL/HQ independent team, based on the comments of EM-36 and EM-37 staff and managers.

Since the March 21, 1994 memorandum was sent to you, my staff has brought to my attention two factors which have caused them th revise this approach to an Operational Readiness Review (ORR) of the Encapsulation Activity, to assure the proper formality and completeness of the review. In accordance with DOE Order 5480.31, the RL Manager would remain the designated approval authority. The draft Plan of Action (POA) for this effort is enclosed.

First and foremost, my staff, in conjunction with EM-25 have recently completed field assessments of the K Basin Program in the areas of Conduct of Operations, Maintenance, Radiological Control and Training, and have identified a number of concerns that will require aggressive WHC action to resolve. As a result, preparations for encapsulation will become more extensive than previously thought and a more vigorous and complex ORR will be required to provide assurance that the activity can be conducted safety.

Second, as a result of discussion with members of your staff, we have determined that RL validation of the safety basis for encapsulation is a prerequisite to start canning operations and provide the technical basis for the ORR. We will accomplish this with the aid of an independent third party review of the documents for their technical adequacy relative to this specific activity. We understand that any deficiencies identified as a result of this review may require updating of

other pertinent documents, e.g., the Environmental Assessment.

We intend to initiate encapsulation in a phased approach. The first phase will involve a limited number of cans as a shakedown run to demonstrate that the conditions we encounter are consistent with what we expected based on our previous experience with encapsulation. Following confirmation of our data and methods, and review of the results of other ongoing studies of alternatives, we will determine how to proceed with the remainder.

As a result of our concerns and our change in approach, I expect that the target Tri-Party Agreement (TPA) milestone of June 30, 1994 may slip as much as 3 months. We will advise our regulators of our current situation and our plans for resolving the issues. However, any further delays can be minimized through the direct participation of HQ staff members in our review and retention of approval for the start-up of encapsulation at the RL level. Even with the delay, I do not expect any other TPA milestones to be affected, provided we adhere to this management approach.

I will proceed on this basis unless I receive further guidance from you.

I can be reached at (509) 376-7434, or your staff may contact J.L. Daily, Nuclear Materials Division, on (509)376-7721.]

J. R. Hunter
Assistant Manager
for Waste Management

Enclosure

cc w/encl:

J.O. Boda, EM-36
E.C. DeLeon, EM-36
D.C. Gupta, E.M.-36