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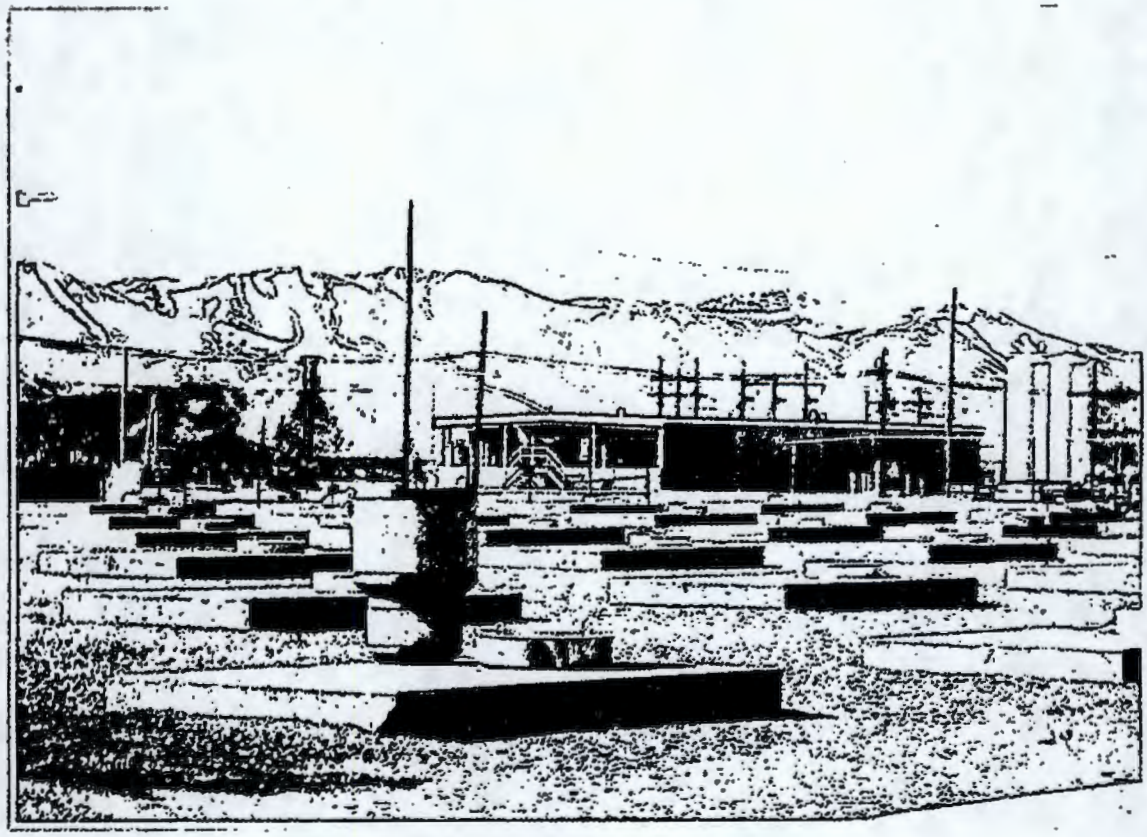
Hanford K Basins Excerpts from

SPENT FUEL WORKING GROUP REPORT



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INVENTORY AND STORAGE
OF THE DEPARTMENT'S SPENT NUCLEAR FUEL
and other
REACTOR IRRADIATED NUCLEAR MATERIALS
AND THEIR ENVIRONMENTAL,
SAFETY AND HEALTH VULNERABILITIES

VOLUME III NOVEMBER 1993
U.S. Department of Energy

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SPENT FUEL INITIATIVE

VOLUME III

SITE TEAM REPORTS

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- EG&G Mound Applied Technologies, Ohio
- Lawrence Berkeley Laboratory
- Battelle Columbus Laboratory
- University Reactors
- Others

INTRODUCTION

Each Site Team, consisting of M&O contractor and Operations Office personnel, performed data collection and identified ES&H concerns relative to RINM storage by preparing responses to the detailed question set for each storage facility at the site. These responses formed the basis for the Site Team reports. These reports are contained in this volume. This volume also contains information received from the sites that were not visited. These sites include the Naval Reactor Facility at the INEL, EG&G Mound Applied Technologies, The Catholic University of America, Rocky Flats Site, Lawrence Livermore National Laboratory, Stanford Linear Accelerator Laboratory, Energy Technology Engineering Center, and Lawrence Berkeley Laboratory. Information received through the Chicago Operations Office for University Reactors, Massachusetts Institute of Technology, and Battelle Columbus Laboratory is also included.

Materials contained in this volume consist of information, data and site documents. They are unedited.

SPENT FUEL INITIATIVE

Hanford Site

SITE TEAM REPORT

SPENT NUCLEAR FUEL - HANFORD SITE TEAM REPORT

Conducted In Support Of Secretary Of Energy's Initiative Direction of August 19, 1993 and The DOE Project Plan For An Initial Report On Assessment Of Vulnerabilities And Department Of Energy Storage And Irradiated Reactor Fuel And Other Reactor Irradiated Nuclear Materials, September 20, 1993.

HANFORD SITE TEAM

John Schmidt	WHC: K Basins Operations Assurance
Dale McKenney	WHC: Solid Waste Program
Don Plowman	WHC: Solid Waste Program
Maria Ortega	WHC: T Plant Engineering
Mark Enghusen	WHC: PUREX - Engineering
Sol Guttenberg	WHC: FFTF - Engineering
Jim Dittmer	WHC: FMEF 308 - EWngineering
Don Knowlton	BNW: 324, 327 Operations
Garry Bryan	BNW: 325 HLRF
Richard Cox	WHC: Operations Programs
Alan Colburn	DOE-RL: OTD

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SPENT NUCLEAR FUEL - HANFORD SITE TEAM REPORT

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SPENT NUCLEAR FUEL - HANFORD SITE TEAM REPORT

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SPENT NUCLEAR FUEL - HANFORD SITE TEAM REPORT

EXECUTIVE SUMMARY

A self assessment was conducted of those Hanford facilities that are utilized to store Reactor Irradiated Nuclear Material, (RINM). The objective of the assessment is to identify the Hanford inventories of RINM and the ES&H concerns associated with such storage. The assessment was performed as proscribed by the Project Plan issued by the DOE Spent Fuel Working Group. The Project Plan is the plan of execution intended to complete the Secretary's request for information relevant to the inventories and vulnerabilities of DOE storage of spent nuclear fuel.

The Hanford RINM inventory, the facilities involved and the nature of the fuel stored are summarized in Table 1. This table succinctly reveals the variety of the Hanford facilities involved, the variety of the types of RINM involved, and the wide range of the quantities of material involved in Hanford's RINM storage circumstances.

ES&H concerns are defined as those circumstances that have the potential, now or in the future, to lead to a criticality event, to a worker radiation exposure event, to an environmental release event, or to public announcements of such circumstances and the sensationalized reporting of the inherent risks.

The following are the conclusions of the Hanford site Team:

K Basins
The ongoing corrosion of RINM at KE results in significant quantities of radioactive corrosion product sludge and releases fission products and actinides into the pool water. These circumstances result in the following ES&H concerns.

KE-1 Worker radiation exposure risks are the norm for activities within KE Basin. The contaminated basin water renders all the water conditioning systems contaminated. The internal contamination and resulting external radiation complicates maintenance and operations of the equipment and contributes to worker radiation exposure.

KE-2 The KE basin has had a leak history. Leakage of contaminated pool water which contains dissolved and suspended solids of spent fuel corrosion product is clearly an ES&H concern.

KE-3 The Pu burden in the pool water filter back-wash collection pit exceeds current Operational Safety Requirements limits. The condition resulted in a USQ declaration May, 1993. This USQ is not yet resolved.

Table 1

HANFORD RINM VULNERABILITY ASSESSMENT

HANFORD SNF INVENTORY
Kg IHM

Storage Facility	Type Fuel						
	N	SPR	Fast Reactor & Mixed Oxide	Shipping Port Blanket	TRIGA	Commercial, Test Reactor & Misc.	Total Kg IHM
KE Basin	1,152,000	400					1,152,400
KW Basin	961,000	100					961,100
PUREX	263	2,879					3,142
T Plant				16,200			16,200
218-W Burial Ground			310*		17.2*		327
FFTF			11,700				11,700
324 Cells						2,400	2,400
325 Cells	0.4*		0.1*			10*	11
327 Cells			6.2*			24.3*	23
308					19.4*		19

Values from EM-37 submittal except *.

*Hanford Irradiated Fuel Base Line
Ref: WHC-SD-CP-TI-175, Rev 1

The material stored at KW Basin is encapsulated in a canister that prevents, or at least greatly inhibits, the release of fission products or actinides within the canister into the pool water. The contents of the canisters have not been inspected since first encapsulated, four to twelve years ago. The level of KW pool contamination, although one to two orders of magnitude less than KE, indicates that the canisters are releasing radio-nuclides into the pool.

KW-1 The RINM contents of the canisters at KW are reacting with the water therein. The extent of degradation of the RINM within and of the canister itself is unknown.

200W Burial Grounds
RINM in casks with a design life of 20 years has been buried for a time that is approaching the design life. The material condition of the casks and the material within is unknown.

BG-1 The condition of the buried material is unknown, raising the potential for worker exposure and environmental release upon retrieval.

T Plant
There is a hairline crack in the storage pool wall at T Plant. The crack is believed to penetrate to the cloth membrane leak barrier. The crack occasionally seeps water. This water has not been definitely traced to the pool water. There is little re-enforcing bar in the T Plant concrete structure compared to current construction practices.

T-1 The crack in the storage pool wall raises doubt on the integrity of the pool structure under seismic events and risks the total release of pool liquid under such circumstances.

PUREX
The RINM in the Purex storage pool is inaccessible for inspection of clad integrity or monitoring or degradation. The N Reactor fuel elements on the dissolver floor show signs of chemical attack.

P-1 The known and unknown extent of degradation of the fuel elements at PUREX poses risk of worker exposure and/or environmental release upon handling this material for removal from Purex and final treatment for disposal.

324
In 1986, a major liquid spill in the B-Cell deposited about 1.3MCi onto the cell floor. The spill did not flow into the sump and initiate an alarm as predicted by the 1984 SAR Supplement. The liquid dried in the accumulated floor dust, retaining the radio-nuclides in the cell.

L-1 The USQ items related to the 1986 spill in 324 are not yet closed and the 1984 SAR is inadequate relative to the current cell configuration.

SPENT NUCLEAR FUEL - HANFORD SITE TEAM REPORT

Hanford Site

The following ES&H concerns become evident following a reading of the individual site responses to the question set:

HS-1 RINM is being stored in kind, quantity, and for lengths of time in facilities that were never intended for such service and the form of the RINM was not designed to remain intact in the current storage environments. (FFTF excepted.)

HS-2 The absence of a clear, certain, and funded path for the removal of the RINM from the current Hanford storage facilities and its final disposal raises ES&H concerns over the risks involved in long term interim storage at the current Hanford site facilities and configurations.

2. FACILITY DESCRIPTION

2.1 KE and KW BASINS

RINM Inventory

KE: 1,152 MTIHM of N Reactor fuel elements and 0.4 MTIHM single pass reactor fuel elements. Maximum 0.95% enriched.

KW: 961 MTIHM of N Reactor fuel elements and 0.1 MTIHM single pass reactor fuel elements. Maximum 1.25% enriched.

M & O Contractor: Westinghouse

C.S.O.: EM

Operations Office: RL

Mission: Interim storage of irradiated production reactor fuel.

Important Characteristics

The KE and KW Basins are water filled fuel storage facilities located 1400 and 1100 feet, respectively, from the Columbia River. Each basin was built in the early to mid-1950s as an attachment to their respective plutonium production reactor. The 105-KE and 105-KW reactor/basin buildings are essentially identical in design. They are separated by 2000 feet on a line nearly parallel to the river. The basins were designed to serve as a holding basin for discharged "metal", (irradiated, aluminum clad, uranium metal "slugs", weighing about 8 pounds each). The irradiated slugs were manually stacked in stainless steel "buckets" and held in the basins for about 150 days to allow for the decay of I^{131} to safe levels prior to reprocessing the fuel. Basin water quality and fuel cooling were accomplished by supplying the basins with filtered river water and spilling the over flow back to the river.

K Basins cont'd.

Figure 2 shows the working area of the basin. The walking surface is suspended from the roof structure. Slots in the floor allow the overhead traveling hoists to access any storage location.

Figure 3 shows the plan view of both basins.

Figure 4 shows the pool water conditioning systems added to each basin. The recirculating water cooling and conditioning were added to negate the original basin cooling process. The recirculating loop equipment has become highly contaminated at the KE basin.

Figure 5 is a North/South section view of the KE and KW basin construction. The basin structure joins the reactor building structure in the pick-up chutes. This construction joint at the KE basin was the source of a 500 gph leak in the late '70s.

Figure 6 shows the arrangement for moving canisters to or from specific floor locations.

Figure 7 illustrates the design of the canisters in use. The Mark 0 canister is open to the pool at the top and has liquid drain holes at the bottom. The Mark 0 was originally designed to be dissolved, along with the fuel that it carried, at the fuel reprocessing operation. In the KE basin the open top and bottom drain holes allow radio nuclides and actinides from those fuel elements with failed clad to migrate to the pool water. The Mark I and II canisters provide a complete seal. Any and all fuel stored at KW entered the basin in a sealed canister.

3 DISCUSSION

3.1 REACTOR IRRADIATED NUCLEAR MATERIAL INVENTORY

The Hanford data in the EM-37 inventory data submittal was reported in units of total mass, metric tons of uranium, and as metric tons of heavy metal(MTIHM). Table 1, in the Summary section of this report, shows the data in kilograms (of) Irradiated Heavy Metal, (KgIHM). This was done in order that those facilities reported in the EM-37 submittal as having "insignificant quantities" in terms of metric tons can be viewed in Table 1 in terms of actual quantities relative to other Hanford facilities.

The bulk of the Hanford RINM inventory is stored in water filled pools. The exceptions are:

Burial Grounds - Uncovered EBR II storage casks and buried containers.

Purex - Some 35 pieces of N Reactor fuel elements on the dissolver floor with ventilation air cooling.

FFTF - The irradiated FFTF fuel assemblies are all stored in a liquid sodium pool. Further, the core is loaded with fuel but not to the extent that it can be taken critical.

Hot Cells - All of the 324/325/327 hot cell RINM is in air with the exception of that in the 327 pool.

Hazardous materials are involved with the liquid sodium at FFTF. At 324, contaminated lead brick shielding and about 1.5 MCi of Cs/Sr occupy the same cell as irradiated fuel.

There is no significant target storage in the sense of the targets competing for storage space with spent fuel.

3.2 PHYSICAL CONDITION OF THE SPENT FUEL

At KE Basin it can be clearly seen that about half of the fuel elements have experienced breached clad. The swelling and uranium corrosion product that results is also clearly visible. The pool water radioactivity at KE is relatively high. The water conditioning equipment acquires this activity and contributes to the radiation dose to workers.

The KW-Basin fuel elements are all sealed in canisters and are not amenable to observation. Opening canisters within KW is not allowed in order that the relatively low basin activity remain in that state. The activity of the KW basin water remains relatively constant over time. If there were no sources it would be expected that continued operation of the water conditioning system would cause the water activity to trend downward with time. That such is not the case suggests that the activity in KW water comes from the inner contents of a number of canisters. It is likely that the corrosion processes in effect at KE are also on going inside sealed canisters at KW.

The PWR Core II assemblies are visible at T Plant but they are not routinely viewed with the intent to search for signs of water penetrating the clad. Pool activity is measured and establishes the basis of confidence in the integrity of the fuel.

The Purex operation used a remotely manipulated video camera to view the "slugs" in the storage pool and the condition of the N Reactor fuel elements on the dissolver floor. The video images indicate that the N fuel is under chemical attack and the slugs that are visible as such in the pool may be developing a thick aluminum corrosion film. The hardware that supports the "buckets" in the pool water appears to be iron alloy and clearly shows sign of corrosion.

The RINM stored in the laboratory hot cells includes whole fuel rods, fuel pins, and samples thereof. Samples obtained by destructive means are stored in containers with lids.

3.3 Water Quality

The KE and KW basin water is essentially de-ionized water. The pH is dictated by the Columbia River and hovers around 7. The KE Basin contains a significant quantity of sludge.

The T Plant pool is monitored and conditioned.

The Purex pool is not monitored nor is the water conditioned.

The FFTF monitors and controls sodium chemistry to the criteria established in the FSAR.

The 308 TRIGA pool is monitored daily and controlled to the criteria of the SAR.

3.4 Facility Condition

The K Basins are approaching 40 years of age. Utility service equipment, eg, water distribution, electricity, and compressed air, all reflect the 40 years. KE experienced a basin leak at the reactor building/basin construction joint in the late 70's. The leak was repaired in the 1979 to early 1980 time frame. There is evidence suggesting that a leak of 50 gph developed in the early months of 1993 but which has diminished to the point of being non-detectable after six months.

Monitoring wells are near both KE and KW basin and also to their North near the river. Air and water effluents are monitored at both facilities. There is no HEPA filtration nor a confinement system. The KE Basin is generally a smearable contamination area with contamination on virtually all surfaces.

The T Plant is nearly 50 years old. It is in reasonable condition considering its age and utilization. The pool level is monitored; there is no leak detection system. A crack has been discovered on the outside vertical pool wall common to the rail tunnel. The crack seeps water occasionally but the constituents of this water cannot be definitely traced to the pool. The pool area is a smearable

radiation controlled area and is accessible for surveillance and maintenance activities.

Purex is approaching 40 years of age. The fuel storage pool has no provisions for leak detection. The radiation levels in the vicinity of the stored fuel is prohibitively high. Extensive HEPA filtration is employed upon facility exhaust air.

The FFTF and 308 Annex(TRIGA) are in excellent condition.

The hot cell facilities range in age from nearly thirty to fifty years. The safety equipment is up to date. There is significant smearable radioactivity in those cells where RINM is stored. HEPA filtration is utilized on all of the cells.

3.5 ES&H Open Items

The KE basin experienced an event in May of 1993 when it was revealed that the quantity of Plutonium in the sand filter backwash retention pit exceeded the limit proscribed by the OSR. This issue is steadfastly moving towards closure.

The 1990 Tiger Team determined that the fuel material stored in KE Basin should be encapsulated.

The K Basin operation has conducted DOE Order Compliance, to the DP protocol and methodology, on 20 Orders explicitly applicable to K Basin operations.

The KW Basin has an open issue with regard to counterfeit bolts used in the new roof structure. This issue is near closure.

The T Plant has submitted a draft Requirements Identification Document, (RID), to DOE HQ for review and validation. This action was in response to DNSFB Recommendation No. 90-2,(Codes and Standards).

The 324 radiochemistry hot cell facility has an open USQ dating back to 1986 radioactive liquid spill. The 1984 SAR predicted that the spill would flow into cell sump where it would trigger a detector and an alarm. The material, containing about 1.3 MCi of Cs/Sr, dried in the dust on the floor of the cell, a condition that is not addressed in the SAR.

The 325 hot cell facility SAR, a 1977 document, was found to be in need of updating by the 1990 Tiger Team. The updated SAR was approved by PNL-BNW and DOE-RL and submitted to HQ for review and approval in January, 1992. Prior to the disposition of the 1992 submittal by HQ, PNL was instructed to upgrade the '92 submittal to the newly issued DOE 5480.23. At this time the 1977 SAR remains the DOE approved SAR for the facility due to a lack of funding for the SAR revision activity.

3.6 Current Authorization Basis
The 1984 SAR for the K Basins is out of date. Funding is available to develop an interim basis document by Sept. 1994, which is to be submitted to DOE HQ for approval.

The FFTF is at a mission crossroads. A major revision of the FSAR will be necessary for what ever future mission is decided.

Current operations at the 308 Annex (TRIGA) are conducted in accordance with the approved FSAR at this time. An interim basis document has been prepared to address interim fuel storage operations. The interim basis document is under review for approval.

The 325 hot cell facility SAR situation was discussed as an ES&H open item.

3.7 Conduct of Operations and Institutional Controls.
All of the Hanford spent fuel storage facilities have programs in place for the Conduct of Operations which is appropriate to their mission and circumstances.

3.8 ES&H Concerns Related To The Storage Of RINM
A central theme runs through the expressed concerns of the various Hanford facility vulnerability assessment authors. First, their facility was never planned or intended to be a long term interim storage facility; programmatic decisions by others, elsewhere, resulted in a de facto interim storage mission. Secondly, programmatic decisions or efforts have yet to be manifest as a clear, certain, and funded path for the disposal of the legacy of the first decision.

RINM VULNERABILITY ASSESSMENT

K BASINS

Question #1

What is your inventory of Reactor Irradiated Nuclear Material (RINM)?

The EM-37 Questionnaire has been prepared and submitted for the N Reactor fuel and describes the K Basin fuel inventory in detail. In response to specific questionnaire elements:

- There is no buried fuel known of in the Hanford K Area.
- There is no target material in the K Basins requiring specific disposition planning.
- There is no classified RINM at the K Basins (Note: Certain aspects regarding accountability issues and security systems remain classified.)
- There are no other hazardous materials stored in the K Basins requiring specific disposition planning. No hazardous materials are used for basin water treatment. Chlorine is used as a biocide for treatment of sanitary water supplied to K Area support facilities.

The RINM stored in the K Basins is also described in detail in various references including the "Technical Supplement to the Notice of Intent to Prepare an Environmental Impact Statement: Disposition of Irradiated Fuel Stored at the Hanford Site."

Question #2

What is the material condition of your reactor Irradiated Nuclear Materials?

a) KE Basin

The irradiated N Reactor fuel assemblies sustained a visibly discernible loss of cladding integrity on approximately seven percent of the fuel upon reactor discharge. With extended storage, it is evident by visual examination of the KE inventory, which is stored in open, unsealed storage canisters, that the damage rate was much greater. Aqueous corrosion of the metallic uranium by water results in a three to one volume expansion of the uranium oxide relative to uranium and, at present, loss of cladding integrity on approximately fifty percent of the stored fuel in KE Basin is visually evident.

The affect of the damaged cladding and aqueous corrosion of the metallic uranium is that the uranium oxides so formed are not all constrained within the fuel cladding; and soluble fission products formed within the oxidized fuel fraction are released to the basin pool water and the escaping insoluble fission, transmutation products, and uranium oxide settle on the floors as particulate matter. As a result of prior fuel storage and handling activities of RINM at KE Basin, the particulates have built up on the main storage bay floor to an estimated one-quarter inch depth and to depths of several inches in basin areas where various handling or water treatment activities are concentrated.

The cladding integrity issue has several ramifications including loss of primary containment of the fission products, increased dose rates for basin workers, increased water treatment costs, and ultimately, increased risk to the public and environment. To restore primary containment, the 105 KE Basin inventory will be encapsulated in sealed storage canisters over a two-year period beginning in May 1994. Subsequently, the sludge will be collected and also placed in sealed storage canisters. Funding is not wholly adequate at present for fuel and sludge encapsulation, needed facility upgrades, and maintenance and operations at the desired level of discipline.

b) KW Basin

Fuel stored in the 105 KW Basin was placed in sealed fuel storage canisters prior to shipment to KW Basin for storage. The sealed storage containers are of two types: an originally developed model using primarily aluminum components and a subsequent model of all stainless steel components and an improved seal design. The fuel stored in the originally developed canister model is planned to be repackaged into the later model, following encapsulation of material in KE Basin, due to long term canister corrosion concerns. Environmentally assisted stress corrosion cracking of a seal locking bar was also experienced on approximately seven percent of the later model canisters and future plans are to replace the failed bars. These two improvements to storage canisters in KW Basin are expected to assure canister integrity in KW Basin over an expected storage period of up to twenty years. Current funding levels however will extend the schedule for these improvements.

The rate and nature of fuel deterioration within the sealed canisters has not been characterized. A characterization program for the fuel including samples from sealed canisters in KW Basin is planned to support the preparation and definition of alternatives for the Hanford Irradiated Fuels Disposition Environmental Impact Statement (EIS). It is intended that the fuel characterization data required to support safe storage in the K Basins for up to twenty years will be obtained in parallel with the EIS characterization effort. For long term disposition of the fuel, the characterization program

will evaluate the risks and feasibilities of various disposition options including the potential pyrophoricity of this fuel under conditions other than underwater storage. At present, the characterization effort is funded although it is expected that EM-37 funding will be provided in FY 1994 for initiation of this effort.

Question #3

What is your water quality (or coolant quality) condition?

With respect to the specific elements for this question:

- Chemistry of basin water is basically de-ionized water with a conductivity of approximately 10 μ mho's. This condition has given acceptable corrosion performance with the possible exception of aluminum canisters in KW Basin for which replacement is planned following encapsulation.

- Radionuclide concentrations in both basins is controlled by two water treatment systems; each of which contains mixed ion beds for soluble radionuclide removal and separate particulate filters. The system contains features which are typical of approaches selected for the short term use originally intended for the K Basins.

  There is no designed-in method for disposing of sandfilter backwash residues (see Unreviewed Safety Question (USQ) portion of Question 5). The ion columns are typically TRU waste and no suitable container exists for their disposal or storage. One particulate (cartridge) filter in each basin is underwater and cartridge changeout is extremely difficult. The spent cartridge filters were recently declared TRU waste and no acceptable disposal container is available.

  On the short term, stored TRU ion columns will be emptied of resin which will be placed in an approved TRU container by a contracted service. Acceptable TRU containers for cartridge filters are being procured. For the longer term, an engineering study is in progress to develop recommended reconfigurations to support an efficient water treatment system and associated waste disposal operations. The costs of such modifications have not yet been identified and incorporated in budget planning.

- No specific biological growth control measures are required to maintain K Basins water quality.

- Sludge issues are discussed under the response for Question 2, part a.

The treatment systems at KW have maintained the basin water quality within an order of magnitude or so of drinking water standards. Some additional ion exchange capability may be necessary to maintain these levels and can be provided in a relatively straight-forward manner as has already been done at KE Basin. The soluble fission products Cs-137, Sr-90, and plutonium and americium levels are three to five orders of magnitude greater in KE Basin water reinforcing the need to quickly encapsulate the KE Basin fuel as planned and funded. In addition, tritium concentration in the KE Basin water is approximately 3 X 10^6 p Ci/l as it is not removed by the ion exchange media. It remains at a relatively constant level because although the existing inventory in the fuel and water is subject to the twelve year half-life decay rate, continued corrosion of the fuel results in replenishment of the water inventory.

Pacific Northwest Laboratories (PNL) has demonstrated the ability to remove up to 75 percent of the tritium in a liquid-bearing stream of 10,000 p CI/l in lab scale testing. Since the Environmental Protection Agency (EPA) views KE Basin tritium levels as an environmental threat, significant incentive exists to develop the PNL technology. Funding support is being pursued under waste disposal development proposals and the results of this approach are not yet known. This development should be funded but is beyond K Basin budget abilities.

Question #4

What is the condition of your facility ("facility" includes safety systems, structures, and equipment)?

The K Basins were originally constructed around 1950. They supported operation of the K Reactors until their shutdown in 1970 and 1971. They were employed for storage of N Reactor irradiated fuel beginning in 1976 (KE) and 1981 (KW). They were intended for only short term storage until Purex restarted and could process accumulated inventory. They received only limited retrofitting for this mission and adequate funding to operate at expected levels has always been limited by initiatives that suggest but do not result in a limited storage mission. (Also, see Question 8)

In specific response to elements for Question 4:

- The condition of this facility is based on a draft assessment of the facilities to DOE Order 6430.1A requirements (WHC-SD-NR-DA-018, Draft), DOE Order Compliance Assessments performed in Response to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 90-2 and involving approximately 20 DOE Orders applicable to the Basins, updated dynamic state-of-the-art seismic analyses of the basin and adjoining structure to assure seismic design adequacy relative to the original

static-based analyses (WHC-SD-N031-SA-002, Draft, WHC-SD-NR-SA-001, Draft, and WHC-SD-NR-SA-024 Rev 0), a documented surveillance program for Operating Safety Requirements (OSRs) and lower tier surveillance and calibration requirements as the principal elements. In addition, numerous engineering studies have been performed on systems or sub-systems and engineering system evaluations are in progress to support outyear planning.

- A small portion of the equipment has a preventive maintenance program in place. However, current funding is insufficient to support an adequate program and a significant maintenance backlog exists. As an example, periodic servicing of high voltage switchgear is generally inadequate compared to recognized industry requirements and frequency and upgrades are necessary. There are no loss of power safety envelope concerns associated with the basins. Many of the facility systems are in a run to failure mode.

- Essential operational monitoring is performed and upgrades of various monitoring systems are funded and in progress as expense-funded facility modifications. Monitoring includes leak monitoring systems. The KE Basin has leaked twice, once in 1976 to 1980 and once in 1993. The early leak was repaired. The recent leak (up to 50 gallons per hour) has decreased to nominally zero by controlling (lowering) basin pool temperature. A leak management strategy is being developed and funded but the effort diverts limited resources from other support functions essential to good conduct of operations.

- The K Basins are not provided with a confinement system or High Efficiency Particulate Air (HEPA) filtration of ventilation effluents. The facilities are capable of meeting WHC air emission requirements which are conservative to DOE Order requirements. The emission points are registered with the State of Washington and State of Washington Department of Health has approved an air permit for the encapsulation of fuel in KE Basin. This permit requires an increase in monitoring and decreased sample analysis turnaround times which are overrunning established FY 93 budgets and FY 94 planning levels. Monitoring systems are marginally adequate.

- Ventilation of the building is marginal. The ventilation system consists of four roof exhausters at each basin. Swamp coolers provide limited ventilation cooling in summer months.

- The work areas in and around KE Basin are radiological controlled areas per the WHC Radiation Control Manual requirements and are so administered. The dose rates are an average of 10-15 mR per hour. Fuel encapsulation will be conducted in an area of approximately 3 mR per hour. The main work area in and around KW Basin is not contaminated

although surface contaminated areas do exist within the facility. Following fuel and sludge encapsulation at KE Basin, the expectation is to decontaminate and release the main work areas.

The basins are seismically adequate to current standards subject to repair of an unreinforced wetted construction joint between the basin and adjacent shutdown reactor structure and minor superstructure reinforcement to maintain stress within allowables. The repairs are an element of an FY 1996 line item (N032-KE/KW Life Extension) which is presently unfunded and for which FY 1994 funding is considered essential. A reassessment of the basins to revised seismic criteria is not anticipated as implementation of forthcoming DOE Order 5480.28 is not funded.

The FY 1996 line item also includes fire protection upgrades identified as necessary for compliance by the earlier referenced order assessments. The basin material has been re-categorized. Present security protection is not adequate for the re-categorized fuel. Funding is required for upgrading the security protection.

Air cooler chillers (Project E-021) replacing existing water-cooled chillers have been installed to provide cooling for the irradiated fuel and improved basin water temperature control. A validated FY 1995 line item project (N-027) is to replace antiquated and grossly oversized components of the present system and bring water and electrical systems into compliance with safety codes and site standards. Budget site priorities, however, have again deferred the line item to FY 1996, compared to the original proposal for FY 1994 line item funding.

A roof repair program has shored failed roof panels and tested roof panels for the design loads. Roof qualification testing for personnel and 105 KE/105 KW reroofing are planned for FY 1994.

The in-depth studies and Facility Life Extension assessment (WHC-SD-NR-FLE-001) have identified no other line item magnitude fixes to ensure continued safe operation of the K Basins. Typical of 40-plus-year-old facilities, significant modifications are required to maintain support systems operability and compliance. Existing budgets are minimal and result in reactive management to safety and major programmatic planning elements, Many elements critical to expected conduct of operations excellence are unfunded and reported as performance deficiencies by Westinghouse Hanford Company (WHC), U.S. Department of Energy (DOE), and other external oversight.

Question #5

Are there any significant Environmental Safety and Health (ES&H) open items?

RINM VULNERABILITY ASSESSMENT

K BASINS

In response to elements for question 5:

- One unresolved USQ presently exists. On May 10, 1993, the OSR limit for accumulation of Pu in the sandfilter backwash pit at KE Basin was exceeded and reported per DOE Order 5000.3B as WHC-KBasins-1993-0016. The criticality limit was based on the extremely conservative assumption that plutonium particulates could segregate in the pit and the limit (225g) was based on a Pu-water spherical and fully reflected system. The root cause investigation cited among the major contributors as conducting an extended mission in a facility prepared for only a limited (three-year) mission, inadequate sampling procedures, and lack of a tracking system for surveillance results.

  Analysis has shown the k_{eff} in the pit to be well below levels of concern, i.e., on the 0.2-0.4 range. Extensive preparations have demonstrated the ability to successfully perform laboratory analysis of samples of the backwash sludge and to obtain representative samples thereof. Representative sampling of the pit has been completed and analysis of samples is in progress. Final resolution of the event will involve Safety Analysis Report/Operating Safety Requirement (SAR/OSR) changes and is scheduled for completion by May 1994.

  A potential inadequacy related to counterfeit bolts in the new KW Basin roof has also been reported per DOE Order 5000.3B. Analysis has shown, based on minimum observed strengths of A325KS bolts at Hanford and in NRC testing, that with significant margin, the event does not constitute an USQ. In-place testing of a bolt sample is in progress to verify bolt strengths are adequate and permit resolution and closeout of this event.

- No Unusual Occurrence Report (UOR) corrective actions exist requiring abnormally long closeout periods.

- Completion of KE Basin fuel encapsulation scheduled for May 1996 is an open Hanford Tiger Team Assessment (DOE/EH0139) corrective action directly applicable to the K Basins.

- Other recent DOE Reviews include U.S. Department of Energy, Headquarters (DOE-HQ) team assessments of conformance to the DOE and Hanford Site Radiation Control Manual, Conduct of Operations, per DOE Order 5480.19 and K Area groundwater monitoring. Findings from these oversights do not involve issues of significant programmatic or budgetary impact with one exception discussed in the following paragraph.

- In response to DNFSB Recommendation 90-2, Order Compliance Assessments have been performed on a set of DOE Orders applicable to the Basins as agreed to with the U.S. Department of Energy, Richland Operations Office (RL). Several additional assessments are planned to close the issue in

response to expanded scope and updated orders previously assessed. The assessment to DOE Order 5480.19, Conduct of Operations, has indicated expanded training of operations and support personnel is required for compliance. While current training has been judged adequate for continued safe operation including encapsulation operations, long term upgrades for operator and support personnel are judged essential. Current funding is inadequate to support aggressive response to all cited training shortfalls.

- Oversight visits from state regulators with enforcement authority for regulated waste handling and radioactive particulate air emissions are routine and without significant findings associated therewith.

Question #6

What is the current authorization basis for your facility?

DOE-approved Safety Analysis Report (WHC-SP-0300, "Safety Analysis: Irradiated N Reactor Fuel") and Operational Safety Requirements (WHC-CM-5-28, "Operational Safety Requirements") exist for the K Basins. The requirements are imposed on facility operations by a disciplined administrative system. In addition, a compliant facility procedure implementing the provisions of DOE Order 5480.21, "Unreviewed Safety Questions," has been in existence since 1991.

The SAR and OSR are sound technical documents. They analyze a wide variety of accidents including beyond design basis events. OSR controls exceed those that would be established based on DOE Order 5480.23. The format is dated. There are minor inconsistencies which in all cases are applied as the more conservative value by implementing requirements. Previous attempts to update these documents have been unsuccessful due to institutional issues associated with evolving format requirements. An implementation plan is in place for DOE Order 5480.22/23 requirements. An Interim Safety Basis (ISB) will be prepared and issued between October 1, 1993 to December 31, 1994 and a fully compliant SAR/OSR will be prepared and issued in FY 95 and FY 96. These efforts are presently funded within the planning case. Additional discussion is provided relative to the questions elements:

- The mission is adequately addressed in the SAR/OSR.

- Interim measures are not necessary and the existing SAR/OSR is documented to DOE as the authorization basis pending described upgrading. A Safety Evaluation per DOE Order 5480.19 performed for KE Basin encapsulation is also included in the facility authorization basis.

- Criticality Control is in compliance with DOE Order requirements and is based on conservative, supported assumptions. Analytical codes employed in criticality safety evaluations are validated and benchmarked to experimental data. Resolution of an Order Compliance corrective action, to assure an adequate basis exists for not requiring a criticality alarm system in the basins, is in progress.

- Current facility configuration is per the SAR with the exception of modifications that do not represent unreviewed safety questions. These will be incorporated in the DOE Order 5480.22/.23 upgrade.

- Loss of cooling events are not significant to the facility. When seismic integrity is ensured by the line item discussed in the response to Question 4, any potential seismic threat will be negated. The heat generation is so low that adiabatic heat-up rates will not result in temperatures exceeding OSR limits. Emergency procedures exist for makeup to the basin for potential beyond-design basis events to assure continued shielding and mitigation of environmental releases.

- Natural phenomena protection for earthquakes has been previously addressed. The facility is above the flood plain for all credible dam failures. High winds are analyzed and prescriptive surveillances performed to assure protection. Ashfall loading protection is afforded in the facility design.

- Protective measures for railroad movements in proximity of the facility are covered.

- A fire risk assessment is planned in response to upgraded fire protection order requirements for the facility but is not presently funded or scheduled. A new water plant is presently funded and is essential to resolve fire protection deficiencies. The project is presently unfunded.

- Loss of power, beyond-design basis accidents, and fuel handling accidents are addressed. Human factors will be addressed as required in DOE Order 5480.22/23 implementation. Supporting Services from other facilities are not elements of the safety authorization.

As a final note, USQ screening of modifications is performed rather than evaluations due to lack of funding to support the full implementation of this order.

Question #7

What are your conduct of operation and operational controls?

RINM VULNERABILITY ASSESSMENT

K BASINS

Conduct of Operations requirements for the facility are based on DOE Order 5480.19, Conduct of Operations. A graded approach has been developed in conjunction with and approved by RL which identifies portions of each chapter of the order as applicable to the facility. All operations and most supporting personnel have attended formal Conduct of Operations training. Continuous improvement in Conduct of Operations is a major goal of the facility.

With response to specific question elements:

- K Area emergency response actions are documented and are integrated with the Hanford site emergency planning and response system. Site drills are held routinely including interactions with offsite entities. These drills periodically involve K Area accident scenarios. A facility drill program was developed and initiated earlier this fiscal year. Both programs include performance evaluations.

- Operators are trained and qualified and the program is being further strengthened. All operators have attended the WHC Core Fundamentals training in addition to Conduct of Operations training. Encapsulation specific training will be given to all operators prior to initiation of fuel encapsulation. Systems training which will cover all basin equipment is being developed and will also be provided to all operators before encapsulation commences. Certification training per DOE Order 5480.20 will be completed by all operators in parallel with conduct of the encapsulation effort. Current funding levels to complete the described training are adequate.

- Radiation Protection for 100 K Area and the Hanford site is based on the DOE Radiation Control Manual (DOE N5480.6) which in early FY 1992 superseded previous WHC practices. For implementing the new Radiation Control requirements, a complete assessment of the new against existing requirements was performed to identify all required changes to practices and implementation procedures and to provide a tracking mechanism for implementation of those changes. Both a Hanford Site (HSRCM-1) and WHC Radiation Control Manual (WHC-CM-1-6) exist to implement the DOE requirements uniformly across the site. Health Physics Technicians are certified per WHC-CM-1-6 and HSRCM-1 and managers are qualified to requirements therein. DOE-HQ conducted an operational assessment of 100 K radiation control practices in the summer of 1993 with only minor findings and required corrective actions.

- Industrial hygiene and industrial safety practices are based on established Westinghouse Hanford Company requirements (WHC-CM-4-40, "Industrial Hygiene Manual," and WHC-4-3, "Industrial Safety Manual") and a host of implementing procedures. As a result of recent WHC and Hanford Industrial Safety performance which is judged inadequate, major

reforms are being developed starting with the concept that working safety and taking ownership for yours, your workers, and co-workers safety is a condition of employment.

- Quality assurance practices applied to K Basin activities are based on the requirements of DOE Order 5700.6C. Facility specific compliance to this order will be evaluated as part of additional DOE Order Compliance Assessments performed in support of DNFSB Recommendation 90-2.

- Work control and program planning systems are designed to identify and provide the required permits for safe and compliant execution of work. Typical of permitting activities in the work control system are controlled entry permitting for confined spaces and excavation permits. Upgrades to the work control process focusing on rigor and thoroughness of packages issued for work in the field are in progress.

  For regulatory compliance, primary interactions are with Clean Water and Clean Air Act requirements. An National Pollutant Discharge Elimination System (NPDES) permit (EPA) exists for discharges to the Columbia River and ventilation effluents are permitted as required. Numerous compliance visits are a matter of record with these agencies and reporting requirements are established and met.

Question #8

Describe your site's most important ES&H concerns regarding the storage and handling of Reactor Irradiated Nuclear Materials.

KE Basin (1976) and KW Basin (1981) received minor retrofitting for the storage of N Reactor irradiated fuel. The storage period was intended to be short term until the Purex reprocessing plant, which entered an extended outage in 1972, could be restarted. Purex did restart in 1983 and reduced the stored inventory from a maximum of just over 4000 mtu to the current 2106 mtu when it was shutdown in 1989 and the subsequent decision was made <u>not</u> to resume further fuel reprocessing operations. This decision re-established the K Basin storage period at up to an additional 20 years until the disposition of N Reactor irradiated fuel can be determined by the EIS process and implemented.

Concurrent with this development, DOE Orders 5480.19 through 5480.23 were issued greatly increasing the requirements for discipline of operation as applied to non-reactor nuclear facilities. Also concurrently, the focus of oversight groups headlined by DNFSB shifted from major reactor operations and restarts throughout the complex to other areas including fuel storage. Facilities such as the K Basins, originally funded for short term operation, is being asked to perform to unprecedented levels for chronically underfunded

facilities. Upgrades of support systems are required to sustain a high level of rigor.

Both DOE and contractor commitments to continuous improvement and efficiency are essential in this climate. Equally important is for the budget planning cycle and results to become synonymous with overall DOE expectations for such facilities. The increased activities necessary to support an intermediate-term mission, increased oversight, and current budgets are not yet synchronized. Thus, the number one ES&H concern is to assure that DOE expectations and budgets are synchronized so DOE and contractor performance in the field can meet the established expectations.

Change Number M-16-98-02	Federal Facility Agreement and Consent Order Change Control Form Do not use blue ink. Type or print using black ink.	Date 5/4/98
Originator **Phone** G. I. Goldberg (509) 376-9552		
Class of Change [ ] I - Signatories [X] II - Executive Manager [ ] III - Project Manager		
Change Title Extend target dates for M-16-07B, M-16-08B, M-16-26A, and M-16-26B. Establish milestones for 100-FR-1 and 100-FR-2 remediation.		