Special Exposure Cohort Petition - Form B

(Modified)

Petition prepared and modified for use in requesting SEC status under the Energy Employees Occupational Illness Compensation Act for submitting to NIOSH OCAS – 4676 Columbia Parkway, MS-C47 in Cincinnati, Ohio 45226. FAX (513) 533-6826

Petitioner and Former
Hanford Site Sub-Contractor Employee
From 1967 through 1971

Table of Contents

This format of SEC Form B is revised for submission as a 'SEC Petition

Introduction

Please note that I am using this format for filing my Special Exposure Cohort Petition only because it provides me with a way to keep all of my information together in one document. In doing so, I am following the Instructions for Completing Special Exposure Cohort Petition - Form B (OMB Number 0920-0639).

To the best of my knowledge and recollection, the reported and described work duties, tasks, jobs, worksites, locations, grounds, structures and buildings that are described herein are and were common to all Carpenters and Apprentice Carpenters of Local 1849, that worked on the Hanford Project in Richland, Washington for the J.A. Jones Construction Company, a sub-contractor for Battelle Corporation a contractor of the (then) U.S. Atomic Energy Commission, and (now) U.S. Department of Energy.

We worked in the same locations, atmospheres and conditions, used the same types of tools and equipment, underwent the same training and safety meetings, and followed the same standards, guidelines and specifications for completing our work from 1967 through 1968 and from 1970 through 1971. It is in this regard that I have taken the liberty to submit this petition in request for consideration of Special Exposure Cohort (SEC) status for ALL Hanford Carpenters and Apprentice Carpenter workers within this class.

I, (Petitioner) do herein assert by this affidavit that the energy employees of the Hanford Site who meet this proposed class definition did not receive monitoring for potential internal radiation exposures. This class of workers were not routinely monitored for internal exposures through bioassay or any other in vivo means. I also herein assert that there was a potential for internal exposure based on the work processes involved in the duties of Construction Trades Carpenters and Carpenter Apprentices during the timeline of this Class.

SECTION C EMPLOYEE INFORMATION

C.1 - Name of Employee:

C.2 - Former Name of Employee:
Nickname:

C.3 - Social Security Number:

C.4 - Address:

C.5 - Telephone Number:

C.6 - Email Address:

C.7 - EMPLOYMENT INFORMATION RELATED TO PETITION:

C.7a - Employee Number:

(Payroll Number)

C.7b - Dates of Employment:

From -1967 through 1968 and (1970 through 1971

C.7c - Employer Name:

J.A. Jones Construction, Inc., Hanford Site Minor Maintenance Sub-Contractor

SECTION C-7 EMPLOYEE INFORMATION continued

C.7d - Work Site Location:

Hanford Site - Richland, WA

(Atomic Energy Commission) - U.S. Department of Energy
J.A. Jones Construction Co. - Richland, WA 99352 (Sub-contractor)
Payroll Number:
Employment Start/Ending Dates:
1967 through 1968 and
1970 through 1971

Building Trades Union:
Carpenters Local #1849
Status: Apprentice Carpenter (4-years)

J.A. Jones carpenters worked in teams mostly as rovers, and as such we were assigned and worked all over the Hanford Project. Those specific locations that I listed are some of those where I spent a minimum of one full eight and one-half hour day.:

Hanford Work Experience
As a carpenter apprentice at Hanford for approximately 33-months, I was very mobile and worked all over Hanford in the 100, 200, 300 and 1100 Areas, as well as the Tank Farms and Burial Grounds. As a result, I believe I was exposed to a large number of carcinogenic agents at extremely high doses, including Beta, Gamma, Neutrons, Protons, 233-U, Thorium, and Polonium, etc. However, my Hanford radiation records are only partial, and are incomplete because I was not monitored completely or correctly during my employment at Hanford. There were times when I worked in 'hot zones' with no protective clothing or breathing apparatus. I was frequently engaged in work with the potential for very high peaks. There was the probable likelihood of such ionized radiation exposures not being captured adequately in the dose recording systems of 1967 through 1971, which was during my employment at Hanford.

HANFORD WORKSITE DESCRIPTIONS and ASSIGNMENT OF WORK DAYS

"There are a network of roads, railroads, utilities, and more than 1,000 buildings and facilities at the Hanford Site, an area of approximately 560 square miles. "The primary mission of the Hanford site throughout its history was the production of plutonium for use as a military deterrent.

Many uncertainties faced the plutonium project. There were various potential methods for cooling the pile (reactor) in which the uranium would be irradiated. The means of subsequent chemical separations was unfixed. The equipment

SECTION C-7 EMPLOYEE INFORMATION continued

needed was not even designed or manufactured anywhere in the world as yet. And there was the question of maintaining health and safety in the presence of large quantities of new, dangerous, and poorly understood radioactive substances. (Gerber 1992, p. 5)"

Primary site operations included: Fuel Manufacturing, Fuel Irradiation, Chemical Separation, and Plutonium Finishing. Each function required support facilities, of which J.A. Jones Construction Company provided the 'minor maintenance' for all operations all over the Hanford Site. Problems encountered while operations were ongoing were resolved through AEC research and development. This R&D function found ways to improve procedures, which in many instances required the alteration of existing buildings and facilities accordingly. And as a result, we always had job backlogs and plenty of work to do. Most of the building alterations we made were because of the changes made when changing the use of or decommissioning or dismantling structures and buildings that were contaminated. We were constantly remodeling labs, shops, warehouses, offices, buildings and structures in 'hot' zones. Such as:

- ☒ 100 Areas (H, F, N, B, C, D, K); 200 Areas (E, W); 400 Area; 300 Area; 1100 Area; and the 3000 Area.
- ☒ #318 Burial Grounds (I believe there were about 10 different burial ground sites where I have worked.)
- ☒ #309 (Scaffold work and shoring of contaminated trenches, ditches, etc.)
- ☒ #303k (Scaffold work and waste storage concrete forms work)
- ☒ #303f (Scaffold work around uranium acid spill)
- ☒ #306e (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #324 (Scaffold work)
- ☒ #313 (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #331 (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #333 (Tank Farm, storage yard, lot or pad work)
- ☒ #325 (Shoring contaminated trenches, ditches and excavated holes, concrete forms construction in basement)
- ☒ #303 Burial Site (contaminated soil shoring, pipe trench concrete forming)
  - ☒ Buildings #314, 305b, 334a, 320, 325, 329, 340, 311, 3706, 3751a, 1234, 1236, 1250, 1252, 1226, etc.
- ☒ #222T Canyon Building, 272W - West Area Shops Building, etc.

"Hanford was the first facility to generate and separate special nuclear material for weapons production. As such, Hanford can be viewed as a type of R&D facility where chemical separation and reactor process were one-of-a-kind experimental prototypes. As the research/information base grew and new chemical processes were developed, contaminated facilities were retrofitted or replaced to accommodate the new processes. It is postulated that this practice was responsible for elevated doses to the Construction Trades Workers (CTWs). Consequently, adjustment factors are developed to augment the dose to the CTWs during specific time periods." (RE: ORAUT-OTIB-0052)

SPECIFIC HANFORD AREA FULL-DAY WORK ASSIGNMENTS:

SECTION C-7 EMPLOYEE INFORMATION CONTINUED

(C-7d) Work Site Locations)
(1.) 105-B, C, D, DR, F, H, KW, and KE Production Reactors
100-AREA The Production Reactors
(I worked 45 to 60 days at or around the 100 area facilities)
Designed to produce plutonium by irradiating metallic uranium, were constructed in the 100 Areas located along the Columbia River on the north side of the Hanford site.

(2.) (1-day at or around these facilities)
The first three reactors (100-B, D, and F) were built in B, D, and F Areas starting in Aug, Nov. And Dec. 1943. The B reactor commenced operation in Sept. 1944. The D and F Reactors commenced operation in Dec. 1944 and Feb. 1945 respectively. In addition to producing plutonium for nuclear weapons, the reactors also produced polonium for use as a neutron source trigger or initiator in the weapons. By May 1945 four of the tubes in D Reactor were charged with bismuth slugs for polonium production. Construction of DR Reactor, located in D Area, was started in Dec. 1947 with startup commencing in Oct. 1950. The H Reactor was constructed in H Area starting in Mar. 1948 with startup in Oct. 1949. Construction of C Reactor in B Area commenced in Jun 1951 with startup in Nov 1952. The KW and KE Reactors were constructed in KW and KE Areas starting in Nov. 1952 and Jan. 1953. They commenced operation in Dec. 1954 and Feb. 1955 respectively. These eight reactors were graphite moderated and single pass cooled using treated river water. The first three reactors (B, D and F) were the same design. The remaining five reactors (DR, H, C, KW and KE) were similar in design with the KE and KW reactors differing primarily in the number, size and type of process tubes, the size of the graphite stack, and the type of shielding. The fuel elements were metallic uranium clad with aluminum. In 1960, confinement systems were incorporated in the first eight reactors and these reactors were shut down over a period of years starting in 1964 and ending in 1971.

(3.) 105-N Production Reactor (1-day at or around these facilities)
Construction of 105-N (ninth production reactor) was started in N Area in 1959. The N Reactor design was based on the original graphite production reactors. However, it differed substantially from the first eight since it incorporated closed-loop cooling and it was the first Hanford reactor to incorporate a confinement system in the original design. It was designed to be a dual-purpose reactor (i.e.

SECTION C-7 EMPLOYEE INFORMATION CONTINUED

(C-7d) Work Site Locations)
producing both plutonium and steam to be used to generate power). The dual-purpose reactor started producing plutonium in Mar. 1964 and electrical power some time later. The N reactor fuel was a tube-in-tube design consisting of a metallic uranium core surrounded by a thin zircaloy-2 cladding. The core consisted of an inner tube enriched to 0.95% U-235 and an outer tube enriched to either 0.95% or 1.25% U-235. From 1965 to 1967, tritium was produced at N-Reactor using fuel elements manufactured in the 333 facility. The N reactor was shut down in 1987.

Full Work Days Spent at Work Locations

ESTIMATED WORK DAYS SPENT AT SPECIFIC WORKSITES:

200-AREA The Separation Facilities
(I worked approximately 60 days at 200E, and 90 days at 200W facilities)

200 Area
There were a number of operations that occurred in the 200 Area including chemical separations, plutonium finishing, liquid and solid waste management, and special projects such as the Critical Assembly Room located in 209E Building. The chemical separations buildings (i.e., 221-T, 221-B, 221-U, REDOX, PUREX) were massive rectangular canyons constructed in the 200 Area to chemically separate plutonium from uranium and fission products. Operations were handled remotely to provide protection to the workers from the high radiation fields.

The 233-S building was constructed in 1957 to contain the third and final concentration cycle at 202-S which is associated with the 202-A PUREX Facility (A Plant) that became operational in 1956 utilizing the plutonium-uranium extraction process to process irradiated fuel. The PUREX Plant was shut down in June 1972 and restarted in November 1983. During the shutdown a new process was added to convert plutonium nitrate to plutonium oxide. It was started up and shut down several times between 1983 and 1992, with final closure announced in December 1992.

Solid waste was disposed of in burial grounds. Those in the 200 Area contain transuranic waste. Historically, low-level waste was buried in cardboard boxes. Transuranic waste was buried in drums. Procedures for inspecting radioactive waste drums prior to shipment were written to ensure integrity of drums filled and buried. Initially, procedures did not contain all required integrity checks.

There were numerous other facilities in the 200 Area that supported the separation of plutonium, the management of waste, and analytical needs. The 222-S Laboratory and the Waste Sampling and Characterization Facility are two support facilities still in operation at the site. Current radiological activities in this area are primarily associated with Surveillance and Maintenance or decommissioning of facilities no longer in operation. It is also clear that neutron exposures to reactor workers should have been better characterized for a number of Hanford facilities, including the "tail-

(C-7d) Work Site Locations)
ends" of the canyon operations, the 233-S Plutonium Reclamation Facility, and, again, the waste tanks and burial ground. Likewise, the implication of radiation shielding that was added over time to various reactors should have been addressed, given its potential significance to characterizing potential worker exposure.

(4.) 305-B Physical Constants Test Reactor (1-day at or around these facilities)
The Physical Constants Test Reactor (PCTR) started operation in 1954. The 800 W test reactor was located in a shielded room in the 305-B building. The mission of the PCTR was to measure reactor changes as a result of use of different reactor fuels. Some plutonium contamination that occurred in the reactor room as a result of an accident could have been the source of minor internal exposure during cleanup. External exposure was negligible since the reactor was located in a shielded underground room and operated remotely. Operation was terminated in 1970.

(5.) 305-B Thermal Test Reactor (1-day at or around these facilities)
The Thermal Test Reactor (TTR) started operation in 1954. The 1 KW reactor was located in a shielded underground room in the 305-B building and operated remotely. The mission of the TTR was to measure thermal impact on fission cross sections. It functioned as an early and small version of the HTLTR. External exposure was minimized since the reactor was operated remotely. Operation was terminated in the 1978.

(6.) 309 Plutonium Recycle Test Reactor (1-day at or around these facilities)
The Plutonium Recycle Test Reactor (PRTR), located in the 309 building, started operating in 1960. The PRTR was a 40 MW heavy-water-cooled and heavy-water-moderated reactor. The reactor was chosen for a large fuels diversification program known as the Plutonium Fuels Utilization Program.
manufacture. As an example, tests were performed on a variety of powdered and pelletized fuels using plutonium oxide blended with uranium oxide and other metallic oxides. The fuel was a nominal 96% depleted uranium
oxide and 4% plutonium oxide powder that was vibration compacted within the fuel pin. External exposure was minimized as a result of the remote operation and the shielding. Maintenance operations resulted in external exposure from activation and fission products. A high extremity exposure occurred when a worker picked up an irradiated steel pin. Tritium (3H) oxide was the principal internal exposure contaminant during normal operation. This whole body exposure was added into the external whole body dose summary (See sections 5 and 6 - Internal and External Dosimetry). The reactor was shutdown in 1969 after an accident resulted in contamination in the reactor. A sample of the contamination showed the major contaminant was 95Zr/Nb. Other contaminants included 60 Co, 103 Ru, 10 Ru, 106 Rh, 140 Ba/La, 141 Ce, 144 Ce, and 144 Pr.

(C-7d) Work Site Locations

(7.) 309 Plutonium Recycle Critical Facility (1-day at or around these facilities) The Plutonium Recycle Critical Facility (PRCF), which was located in the 309 building, began operating in 1962. Tests were conducted in the PRCF to determine which geometrical arrangement of fissionable materials would work in a reactor. It was shut down in 1976.

(8.) FUEL SEPARATIONS FACILITIES (20-days at or around these facilities) Seven separation facilities, B Plant, T Plant, U Plant, Reduction/Oxidation (REDOX), Plutonium-Uranium Extraction Facility (PUREX), U_{O3}, and C Plant, were constructed and operated in the 200-W and 200-E Areas from 1943 to 1993. The tritium processing facility was operated from 1949 to 1955 in the 108-B building located in the 100-B Area. Natural uranium and thorium fuel elements and lithium-aluminum (Li-Al) target elements were irradiated to produce Pu-239, U-233, and tritium, respectively. The spent reactor fuel was transported to the 200 Areas (*i.e.* Separations Areas) for processing. Initially spent fuel was stored in the reactor storage basins and the 212-N, 212-P, and 212-R buildings in the 200-N Area prior to processing in the fuel separations facilities (e.g.221-B 221-T, REDOX and PUREX). The irradiated lithium-aluminum target elements were transferred to the 108-B building, 100-B Area for processing. Irradiated thorium fuel elements were processed in the PUREX Plant to recover U-233 in two separate campaigns that occurred in 1966 and 1971. External exposures were primarily high-energy betas and photons in the separations facilities associated with fission products (FP). Internal exposures, primarily associated with contamination incidents, could be due either to FP and/or plutonium.

(9.) Original Fuel Separations Facilities (30-days at or around these facilities Three large canyon buildings 221-T, 221-B and 221-U were originally constructed in the 200 Area in 1943 (?) to chemically separate plutonium from uranium and fission products. These buildings were massive rectangular canyons that housed the chemical separations equipment. This equipment was operated remotely to provide protection to the workers from the high radiation fields. The T Plant was started up Dec.1944 and shutdown Aug. 1956 while B Plant started up in Apr. 1945 and shutdown in Oct. 1952. Since the capacity was not needed, the start up of U Plant was delayed until 1952 when the mission was changed (see section 2.2.4). The 221-T and 221-B buildings known as the T and B Plants utilized a bismuth phosphate precipitation batch process to separate plutonium from the uranium and fission products after the aluminum jackets were dissolved in sodium hydroxide solution and the uranium metal slugs were dissolved in nitric acid. The dilute plutonium solution from T and B plants was transferred to the 224 Concentration Buildings (e.g.224-B and 224-T) located behind each canyon building where the product was purified, the product volume was reduced and the carrier was changed from bismuth phosphate to lanthanum fluoride. The final plutonium product was concentrated in the 231-Z Building. In March 1956 221-T was converted to perform equipment decontamination (WHC-MR-0452). In1959 the 2706 T Decon Annex was added to the 221-T building to enhance the equipment decontamination capabilities, particularly pieces of equipment too large to take into T-Plant.

(C-7d) Work Site Locations)

(10.) Concrete Smoke Stack Emissions (2 to 3 days weekly for 33-months)
My exposure as a result of working and eating near and/or around the smoke stacks was frequent and constant. Working in the 300 area where the concrete stack pipes were constantly 'spewing' a toxic sulfur-like cloud of gases full of particles into the atmosphere. We breathed, ingested, inhaled, and absorbed this pollution week after week without any filter masks. This went on at least 2 to 3 days each week for 33-months, and we always ate our lunch in this location and environment.

"For more than 40 years, the U.S. government produced plutonium for nuclear weapons at the Hanford Site. The process of separating the plutonium caused the smoke stacks to release polluted 'hot particles' to the air and the ground. These particles were called 'hot' because they were radioactive. The Hanford Environmental Dose Reconstruction Project has 'cumulative release estimates' for 1944 – 1972."

> "The released particles contained plutonium, cerium and strontium. Other radioactive materials were also present, but in lower concentrations. Most of the particles were rust or other non-radioactive material. Hanford documents reported the release of as many as 100 million particles per month. Because of their size and weight, many of the particles landed on the ground within the Hanford Site boundaries. Construction workers were not issued filter masks."

"For plutonium, the latency period is estimated to be more than 30 years, but may vary depending on the dose received. Plutonium in a soluble form acts differently in the body than the insoluble form. Instead of remaining in the lungs and the lymph nodes, as the insoluble form does, soluble plutonium enters the blood relatively quickly and deposits on bone surfaces and in the liver."

(11.) 202-A PUREX Plant (10-days at or around these facilities)
Construction of the PUREX Facility (A Plant) commenced in 1953. The building was 100 ft (with 40 ft. being underground) x 1,080 ft. the size of three and a third football fields. The structure was made of three components: a heavily shielded process canyon; a pipe, sample, and storage gallery section; and a steel and transite annex which houses support services. It was started up in Jan. 1956 utilizing the plutonium-uranium extraction process (WHC-MR-0437: Marceau, 2002). The PUREX process was an organic solvent extraction process that utilizes tributyl phosphate in kerosene instead of hexone, nitric acid as a salting agent, pulse column contractors, and nitric acid recovery by distillation. The nominal design capacity was 8.33 short tons uranium per day as opposed to 2.5 for the REDOX Plant. In 1955 due to the development of more restrictive $_{131}$I release limits the 293-A facility was constructed between PUREX and the 291 A stack. In 1958 PUREX initiated $_{237}$Np recovery activities. Equipment was added in 1962 to permit continuous recovery of $_{237}$Np. In 1963 the processing of e-metal fuel containing $_{235}$U enriched to 1.75 %. The processing of irradiated powdered thorium oxide targets to recover $_{233}$U commenced in 1965 and 1966. In 1970 the targets were changed to pelletized thorium oxide. The PUREX Plant was

SECTION C-7

(C-7d) Work Site Locations)
shutdown in June 1972 and restarted in Nov. 1983. During the shutdown a new process was added to convert plutonium nitrate to plutonium oxide. The PUREX solvent extraction (tributyl phosphate) system was operated from January 12, 1956 until the end of September 1972, to separate and decontaminate uranium, plutonium and neptunium produced by the Hanford reactors.

(12.) 224-U U_{O3} Plant (1-day at or around these facilities)
The 224-U Bulk Reduction Building (known as U_{O3} Plant) was constructed in the 1940's. In 1951 it was converted to process the liquid uranium nitrate solution from U Plant to produce a powdered uranium oxide (Uo3) using a calcination process. It was started up in Jan. 1952. The product was shipped off-site for reuse. A major addition (224 UA) was added to the U_{O3} Plant in the fourth quarter 1956 to house 3 new calciners. It was shutdown in 1972 and opened again in 1983 (there were 17 start ups and shutdowns between 1984 and 1992 corresponding to activities at PUREX) and was deactivated in the summer of 1993.

300 AREA *(I worked approximately ll-months in the 300-Area facilities)*

The Hanford Site 300-Area is north of the city of Richland and is contiguous to the Columbia River. The 300 Area served as the research and development center and housed fuel fabrication facilities, test reactors and research and development laboratories located on the south side of the Hanford Site.

FUEL FABRICATION FACILITIES
The Hanford Fuel Fabrication facilities described in subsequent sections were built and operated in the 300 Area from 1944 to 1988. These include three fuel fabrication facilities, 313 (Uranium Metal Fuels Fabrication), 314 (Uranium Metal

I have also worked in or around: 105DR Reactor Building, Canyon Building, Rattle Snake Mountain Nike Missile Site, Area #100 (Burial sites #1,2,4, 5)
Area 200-e (Burial grounds, tank farm, We buried a RR train locomotive). I also worked at 200-w (Burial ground, burning pit, debris dump, K-Basins and the powerhouse pond. Extrusion), and 333 (Fuel Cladding) buildings, and two support facilities, 303 (Uranium Storage and Oxide Burner), and 306 (Reactor Fuel Manufacturing

(C-7d) Work Site Locations)
Pilot Plant). External exposures were related to betas and photons associated with uranium. Due to the pyrophoric nature of uranium turnings and chips, internal exposure was related primarily to inhalation of uranium.

SECTION C EMPLOYEE INFORMATION

(C-7d) Work Site Locations)

(13.) 313 Uranium Metal Fuels Fabrication Facility

(20-days at or around these facilities)

The aluminum-clad fuel for the first eight production reactors was produced in the 313 Building starting in Mar. 1944 *(Key dates doc says Dec. 1943*). Natural uranium billets or bars were heated to a red heat and shaped into long rods using an extrusion press (see 314 building below). These were cut into shorter lengths called slugs using a turret lathe. After receiving a finish cut in another turret lathe, the slugs were degreased using nitric acid. The cleaned slugs were dipped in a succession of molten baths (i.e. triple-dip method) and pushed into an aluminum can. An aluminum cap was pushed into the can and the top edge of the cap was welded to the can. Bismuth fuel targets were fabricated in the 313 Building beginning in 1944. These were irradiated in the production reactors to Produce $_{210}Po$ (used as an initiator in the earliest atomic weapons). Lead-cadmium fuel rods, welded into non-bonded aluminum cans, were produced for use as "poison" elements for the production reactors. Lithium targets were manufactured for tritium production from 1949 to 1952 and again from 1965 to1967. In the 1950's, production reactor fuel changed from natural uranium to low enriched uranium (LEU). In Mar. 1954 a new, simpler, canning method involving a lead-dip process was initiated to replace the old method. All uranium scrap and waste from these processes was salvaged as uranium oxide and shipped off the Hanford site. In 1955 the fuel production facilities were expanded to produce the fuel for the K Reactors. In Jan. 1971 the manufacture of aluminum-clad fuel used in the first six reactors was terminated.

(14.) 314 Uranium Metal Extrusion Facility

(8-days at or around these facilities)

The 314 building was known as the Press Building, Metallurgical Engineering Laboratory and later as the Uranium Metal Extrusion Facility. Operation of the 314 Press Building was commenced in July 1944 with a mission to process raw uranium billets into extruded rods that were suitable for fabrication into fuel elements. In early 1945, a 1000-ton large extrusion press was installed in the 314 building. After installation, the 313 and 314 buildings assumed all of the fuel manufacturing responsibilities for Hanford. An additional mission, uranium scrap recovery, was started in 1945. An oxide burner was operated outside the building in 1946. A milt plant started operation in December 1947. Uranium scraps were mixed with U_{F4} (green salt) and calcium chips. Conversion to metal took place in a reduction furnace (HS300AHD). The high air contamination that occurred frequently, involved a highly soluble, class F material. The milt plant was shut down in 1954. The uranium billets were extruded into rods, outgassed and straightened in the 314 building. The extrusion process was terminated in 1948 the fuel element process was changed to use rolled uranium rods. An oxide-burner was installed in the 314 building in 1946. In 1950, a rolling mill was installed in the 314 building in order to fabricate Hanford fuel elements on site. The building was deactivated in 1971.

SECTION C EMPLOYEE INFORMATION

(C-7d) Work Site Locations)

(15.) 333 Fuel Cladding Facility (8-days at or around these facilities)
The N Reactor fuel was produced in the 333 building starting in 1961. The N Reactor fuel elements used a tube-in-tube design consisting of slightly enriched uranium inner and outer cores and thin zircaloy-2 cladding. The production process included: cleaning of the uranium billets and Zirconium-2 cladding shells; billet assembly and preheating; extrusion; fuel element shaping and cleaning; and welding of the end cap. In 1965 -1967 outer driver fuel elements were produced in support of tritium production at N Reactor. The Li/Al inner target element was manufactured in the 3722 Area Shop.
The 333 building was placed on standby in 1988 when the manufacture of N Reactor fuels ceased.

(16.) 306 Reactor Fuel Manufacturing Pilot Plant (6-days at or around these facilities) Construction on the 306 building was completed in 1956 and it began operation in May 1957 as a pilot plant for reactor fuel production. The 306 building had a complete fuel element canning line with the exception of autoclaving. The co-extrusion process was developed in the 306-E building in the early 1960's in support of the N Reactor fuel needs. This facility was shut down in 1984*.

(17.) 303 Facilities Fresh Metal Storage Facilities (10-days at or around these facilities)Ten buildings (303-A, B, C, D, E, F, G, J, K, and M) were built over a period of years from 1944 to1983 to store fresh uranium, chemicals, uranium scraps and plutonium. Uranium was shipped to Hanford in the form of metal billets. The metal billets were moved to the 303 Fresh Metal Storage buildings where they were inspected, entered into accountability records and held for processing. Building 303-L is another building not mentioned above, however, Building 303L was a small building that was constructed in 1961 to burn uranium metal scraps to an oxide form that would be suitable for shipment to the Feed Materials Production center (FMPC) for recovery. Burning was stopped in 1971 due to the use of unconventional burning vessels (two cement mixers lined with concrete) and poor ventilation. These two factors combined to produce airborne contamination readings that frequently exceeded the then-current HW maximum permissible concentration (MPC) of 2×10^{-12} µCi/mL for unrestricted areas and 6×10^{-11} µCi/mL for restricted areas (see WHC-MR-0388, Past Practices Technical Characterization Study-300 Area-Hanford Site, M. S. Gerber, December 1992). Building 303L was shut down in 1971 and the building removed in 1976. In 1983, the new Oxide Burning Facility (303-M) was placed into operation at the same site. It operated from 1984 to 1987. In 1970*, the 303-C building was utilized by PNNL for the storage of plutonium and americium. A pressurization of one of the sealed metal storage cans resulted in the spread of plutonium contamination and the subsequent shut down of the building until cleanup. It currently is being used for other purposes.

SECTION C EMPLOYEE INFORMATION

(C-7d) Work Site Locations)
(18.) 320 Low-Level Radiochemistry Facility
(4-days at or around these facilities)
The Low-Level Radiochemistry Laboratory was built in the 320 building in 1966. The original mission was to house analytical chemistry services and provide plant support involving low-level and non-radioactive samples. The 320 Building currently provides a low-level radiochemistry facility in which very sensitive radiochemical analysis, sample preparation, and methods development can be performed. External and Internal exposures were minimal. The facility is still in operation.

(19.) 324 Chemical and Materials Engineering Laboratory
(4-days at or around these facilities)
The Chemical and Materials Engineering Laboratory began operation in 1966 to provide research and development studies in support of the PRTR operations. It was used first as a fuel recycle pilot plant by housing chemical reprocessing and metallurgical examination capabilities used for PRTR fuel elements. It consisted of two groups of large shielded cells used for both radiochemical and metallurgical studies. The chemistry cells consisted of four cells connected to an air lock where studies of various processes for solidifying high-level liquid waste were performed. It was used in conjunction with the 325-A hot cells to perform studies on solidification of high-level liquid waste (i.e. Nuclear Waste Vitrification Project) from processing irradiated fuel elements from commercial reactors). A special underground liquid waste pipe line connected the hot cells in 324 and 325-A. Most recently, it was used as a Waste Technology-Engineering Laboratory. Since most of the work was performed in hot cells, external and internal exposures were minimized. The 324 building is currently undergoing decontamination and decommissioning activities.

(20.) 325 Radiochemistry Laboratory (7-days at or around these facilities)
The 325 building was completed in 1953 to permit multi-curie level chemical development work in support of production and process improvement (Marceau, 2002; HS300AHD). A high-level radiochemistry wing, 325-A, was placed into operation on the east side of the building in 1959/1960. It included three large hot cells for isotope research activities. These cells were also used in support of the studies on solidification of high-level radioactive waste (i.e. Nuclear Waste Vitrification Project) from processing irradiated fuel elements from commercial reactors. A special underground liquid waste pipe line connected the hot cells in324 and 325-A. The Nuclear Waste Vitrification Project that was conducted in the 324 and 325 buildings in the 1970's, involved high "burnup" commercial fuel elements were characterized by nominally 26% ^{240}Pu (Carbaugh 2003). High-level radio-analytical hot cells were added on the west side in 19UNK. The building became known as the Radiochemistry/Cerium recovery Building. Limiting access to high-level dose-rate or contamination areas controlled external and internal exposures. Most exposures were related to maintenance performed in hot cells or accidents in laboratory areas where work was being performed with

SECTION C EMPLOYEE INFORMATION CONTINUED

FP, plutonium, and other radionuclides. A Major $_{147}$Pm contamination incident occurred in the late 1960's. The radiochemical laboratory work resulted in external exposure and any internal exposure resulted from contamination incidents. The 325 building still is in use in support of cleanup efforts at Hanford.

(21.) 329 Biophysics Laboratory (5-days at or around these facilities) chemistry, environmental monitoring, and bioassay analysis programs. Missions for the Laboratory include the analyses of low-level (i.e. near background) quantities of radioactive materials in air, vegetation, soil, wildlife, river and well water samples. A neutron multiplier facility was built in 1974 as section D of the biophysics laboratory.

(22.) 3706 Radiochemistry Laboratory
(14-days at or around these facilities)
The 3706 building, the original radiochemistry laboratory was placed in operation in early1945 (Gerber, 1993; Marceau, 2002; HS300AHD). This building was also known as the Technical Building. The original mission was to perform small-scale experiments with both low- and high-activity radioactive materials in support of production activities with the primary focus on improving the bismuth phosphate process. The QA/QC activities associated with fuel element fabrication also were performed in 3706 building. Another mission was the metallurgical examination of irradiated fuel elements, fuel development for the 313 Building, examination of graphite from the experimental levels of the 100 Area piles and special sample analyses from 231Z and 200 Area separation facilities. In 1947, it was used in the development of the REDOX process. Pioneering radiochemistry work in the development of the REDOX, PUREX, and RECUPLEX processes was performed until 1953. Thyroid checks were initiated in May 1947. In 1954, many of the laboratories were decontaminated and converted to offices.

(23.) High-Level Liquid Waste Tanks (I spent about 5 or 6 months here and 5 or 6 months at a variety of burial grounds facilities..
High-level radioactive liquid wastes from reprocessing facilities at Hanford were stored in underground single-shell and double-shell tanks starting in 1944. The high-level radioactive waste is transported through underground process lines to the storage tanks that are located in tank farms in both 200-Eand 200-W Areas. The storage tanks are of two types, single-shell and double-shell tanks. Both types are cylindrical shaped concrete structures with carbon steel liners.

The single-shell tank has a single liner and the double-shell tank has two liners with a space in between. Initially, the T and B Plants produced over 10,000 gallons of high-level radioactive waste for each ton of uranium processed. These wastes were transferred to the first 64 tanks constructed in 1944-1945. Thirty new single-shall tanks were constructed in 1947-1948. Additional single-shell tanks were constructed in 1950-1952 (30), in 1953-1955 (21), and 1963-1964 (4). From 1968-1988 a total of 28 double-shell tanks was constructed. Most of the

SECTION C EMPLOYEE INFORMATION CONTINUED

(C-7d) Work Site Locations)
single and double shell tanks are still in use. A new waste glassification facility is under construction to process the stored high-level liquid wastes. External exposure is due to high-energy beta and photon radiations from the fission products stored in the tanks. Under normal conditions shielding, distance and time, minimizes personnel exposures. Most external exposures would be related to leaks of high-level wastes.

(24.) 340, 340-A and 340-B Liquid Waste Handling Buildings
(5-days at or around these facilities) The 340-facility complex was operated starting in 1954 to receive radioactive liquid wastes from various 300 Area laboratories via the radioactive liquid waste sewer line. The complex accumulates the liquid wastes in storage tanks. After sample analyses and pH adjustment, the liquid wastes are shipped via a shielded railcar tank to the 200-E Area Tank Farms for treatment and disposal. Access to the tank area was administratively controlled. The external exposures to the operators were related to the high-energy betas and photons. Internal exposures were unplanned and would be related to leaks or an accident.

SECTION C-7e IDENTIFICATION OF SUPERVISOR

C.7e - Supervisor's Name:
- Foreman - J.A. Jones 300 Area - Richland, WA - Hanford Site;

(Project Superintendent) for J.A. Jones Construction Company, Inc. - First Street - Richland, WA 99352

As an apprentice carpenter, whenever I was assigned to a task where there also was a Journeyman Carpenter on that job, that journeyman carpenter became my boss. However, was the 300 Area Foreman where I spent about 1/3 or my work experience. was my primary supervisor and my mentor, and was grooming me for becoming a journeyman carpenter with J.A. Jones Construction Co. Under the Affirmative Action Plan of J.A. Jones Construction Co.

J.A. Jones, Construction was signatory to the Southeastern Washington State 'Hometown Plan (under Executive Order 11246) which was designed to bring Affirmative Action into the Construction and Building Trades on federally funded contracts like those at Hanford. As such, I was fortunate enough to work on many job assignments with him - which also resulted in my roving from job to job all over Hanford for several days at a time.

As a result of the On-the-Job training, grooming and networking made available to me I was subsequently selected for the position on the Construction Affirmative Action Program after my departure from J.A. Jones Construction in 1971. (The one difference in me and other Class members is that I may have traveled a bit more frequently from site-to-site than most other apprentices.)

PART E PROPOSED DEFINITION OF CLASS

E.1 - Name of DOE Facility:

U.S. Department of Energy - Hanford Site - Richland, WA 99352

Hanford Work Site Environments
This is an overview of the environmental characteristics of the Hanford Site facilities, as well as site-specific characteristics of Hanford 300 Area where approximately 1/3 of my work took place. One third of my Hanford work experience equals approximately 11-months, which should be computed at an average of 50-hours per work week. These listed worksites are locations where I worked repeatedly, so (to the best of my recollection) I have estimated the approximate length of time spent at these locations in total work days spread over my 33-months of employment.

E.2 - Locations at Facility Relevant to this Petition:

Descriptions of the Locations at Hanford Relevant to this Petition

The Complexity of Hanford Site Facilities:
(And the potential for radiation exposure)

The Environment
The production of nuclear weapons materials and nuclear energy research and development took place on the Hanford Site from 1943 -1990. Hanford was and remains a complex operation involved in numerous missions, each of which has its own unique exposure hazards, while producing the potential for external radiation exposure at the facility. Occupational risks of exposure to ionizing radiation are defined by Hanford's past missions, such as these facilities of concern:

• "Nine graphite-moderated, light-water cooled reactors were constructed near the Columbia River in the Hanford 100 Areas over a period of 20 years commencing in 1943 (Carlisle 1996). The production reactors were used to produce plutonium by irradiating metallic uranium fuel elements with neutrons during the fission reaction in the reactor core. Other defense-related radionuclides that were experimented with included: irradiation of thorium to produce 233 U, irradiation of depleted uranium to produce 240 Pu, irradiation of neptunium targets to produce 238 Pu, and irradiation of americium to produce medical grade 238 Pu."2 Radiological hazards included external photon, beta, and neutron exposure from fission products and neutron radiation, and internal exposure to fission and activation products.

E-2 Descriptions of the Locations at Hanford Relevant to this Petition

• Five chemical separation plants and associated fuel separation facilities including the T and B plants, the REDOX plant, the PUREX plant, and U Plant, where radiological hazards included potential for internal and external exposure to a variety of radionuclides.

• "Three facilities for fuel fabrication, i.e., the Uranium Metal Fuels Fabrication facility, the Uranium Metal Extrusion facility, and the Fuel Cladding facility. There were also two support facilities; the Uranium Storage and Oxide Burner facility and the Reactor Fuel Manufacturing Pilot Plant."

• "Two plutonium finishing facilities, 231-Z (Plutonium Isolation Building) and 234-5Z (Plutonium 18 Finishing Plant Complex) operated at Hanford from 1945 to present. The latter is still involved in 19 plutonium stabilization efforts as a part of the Hanford cleanup program. Both of these complexes are located in the 200-W Area."

• Twenty-one research, development, and testing facilities where a variety of exposures to radioisotopes occurred. Seven physical testing, research, and demonstration reactors.

• Some 2,710 waste disposal sites and burial grounds in the 100, 200, 300, and 1100 Areas, currently being characterized and remediated. The preponderance of these sites poses radiation exposure risks.

• Waste handling and storage facilities, one in each of the 200-W and 200-E areas, a trench facility, a settling tank area, an evaporator facility, chemical separations exhaust filtration facilities, and three liquid waste handling buildings, all providing a potential for external and internal exposure, as well as exposures via the environmental transport pathway.

"Overall there were more than 500-facilities that contributed to the mission of producing plutonium, uranium, tritium, and other radio nuclides that contributed not only to the weapons program but also to the space program and the medical profession. These facilities were used for radiation effects studies, nuclear physics research and development, criticality studies, calibrations, radiochemistry development, radio metallurgy, biochemistry, process equipment development, and many other applications.

E-2 Descriptions of the Locations at Hanford Relevant to this Petition (Con't.)

Radioactive Worksite Locations and Examples of Work

- ☒ #318 Burial Grounds (I believe there were about 10 different burial ground sites where I have worked.)
- ☒ #309 (Scaffold work and shoring of contaminated trenches, ditches, etc.)
- ☒ #303k (Scaffold work and waste storage concrete forms work)
- ☒ #303f (Scaffold work around uranium acid spill)
- ☒ #306e (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #324 (Scaffold work)
- ☒ #313 (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #331 (Shoring contaminated trenches, ditches and excavated holes)
- ☒ #333 (Tank Farm, storage yard, lot or pad work)
- ☒ #325 (Shoring contaminated trenches, ditches and excavated holes, concrete forms construction in basement)
- ☒ #303 Burial Site (contaminated soil shoring, pipe trench concrete forming)
- ☒ Buildings #314, 305b, 334a, 320, 325, 329, 340, 311, 3706, 3751a, 1234, 1236, 1250, 1252, 1226, etc.
- ☒ #222T Canyon Building, 272W - West Area Shops Building, etc.

We have also worked in or around: 105DR Reactor Building, Canyon Building, Rattle Snake Mountain Nike Missile Site, Area #100 (Burial sites #1,2,4, 5) Area 200-e (Burial grounds, tank farm. We also worked at 200-w (Burial ground, burning pit, debris dump, K-Basins and the powerhouse pond.

Hanford was and remains a complex operation involved in numerous missions, each of which has its own unique exposure hazards. As a carpenter apprentice at Hanford for approximately 33-months, I was very mobile and worked all over Hanford in the 100, 200, 300, 400 and 1100 Areas, as well as the Tank Farms and Burial Grounds - the preponderance of which poses radiation exposure risks. As a result, I believe I was exposed to a large number of carcinogenic agents at extremely high doses, including Beta, Gamma, Neutrons, Protons, 233-U, Thorium, and Polonium.

• Waste handling and storage facilities, one in each of the 200-W and 200-E areas, a trench facility, a settling tank area, an evaporator facility, chemical separations exhaust filtration facilities, and three liquid waste handling buildings, all providing a potential for external and internal exposure, as well as exposures via the environmental transport pathway.

We worked everywhere - we were the 'supportive maintenance' services Construction Trades Workers on the Hanford Site. When a scaffold was needed, Carpenters erected it and dismantled it, when a ditch or pit had to be shored-up, Carpenters had to do it. The union trades were very strong, and only the 'specific union trade workers did that union's work. In other words, only Carpenters did carpenter's work - or the work would get shut down instantly. As such, we worked all over the place. We were the 'grunts' that were actually out there in the dirt.

E-2 Descriptions of the Locations at Hanford Relevant to this Petition

LOCATIONS OF CLASS EXPOSURE TO RADIATION 'HOT SPOTS':

(NOTE: The length of time (in days) indicate the approximate length of time that petitioner spent at these locations. Other class workers spent time at these same locations, however, I don't know what percent of time they spent at any particular location or facility.)

(1.) **105-B, C, D, DR, F, H, KW, and KE Production Reactors**
(1-day at or around these facilities)

(2.) **105-N Production Reactor**
(1-day at or around these facilities)

(3.) **305 Hanford Test Reactor**
(1-day at or around these facilities)
The 305 Hanford Test Reactor (HTR) (also called the Test Pile

(4.) **305-B Physical Constants Test Reactor**
(1-day at or around these facilities)

(5.) **305-B Thermal Test Reactor**
(1-day at or around these facilities)

(6.) **309 Plutonium Recycle Test Reactor**
(1-day at or around these facilities
The Plutonium Recycle Test Reactor (PRTR), located in the 309 building, started operating in 1960.

(7.) **309 Plutonium Recycle Critical Facility**
(1-day at or around these facilities)

(8.) **FUEL SEPARATIONS FACILITIES**
(20-days at or around these facilities

(9.) **Original Fuel Separations Facilities**
(30-days at or around these facilities)
Three large canyon buildings 221-T, 221-B and 221-U were originally constructed in the 200 Area in 1943 (?) to chemically separate plutonium from uranium and fission products.

(10) **313 Uranium Metal Fuels Fabrication Facility**
(20-days at or around these facilities)

(11) **202-A PUREX Plant**
(10-days at or around these facilities)
Construction of the PUREX Facility (A Plant) commenced in 1953. It was started up in Jan. 1956 utilizing the plutonium-uranium extraction process (WHC-MR-0437: Marceau, 2002).

(12.) **224-U U_{O3} Plant**
(1-day at or around these facilities)

E-2 Descriptions of the Locations at Hanford Relevant to this Petition

The 224-U Bulk Reduction Building (known as Uo3 Plant) was constructed in the 1940's. In 1951 it was converted to process the liquid uranium nitrate solution From U Plant to produce a powdered uranium oxide (Uo3).

FUEL FABRICATION FACILITIES

(13.) 313 Uranium Metal Fuels Fabrication Facility (20-days at around these facilities)

The Hanford Fuel Fabrication facilities include three fuel fabrication facilities, 313 (Uranium Metal Fuels Fabrication), 314 (Uranium Metal Extrusion), and 333 (Fuel Cladding) buildings, and two support facilities, 303 (Uranium Storage and Oxide Burner), and 306 (Reactor Fuel Manufacturing Pilot Plant). External exposures were related to betas and photons associated with uranium. Due to the pyrophoric nature of uranium turnings and chips, internal exposure was related primarily to inhalation of uranium.

(14.) 314 Uranium Metal Extrusion Facility (8-days at or around these facilities)

(15.) 333 Fuel Cladding Facility (8-days at or around these facilities)

(16.) 306 Reactor Fuel Manufacturing Pilot Plant (6-days at or around these facilities)

(17.) 303 Facilities Fresh Metal Storage Facilities (10-days around these facilities)

(18.) 320 Low-Level Radiochemistry Facility
(4-days at or around these facilities)

(19.) 324 Chemical and Materials Engineering Laboratory
(4-days at or around these facilities)

Nuclear Waste Vitrification Project) from processing irradiated fuel elements from commercial reactors).

(20.) 325 Radiochemistry Laboratory
(7-days at or around these facilities)

(21.) 329 Biophysics Laboratory
(5-days at or around these facilities)

(22.) 3706 Radiochemistry Laboratory
(14-days at or around these facilities)

WASTE HANDLING FACILITIES

(23.) High-Level Liquid Waste Tank Farms (50% of time) **and Burial Grounds** (50% of time)
11-months at and around these facilities

E-2 Descriptions of the Locations at Hanford Relevant to this Petition

(24.) 340, 340-A and 340-B Liquid Waste Handling Buildings

5-days at or around these facilities)

(25 .) Concrete Smoke Stack Emissions
(33-months at or around the smoke stacks)

(26.) **The 100-Area** (I Worked Approximately 60-days at this site.)
(27.) **The 200-Area** (I Worked Approximately 150-days at this site.)
(28.) **The 300-Area** (I Worked Approximately 11-months at this site.)

SECTION E-2

TANK FARMS AND WASTE DISPOSAL

(I worked approximately 11-months at or around the various Tank Farm and Burial Ground facilities)

The Tank Farm characterization in the TBD (Bihl 2004) is inadequate for dose reconstruction guidance in several respects. The following are the categories under which the TBD guidance needs to be more specific and complete:

•Radionuclide lists and waste management operations are incomplete for both internal and external radiation.

•Current environmental restoration and waste management projects included in the TBD are incomplete.

•Completeness and adequacy of Tank Farm' data used in the TBD are in question. In this section, the term "Tank Farm workers" refers to all personnel who performed work in the 200W, 200E, and 300 Areas. Construction Trades Workers were highly exposed to all types of contamination at Hanford:

"I frequently experienced severe 'flu-like' symptoms, was treated for the flu by the Hanford Environmental Health doctor who knew I didn't have a cold. I also experienced minor cuts, punctures and abrasions. I reported the worst vapor exposures, cuts and abrasions to my supervisor and to the Hanford Environmental Health Foundation."

<u>Excerpt:</u> NIOSH Health Hazard Evaluation: HETA-2004-0145-2941 (Boudreau, Cardarelli, Burr)
"NIOSH representatives conducted an evaluation at Hanford Tank Farms in March 2004. The tanks contain a mixture of chemical and radiological waste which is being transferred to another location for processing into glass. Although there is no occupational exposure limit (OEL) for the mixture of chemicals and compounds that may be present in vapor that escapes from the tanks, OELs do exist for some of the individual vapor constituents.

NIOSH investigators determined that employees at the Hanford Site may be exposed to vapor mixtures emanating from the 'head space' (air space above the tanks' liquid contents) area of the tanks and that these exposures, on occasion, may be in sufficiently high concentrations to pose a health risk to exposed workers. The tank farm workforce was not routinely provided personal protective equipment (PPE) to protect them from tank vapors.

E.2 - Tank Farms Site/Work Relevant to this Petition:

Construction Trades Workers received a 'environmental dose of radioactive contaminants while outside of operational facilities onsite such as process buildings, chemical separations plants, reactors and other structures at Hanford.

The four chemical separations plants, T Plant, B Plant, REDOX Plant and the PUREX Plant, along with the plutonium handling Z Plant are known to be the most important release points at Hanford, and as a result were important sources of worker exposure.

Being that CTWs worked outside process buildings and facilities at Hanford, their pathways of concern are:

1. The inhalation of radionuclides in the air,
2. Direct external radiation from plumes, and
3. Physical contact with particulates radiocuclides incident on the skin.

NIOSH investigators determined a potential for significant occupational exposures and health effects from vapors released from the hazardous waste storage tanks. Although the concentrations of the compounds in the vapor will change over time and during waste movement activities, vapor constituents may be present at sufficiently high concentrations to pose a health risk to workers."

However, SC&A also found a lack of characterization of potential worker exposures at the Hanford Tank Farms and in remediation and waste management in general. The list of radionuclides provided for those operations is incomplete, which increases the potential for missed dose. Although extensive descriptions of key production and storage facilities are included, the numerous environmental waste streams and cribs that existed at Hanford, but that have been since cleaned up, are not considered in the TBDs, although they certainly may have contributed significantly to worker exposure both before and during cleanup.

SECTION E-2 TANK FARM ISSUES

Health Hazard Evaluation Report No. 2004-0145-2941 ISSUES

TANK FARMS EXPOSURE AND MONITORING ISSUES:
•Inconsistencies in medical evaluations for vapor exposures;
•Disincentives to report vapor exposures, including lost work time and too much
paperwork;
•Too little detail provided to field workers regarding the specific compounds for which the IH technicians are monitoring;
•Too little personal air monitoring;
•Difficulty procuring specific data regarding the constituents in the tanks;
•Uncertainty as to why "old" data are used to characterize tank contents when ongoing processes, such as mixing of the contents of different tanks, could change the concentrations of the constituents; 3 A Problem Evaluation Request is a mechanism for CHG employees to report perceived problems.
•Perception that air monitoring zones (AMZs) are not determined based on science, but rather are arbitrarily selected and constructed;

- Information not readily provided on results of Summa canister b tests;
- Potential radon exposures;
- Concerns about asbestos exposure during remodeling of buildings; and
- Past and/or current exposure to beryllium and the receipt of appropriate medical evaluations.

RESPIRATOR ISSUES:
•Difficulty in procuring respirators when someone wants to wear one voluntarily; and
•PAPRs with non-working batteries. Interviewed workers also made suggestions for
improvements including providing small vehicles (such as tractors) to transport
equipment and personnel between tank farms; providing improved lighting of the tank farms at night using the large light fixtures that are already in place on the tank farms; utilizing science (such as barometric pressure and real-time monitoring) to establish AMZs and PPE criteria; conducting sampling before, during, and after waste transfers; and providing more personal exposure monitoring.

SECTION E-3 JOB TITLES AND DUTIES

E.3 - Job titles and/or duties of CTW employees included in the class:
All Journeyman Carpenters and Apprentice Carpenters that worked at the Hanford Site from April 25, 1967 through December 13, 1968; and again from January 07, 1970 through February 01, 1971 should be included in the class. I believe my job duties were common duties performed by most carpenters and carpenter apprentice that were assigned to 'roving duties.'

Description of the Hanford Construction Trades Workers Titles, Duties Work Standards , and Hazardous Environment, and Movement around the Site. It needs to be noted that we were constantly working in the Hanford soil: Pits, Trenches, Forming for concrete, etc. I estimate that for approximately 30% of my work was directly in the Hanford soil.

Historically, much of the Hanford workforce was fairly stable. Some staff in the 200 Area typically remained in the 200 Area; however, they may have moved between different 200 Area facilities. Personnel in other areas of the site were more stable. ROVERS primarily included Security, Health Physics, and Maintenance staff. Engineers also moved around. The maintenance personnel were deployed to areas of the site as needed. Maintenance personnel included all crafts and trades of the Building and Construction Trades Council.

In the early years of operation, J.A. Jones was one of the companies involved in the construction maintenance throughout the entire Hanford site. They had some standard crews that were located on the Hanford site and roving and temporary crews that were brought in to provide support to the various Area construction projects.

Mobility - I was one of the roving employees that had to be very mobile. I was an apprentice carpenter, and Management's thinking was 'that my apprenticeship on-the-job training, and grooming would take place in every possible job task that carpenters undertook.' I worked practically everywhere, repeatedly, and many of those job sites were very highly contaminated. Many of these sites were extremely 'hot with toxic's, and the type of work I did put me 'knee deep' in contamination repeatedly. I was crawling over, under and onto contaminated pipes in pipe galleys and other hot zones.

I worked on the Hanford Tank Farm Site. I repeatedly worked in 'contaminated trenches, pits, and in the soil of excavated holes.' The gas masks we wore in 1967-71 were not designed well for vapor purification. I also was on one of the first work teams to start tearing down decommissioned structures and buildings throughout the 300-Area for renovation in 1970-71. We were constantly changing and remodeling buildings, labs, shops, offices, warehouses, storage structures, storage yards, etc. We did not wear protective clothing or equipment all the time during this phase of our dirty and dusty work. And we were monitored inadequately during these assignments.

SCOPE AND EFFECT:

Regular and Reoccurring Duties

Refurbishing buildings, making structural repairs, ongoing repairs, structural framing and covering, building stairs, framing, doors, walls, ceilings, installing sheet rock, asbestos siding, constructing, cutting, grinding, drilling steel framing, building massive radioactive waste burial boxes, lining burial boxes with lead sheets, lining and sealing massive concrete storage pits with lead and/or rubber, installing insulation on walls and ceilings, building concrete forms around all sized asbestos covered pipes in massive underground canyons and tank farms, constructing concrete forms for slabs and tilt-up walls, constructing forms for footings and load bearing walls and floors, erecting and dismantling scaffolding, and on occasion laying out and building massive footings for towers, and parking lot aisles and stalls. As such, no other craft touched 'carpenter's work' - so when there was a need for carpenters, a work team was assigned as necessary. Our work teams were assigned all over the Hanford Project.

The Journeyman Carpenters provided the technical expertise. And us carpenter apprentice's on the Hanford Project were always assigned to the 'grunt' work: the hardest, dirtiest, heaviest, least desirable jobs, outside in winter, inside in summer, low-man on the totem pole work. That was the nature of the industry, and there was plenty of work, and I was assigned everywhere on the Hanford Project. My immediate supervisor was and his supervisor was For about 6-months, I was assigned to the Carpenter's Shop at the J.A. Jones HQ's area. During this assignment, I built modifications for plexi-glass hoods, plexi-glass boxes, and protective handling cages for handlers of hot/dirty materials in accordance with specifications from Bechtel. It was during this assignment that I used acetone, solvents, and glues for wood, plastic, rubber, etc. My Carpenter Shop supervisor was (?)., Section E3 WORK COMPLEXITY:

I was a Carpenter Apprentice employed by J.A. Jones Construction Company, a sub-contractor of Bechtel Corp. J.A. Jones Co. had the minor construction maintenance contract for the entire Hanford Project. As a result of the nature of my employment, to the best of my recollection, I believe I have worked on almost every Hanford facility and practically on or in as many as 10 different facilities on some sites and at least two facilities on each site.

I was employed full-time (intermittently) from 1967 through 1968, and again from 1970 through 1971. Hanford was a union job, and I was a member of the Carpenter's Local #1849. Although I was stationed at the '300' Area, during my total employment I only worked in the '300' Area about 1/3 of the time; I was a 'Rover' 2/3 of the time: I worked at the 'Tank Farms' and Burial Grounds about 1/3 of the time. I worked at the beginning construction for the FFTF site, the PUREX site in the pipe galleys , and the 100 Areas, 200 West and 200 East, 400 Area, 1100 Area, at WPPSS, and at a huge underground canyon facility. We had to wear two sets of protective clothing and a gas mask about 40% of the time. I performed physical activities that required considerable use of my arms and legs and moving my whole body, e.g. climbing, lifting, walking, stooping, crawling, and standing.

I cut and shaped materials such as wood, plastic, steel, ceiling tiles, fiberglass, asbestos, sheet rock and drywall with hand and power tools, such as nail guns, chisels, planes, saws, and drills. I was primarily involved in tasks such as tearing down walls, floors, ceilings and framing of existing contaminated structures. Some of these structures were huge, and were hazardous due to chemical spills, asbestos, lead and other substance work that was performed in these structures: labs, storage buildings, warehouses, nuclear fuel manufacturing work sites, etc.

Most of the noise pollution that I was exposed to was due to blowers, heaters, air filters, exhaust fans, construction equipment and machinery, cranes, graders, back hoes, vehicles and working in close proximity to other craftsmen and work teams. Although we had safety goggles, gloves, shoes, etc., no earplugs were issued. I also frequently worked in hazardous situations whereby I built shoring and concrete forms in contaminated earth pits that were excavated due to chemical spills, etc., especially at the tank farms.

SECTION E3 PHYSICAL DEMANDS:

The work was highly physical and required a lot of climbing, lifting, pushing, pulling, carrying, balancing, stooping kneeling, crouching, crawling, and reaching under, inside and outside of buildings, and underground pipe galleys and trenches. I worked on, near and around contaminated debris and equipment, tools, pipes and underground radioactive storage tanks, hazardous dust, chemical spills, welding fumes, etc.

The work was active and most times strenuous because of prolonged standing, climbing, bending, and kneeling - often over contaminated pipes and other obstructions. We risked injury from slips or falls, from working with sharp or rough materials, and from the use of sharp tools and power equipment.

The work involved constant exposure to respiratory toxins and other hazards such as dust from grinding metals, asbestos, insulations, fumes, solvents, dry wall, lead, noise, silica dust and the breathing of particles in the air contaminated by the sulfuric-like debris constantly spewing from the concrete stacks in the 300 area, etc.

SECTION E3 WORK ENVIRONMENT:

. . .It needs to be noted that we were constantly working in the Hanford soil: Pits, Trenches, Forming for concrete, etc. I estimate that approximately 30% of my work was directly in the Hanford soil. . . Sometimes we had on protective clothing and sometimes we just wore our own clothing.

Protective Clothing
The risks and potential dangers imposed by the physical surroundings and hazards required us (40% of the time) to wear two sets of protective cloth clothing and gloves (each set taped separately to seal openings), cloth shoe covers, then rubber boots, rubber gloves over the cloth gloves, a gas mask and a cloth hood taped over the gas mask. I also had a radiation dosimeter on my person for measurement of exposure to contamination.

On occasion, (once or twice every 3 months) a safety inspector would make a work site visit with a radiation detecting devise for checking our worksites and tools, often we would have to throw our tools into burial boxes because they had became 'hot' with radiation and we were not allowed to continue to work with them, or we were required to leave the 'hot' tools at sites that were constantly 'hot' such as the tank farms, the T-canyon, K-basins, etc., and we would later use these tools for subsequent work at those work sites.

Internal Radiation Exposure Conditions
There was a strong potential for getting internal doses of radiation in that, one-third of the time we ate lunch in the 300-area not far from the smoke stacks. While working, we were constantly ingesting, absorbing, inhaling contaminants and exposed to our area environment and the foul emissions from the smoke stacks that were spewing contaminants and particles such as (ionized radiation?) in the 300-area - as well as from the smoke stacks in other areas at Hanford. We also were exposed to everything else out-of-doors, and everything indoors as a result of being near or working near radioactive materials, toxins, and/or other harmful contaminants.

SECTION E-3 JOB TITLES AND DUTIES continued

Primary Construction Work Activities on the Hanford Site:

As a carpenter apprentice with the J.A. Jones Construction Company, we constructed, erected, installed, dismantled, tore down, repaired and built structures and fixtures of wood, metal, plywood, wallboard, asbestos siding and asbestos insulation using carpentry hand and power tools. we worked in several different buildings and locations throughout the Hanford Site, some of which I remember. The job-specific assignments we worked at the Hanford area included:

- ✓ Shoring trenches, ditches and excavation in soil contamination locations
- ✓ Removing contaminated shoring materials
- ✓ Tearing down and constructing forms for concrete pads, floors, walls, stairs, footings, etc.
- ✓ Building burial boxes
- ✓ Lining burial boxed with sheet lead
- ✓ Scaffold erection and dismantling
- ✓ Tearing down framed walls, floors and ceilings in contaminated structures
- ✓ Tearing down and constructing suspended ceilings, sheetrock ceilings and walls
- ✓ Tearing down and constructing metal stud and plate framing for walls, doors, etc
- ✓ Renovating shops, laboratories, offices, workshops, storage areas, etc.
- ✓ Carpenter shop work
- ✓ Building and tearing down concrete forms around contaminated pipes at the tank farms

We have worked in or closely around buildings and locations such as: Fuels Manufacturing, Research Labs, Machine Shops, Waste Storage Areas, Materials Storage Areas, Chemical Labs, Ditches, Trenches, Offices, Reactors, Storage Pads, Tank Farms, Pipe Trenches and Galleys, Excavation Pits, Debris Dumps, Burial Grounds, etc.

SECTION E-3 CTWs Provided Maintenance Services for these Hanford Facilities

306 building had a complete fuel element canning line with the exception of autoclaving. The co-extrusion process was developed in the 306-E building in the early 1960s in support of N-Reactor fuel needs. This facility was shut down in
the early 1980s.

The N-Reactor fuel was produced in the 333 Building starting in 1961. The N-Reactor fuel elements used a tube-in-tube design consisting of slightly enriched uranium inner and outer cores and thin zircaloy-2 cladding. The production process included: cleaning of the uranium billets and Zirconium-2 cladding shells; billet assembly and preheating; extrusion; fuel element shaping and cleaning; and welding of the end cap. In 1965 – 1967, outer driver fuel elements were produced in support of tritium production at N Reactor. The Li/Al inner target element was manufactured in the 3722 Area Shop. The 333 Building was placed on standby in 1988 when the Manufacture of N-Reactor fuels ceased.

The High Temperature Lattice Test Reactor (HTLTR) was a 2 MW test reactor built in the 318 Building in 1967 with operation commencing in 1968. The reactor consisted of a graphite cube located in a large shielded room and was operated at elevated temperatures up to 1000 0 C. The mission was to advance reactor physics technology. It was shut down in 1971 after 3 years of operation, during which time they operated with six different cores (i.e., three - 233 U, one - 235 U, one – 238 U, and one - 239 Pu). Since the reactor was heavily shielded and operated remotely, external exposure was minimal. There were no contamination incidents so internal exposure was negligible. In the 1980s, this building was converted for use as the Hanford radiological calibrations laboratory to primarily calibrate dosimeters and portable radiation protection instrumentation. Numerous measurements of sources in this building have been done to ensure traceability with national standards laboratory. This is basically a low-dose facility to the workers within the building.

The 3706 Building was involved in handling plutonium. Analytical testing to improve fission product decontamination was conducted in this building.

According to a 2000 DOE assessment of recycled uranium at Hanford: The facilities that were identified to have involved the handling of recycled uranium included (1) the 313-314 building complex in the 300 area which was primarily involved in the fabrication of aluminum-clad reactor fuels; (2) the 333 building complex in the 300 Area, which was involved in the fabrication of zirconium-clad reactor fuels;

The REDOX chemical separations plant in the 200 West Area where reactor fuels were dissolved for plutonium and uranium (including transfer of the UNH to the U03 Plant for calcinations).

(4) the U plant in the 200 West Area where pre-1952 tank wastes were processed for Uranium recovery.

SECTION E-3 CTWs Provided Maintenance Services for these Facilities

The UO3 plant in the 200 West Area, where uranium was recovered as UNH was received, concentrated, calcined and packaged for shipment and recycle,

The PUREX plant in the 200 East Area where irradiated fuels were dissolved for the recovery of uranium and plutonium (with the UNH shipped to the UO3 plant by truck for calcination), and

The 183 H solar basin in the 100 H-Area that was used for a ten-year interval to evaporate dilute liquid wastes generated at the 300-Area fuel fabrication plants.

400 AREA

400 Area

During the operations of the Fast Flux Test Facility (FFTF), the radionuclides of concern were 22 Na, 24 Na, 137 Cs, 54 Mn, 60 Co, 237 Np, and 241 Am (in the waste stream). After shutdown of the reactor, 60 Co and 137 Cs became the radionuclides of concern. There are limited amounts of alpha contamination (plutonium) in the facility as a result of failed fuel and washing of this leaking fuel in the Sodium Removal System (i.e., primarily in the waste stream). There is also tritium associated with the primary and secondary Na systems. FFTF had occasional issues with neutron exposure during fuel handling operations. There was no detectable neutron exposure from the operation. Prior to the identification of uranium and plutonium in the wash area, only beta/gamma surveys were required. FFTF is currently shut down and there is not much potential for exposure.

SECTION E-4 EMPLOYMENT DATES OF PETITIONER

E.4 - Employment Dates relevant to this petition:

(1) *Full-time From 1967 through 1968 and

(2) *Full-time From 1970 through 1971

*Averaged at (8 ½ Hours Per Day - 5+-Days Per Week for 50-hour week)

SECTION E-5a UNPLANNED RADIATION EVENTS AND INCIDENTS:

'Is this petition based upon one or more unmonitored, unrecorded or inadequately monitored or recorded exposure incidents?':

THE ANSWER IS: YES, Particularly at the 'Hanford Tank Farm Site' the class workforce was not routinely provided for with adequate personal protective equipment (PPE) to protect them from tank vapors from 1967 through 1971." Re:

Health Hazard Evaluation Report 2004-0145-2941
CH2M Hill Hanford Group, Inc. and
U.S. Department of Energy, Office of River Protection
Richland, Washington - July 2004

Yvonne Boudreau, MD, MSPH
John Cardarelli, PhD, CIH, PE
Gregory Burr, CIH

SUMMARY
NIOSH HEALTH HAZARD EVALUATION REPORT

"The National Institute for Occupational Safety and Health (NIOSH) received a confidential request from employees of CH2M Hill Hanford Group, Inc., and a subsequent request from the United States Department of Energy, Office of River Protection, to evaluate the potential for exposures and health effects of vapors emitted from hazardous waste storage tanks at the Hanford Site in Richland, Washington. In response to these requests, NIOSH representatives conducted an evaluation at the Hanford Tank Farms in March 2004.

The tanks contain a mixture of chemical and radiological waste which is being transferred to another location for processing into glass. Although there is no occupational exposure limit (OEL) for the mixture of chemicals and compounds that may be present in vapor that escapes from the tanks, OELs do exist for some of the individual vapor constituents. NIOSH investigators determined that employees at the Hanford Site may be exposed to vapor mixtures emanating from the "head space" (air space above the tanks' liquid contents) area of the tanks and that these exposures, on occasion, may be in sufficiently high concentrations to pose a health risk to exposed workers.

The tank farm workforce was not routinely provided personal protective equipment (PPE) to protect them from tank vapors. Exposure data for individual workers were limited in quantity and quality, not easily accessible and, in some situations, had not been obtained until hours after an accidental exposure had occurred. Due to these data limitations, the true exposure potential was difficult to ascertain.

Of the 54 interviewed workers, 35 reported a variety of acute and chronic health concerns they believed were related to vapor exposures. Those interviewed were also concerned about the available PPE and the adequacy and accuracy of the environmental monitoring which has been performed. To ensure their safety, NIOSH investigators recommend that, at a minimum, a NIOSH approved air purifying respirator be provided to any worker entering a tank farm to protect against exposure to nuisance vapors. For workers entering known vapor release area, higher levels of respiratory protection may be required, such as powered air-purifying respirators equipped with high-efficiency particulate air filters and organic vapor/ammonia cartridges, airline respirators, or self-contained breathing apparatus. NIOSH also recommends that the employer routinely sample the head space of the tanks and conduct personal sampling while the employees are working. Results from this sampling should then be discussed with employees to develop mutually agreeable strategies for further sampling and appropriate personal protection.

significant occupational exposures/health effects from vapors

NIOSH investigators determined a potential for significant occupational exposures and health effects from vapors released from the hazardous waste storage tanks. Although the concentrations of the compounds in the vapor will change over time and during waste movement activities, vapor constituents may be present at sufficiently high concentrations to pose a health risk to workers. Recommendations are given in this report to help protect workers, including providing, at a minimum, air purifying respirators to workers and routinely sampling the head space of the tanks and the personal breathing zones of the workers.

HETA 2004-0145-2941

NIOSH HEALTH HAZARD EVALUATION REPORT - July 2004
DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health.
http://www.cdc.gov/NIOSH/hhe/reports/pdfs/2004-0145-2941.pdf

SECTION E-5b (Continued)
1967-71 NTA Neutron Dosimeters and Monitoring History of the Class:

By definition, workers who were issued dosimeter badges at DOE sites had a potential for photon exposure, and photon radiation sources were generally omnipresent at the sites so the issuance of dosimeter badges is considered an indicator of the potential for exposure. (ORAUT-OTIB-0023)

The following paragraphs describe the Hanford beta/photon dosimeters and period of routine use to provide the recorded dose of record for the Class.

Many changes in external radiation dosimetry practices at Hanford have been made since the start of the program in 1943. Initially at Hanford external dosimetry was performed using pocket ionization chambers (PICs), which were followed shortly by two-element film dosimeters. Hanford dosimetry then progressed to multi-element film dosimeters. Presently thermo luminescent dosimeters are used at Hanford, and all other DOE sites, for external dosimmetry.

While working at Hanford, I was monitored externally for beta, gamma, and neutron doses. Even though I was also exposed to 233U, Plutonium, Tritium, Thorium, Polonium and other radio nuclides, I was not monitored externally or internally for these other radioactive contaminants.

Between 1967 and 1971, our dosimeters were the pencil (self-reading) film dosimeters – neutron dosimetry was either unavailable or dosimeters were inadequate to cover the entire spectrum to which members of the Class were exposed.

Use of NTA Film, January 1950 to December 1971. Hanford NTA film, which was introduced on January 1,1950, was processed independently from the beta/photon film even though the NTA film was typically exchanged along with the beta/photon film. Prior to 1957, NTA film was housed in the two-element beta/photon dosimeter holder along with the beta/photon film. Beginning in 1958, the NTA film was housed in an NTA-specific holder assigned to personnel. There was space in the yearly forms, manually prepared before 1957, to record the neutron dose. The Hanford policy to process NTA film varied historically but basically involved the practice to read all NTA film for the 200 West plutonium facilities and, for other Hanford facilities, to process the NTA only if the photon dose was at least 100 mrem. This was based on the observation (Watson 1959) that neutron dose was always accompanied by photon dose. For the other facilities, potential neutron dose was considered to be relatively small compared to the photon dose. A neutron dose is recorded for all Hanford workers assigned a NTA film. If it was not processed a zero neutron dose is recorded. The earliest recorded neutron dose for Hanford workers occurred in 1950 (Buschbom and Gilbert 1993).

. . . "OCAS-IG-001 **dismisses** the potential use of a neutron-to-photon dose ratio as a viable method . . ."

Equally, Fix et al. (1994), who assessed the bias and uncertainty in recorded external dose for Hanford, stated the following (pages 2.11 and 2.12):
Dosimetry practices at Hanford changed over time as technology evolved, resulting in improved capabilities to measure a wide range of energies and types of radiation . . . . Because of the different capabilities of dosimeters used in different time periods, separate evaluations ***of bias and uncertainty*** *are presented for the period 1944-56, 1957-71, and 1972-93.* [Emphasis added.]

SECTION E-5c Significant and Critical Missing Dose Issues

Assumed Limitations of NTA Neutron Dosimeters

(1) Section 2.2.1of OCAS-IG-001 acknowledged several limitations for NTA film dosimeters. A serious limitation of fast neutron dosimetry by track analysis is its insensitivity to neutrons.

(2) OCAS-IG-001 has assumed that NTA film dosimeters were insensitive to neutrons below 500 keV. This value significantly differs from the 1 MeV value cited by others, including Fix et al. (1997), whose work is heavily referenced throughout this procedure, as summarized below. Fix et al., (1997). Fix's reference to a lower energy neutron cutoff of about **1 MeV** is cited on pages iv and v of the executive summary. On page 3.3 of Section 3.2, Fix et al. state that ". . . tracks of length less than about 3 microns are difficult to identify at Hanford, the observation of a track was confined to tracks with four or more grains. . . . As such, the lower energy threshold for the Hanford NTA film dosimeters is expected to be about 1 MeV, particularly when photon 'fogging' is present."
Hine and Brownell (1956). In their classic reference text *Radiation Dosimetry*, Hine and Brownell assume a similar value, as described on page 338, which is reproduced below:

(3) A serious limitation on fast-neutron dosimetry by track analysis is its unsuitability at lower energies. Tracks of length less than perhaps 3 μ (proton energy of about 0.3 Mev) are difficult to distinguish from the change alignment of fog grains. than 0.3 Mev, the ***error introduced by neglecting to count the shorter tracks is large at neutron energies this low.*** [Emphasis added.]
In summary, 500 keV threshold value assumed by OCAS-IG-001 appears inconsistent (and not claimant favorable) when compared to the 1 MeV value cited by others.

(4) OCAS-IG-001, Section 2.2.2.1, acknowledges that neutron exposures occur in combination with photon exposures and references the work of Watson (1959), who correlated the magnitude of neutron exposures with photon exposures. However, OCAS-IG-001 **dismisses** the potential use of a neutron-to-photon dose ratio as a viable method ".

SECTION E-5d FAILURE OF TANK FARM RADIOLOGICAL CONTROLS

". . .THE HANFORD TANK FARM WORKING ENVIRONMENT IS COMPLEX IN THAT BOTH RADIATION AND CHEMICAL HAZARDS ARE PRESENT. . ."
(Page 14 - Health Hazard Evaluation Report No. 2004-0145-2941)
http://www.cdc.gov/NIOSH/hhe/reports/pdfs/2004-0145-2941.pdf - page 14

In that Construction Trade Carpenters and Carpenter Apprentice tank farm workers of the class were not monitored internally, there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class, compounded by the fact that these exposures were unmeasured, unrecorded, and unmonitored from 1967 through 1971.

E.5e - Inadequately Monitored Tank Farm Work Relevant to this Petition:

Construction Trades Workers at the Hanford Site primarily worked in HOT ZONES. There were not many days when we were not working in a hot zone. I listed all of these sites because I believe that we became contaminated at each one of them, and the health of members of the class may have been endangered as a result there of. And, there does not appear to be sufficient information and data to estimate most or all external radiation exposures to members of this class either.

Of particular importance is the fact that Construction Trades Workers were not monitored internally for radiation from 1967 through 1971 on the Hanford Site. There was no program to monitor for internal exposure due to ingested or inhaled radioactive material, yet our health may have been endangered by such radiation dose. The very fact that no internal monitoring was provided for CTWs establishes that NIOSH lacks access to sufficient information to estimate either the maximum radiation dose incurred by any member of the class, or to estimate such radiation doses more precisely than a maximum dose estimate.

However, I have centered most of the relevancy of becoming contaminated at work at the Tank Farms and Burial Grounds because working there was very harmful and immediately telling on our bodies. Every time I was assigned at the Tank Farms I experienced what I described as 'flu like symptoms. I really thought that I had some type of cold bug. When it got extremely bad and unbearable, I would report it to my Foreman, who took me for examination and treatment at the Hanford Environmental Health Clinic.

The doctors there did treat me for the flu and for a cold, but never administered any other tests or treatments. The doctors eventually realized that what I was suffering from was not a cold or flu bug, but still only treated me for colds. These visits were documented, and copies of the recorded visits and treatments are in my NIOSH case file. I believe most of my co-workers didn't report illnesses or go to the clinic - for fear of loss time and the fear of being laid-off. Although I worked approximately 5 or 6 months at the Hanford Tank Farm Sites, (and another 5 or 6 months at the various burial grounds) my time there was not all within a compact 5-or 6 months. It was a few days here, a week there type of work assignments scattered throughout my span of employment.

In August of 2002, NIOSH received a confidential request from employees of CH2M Hill Hanford Group, Inc., and a subsequent request from the United States Department of Energy, Office of River Protection, to evaluate the potential for exposures and health effects of vapors emitted from hazardous waste storage tanks at the Hanford Site in Richland, Washington." (This was also going on from 1967 through 1968, during the timeline of my class of workers.) "In response to these requests, NIOSH representatives conducted an evaluation at the Hanford Tank Farms in March 2004."

To quote Yvonne Boudreau, MD, MSPH; John Cardarelli, PhD, CIH, PE; and Gregory Burr, CII re: the Health Hazard Evaluation Report 2004-0145-2941 CH2M Hill Hanford Group, Inc. And the U.S. Department of Energy, Office of River Protection - Richland, Washington - July 2004.

"Exposure data for individual workers were limited in quantity and quality, not easily accessible and, in some situations had not been obtained until hours after an accidental exposure had occurred. Due to these data limitations, the true exposure potential was difficult to ascertain."

"NIOSH investigators determined a potential for significant occupational exposures and health effects from vapors released from the hazardous waste storage tanks. Although the concentrations of the compounds in the vapor will change over time and during waste-movement activities, vapor constituents may be present at sufficiently high concentrations to pose a health risk to workers. Recommendations are given in the NIOSH Health Hazard Evaluation Report (HETA 2004-0145-2941) to help protect workers, including providing at a minimum, air purifying respirators to workers and routinely sampling the head space of the tanks and the personal breathing zones of the workers."

The tank farms environment at Hanford is relatively unique in terms of potential exposures due to the mixture of compounds in the tanks and the resultant mixture of constituents in the vapors. Because of this, the health risks from exposure to the tank vapors have not been well documented. More data are needed to better identify and understand the potential health effects from these exposures.
"The tanks contain a mixture of chemical and radiological waste which is being transferred to another location for processing into glass. Although there is no occupational exposure limit (OEL) for the mixture of chemicals and compounds that may be present in vapor that escapes from the tanks, OELs do exist for some of the individual vapor constituents. NIOSH investigators determined that employees at the Hanford Site may be exposed to vapor mixtures emanating from the "head space" (air space above the tanks' liquid contents) area of the tanks. And that these exposures, on occasion, may be in sufficiently high concentrations to pose a health risk to exposed workers.

The tanks at Hanford contain a mixture of liquid and solid (sludge and saltcake) wastes with both radioactive and chemically toxic hazardous constituents.7 In addition to the radioactive waste, the tanks contain chemicals including sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate and phosphate; and hydrous oxides of aluminum, iron, and manganese. Mixed tank waste may also contain heavy metals such as lead, chromium, zirconium, potassium, and cadmium. Waste in some of the tanks includes detectable amounts of organic compounds that resulted from spent nuclear fuel and plutonium separation processes.

Since 1946, the wastes from various processes have been transferred among tanks, so the chemical and physical characteristics of the wastes vary. The tank contents are subject to a variety of influences (e.g., changes in barometric pressure and chemical reactions) that cause pressure to build up within the tanks, which must be released through venting. The majority of the tanks are passively vented and so the vapor releases are unpredictable. Workers can potentially be exposed to these vapors when performing certain tasks at the tank farms.

Several situations have been identified that pose a higher than normal potential for personnel exposures. Examples include breaching an enclosed system, waste intrusion (such as pump installation and core sampling), saltwell pumping, transfer of waste, and a variety of maintenance activities. Vapor releases are more likely when layers of waste are stratified and the work task requires breaking through the layers, or when the environmental conditions are such that atmospheric stagnation occurs (e.g., calm winds, temperature inversion). Based on sampling performed by CHG and other contractors, a variety of compounds has been identified in the vapors, including ammonia, nitrous oxide, benzene, butanol, acetone, hexane, and xylene.

<u>Consequential Injuries (Diagnosed after covered employment)</u>
'During my employment at Hanford I was exposed to a large number of carcinogenic agents at extremely high doses. My Hanford radiation records are only partial and are deficient because I was not monitored adequately or correctly during my work at the Tank Farms, Burial Grounds, Area 100, 200, 300 etc. My 1967-71 dosimeter did not completely detect or record all of the contaminants or radiographic toxins to which I was exposed. I also had accidents and incidents in 'high exposure' areas that were practically ignored.

<u>(Cancer Diagnosis)</u>
20-years after my construction employment at Hanford ended, I became ill - in late 1991, and was subsequently diagnosed on 1992 (the date of my with cancer – for which I had surgery on July 18, 1992. I have also been diagnosed with other illnesses that also are likely to have been caused and/or contributed to impairing my health because of my work place exposures at Hanford.

Complete Medical Diagnosis

As a carpenter apprentice at Hanford for approximately 33-months, I was exposed to a large number of carcinogenic agents at extremely high doses. And my Hanford radiation records are only partial, and are deficient because I was not monitored completely or correctly during my employment at Hanford. And I was frequently engaged in work with potential for very high peak, and relatively short-term exposures, with the probable likelihood of such ionized radiation exposures not being captured adequately in the dose record systems of 1967 through 1971 during my period of employment at Hanford.

I was exposed repeatedly to noise, asbestos, beryllium, solvents, welding fumes, metals, dust, ionizing radiation, alpha particles, beta particles, gamma rays, x-rays, neutrons, protons, and a host of other dangerous and contaminating substances and particles capable of producing ions in the body.

However, documented evidence of my consequential injuries as they were newly developing is found in the 'Hanford Environmental Health' doctor reports, which at the time were mistakenly and/or erroneously diagnosed as the 'flu' and/or common colds. Rather, they were the possible 'early stages' of internal injury or disease occurring as a consequence of toxics and cancer causing contaminants. The only treatment I received for this was 'treatment for a cold':

> There was little effort to conduct bioassay monitoring for construction workers during the 1967 – 1971 era, even though we were heavily exposed to radiation from internally-deposited radioactive and toxic materials and substances. We were repeatedly and constantly exposed, however, there were no internal monitoring programs in effect for us, even though we worked in the dirt, dust, environment and elements of the Hanford Project. The exposure we experienced was anything but 'incidental.' It was the 'nature of the job.' They said we were safe, we thought we were safe, and we were exposed day after day.

20+ years after my employment at Hanford, medical doctors at Kaiser Permanente diagnosed the following illnesses that could possibly link or relate to my past DOE employment:

SECTION E-5f Finding of The 2005 Hanford Site Profile Review

NOTE:
The working Group of the NIOSH Advisory Board on Radiation and Worker Health has developed the '2005 Hanford Site Profile Review' - an assessment of the adequacy and accuracy of the Hanford Profile for use with dose reconstructions.

" Of particular note in that matrix are three issues that point to the possibility of potentially significant missing dose for Hanford Construction Trades Workers"

The finding of the 2005 Hanford Site Profile Review identified specifically those deficiencies that hinder NIOSH from preparing dose reconstructions for our class of workers with sufficient accuracy under 42 CFR 83, which are: The Draft Issue Resolution Matrix based on the 2005 Hanford Site Profile raised three issues that point to the possibility of potentially significant 'missing dose.' Indicating that our class of workers (1967 - 1971) were not monitored adequately for neutron exposures at Hanford. These three issues point to the possibility of potentially significant "missing dose."

(a) "The first is the finding that historic neutron exposures of Hanford workers at the reactors and other facilities were not adequately characterized. Neutron-to-photon dose ratios in the NIOSH site profile for use in pre-1972 neutron dose reconstruction are based on non-conservative assumptions, and do not reflect facility design and modification over time."

(b) "For many Hanford workers, neutron exposure contributed a large fraction of the total dose derived from external radiation; in fact, for the Hanford 200 and 300 Area plutonium facilities likely dominate that dose. The fact that many workers were not monitored for neutron exposure makes it important to establish facility-specific exposure sources and shielding, representative spectral energies, and necessary adjustment factors for dosimetry in use, and changes in operations and facilities over time. This issue is presented in the matrix as comment numbers 1 and 2 for neutron characterization and neutron-to-photon ratios, respectively."

(c) "The second issue is a significant finding for missed internal dose at Hanford that is insufficiently addressed in the TBD. Issues not adequately addressed include estimation of uncertainties for bioassay measurements prior to 1981, uncertainty corrections for whole-body counting prior to 1986, and the potential contribution of radioactive contaminants in recycled uranium. This issue is addressed as comment #6 in the matrix."

(d) "Finally, the third issue is the site profile does not adequately account for the production and processing of 233 U, thorium, and polonium, and the extent they contributed to worker exposures, particularly for the peak years of 233 U production in the 1960s to 1970s, and for thorium in the 1950s to 1960s." During the employment period of the Class. (re: John Mauro, SC&A Project Manager)

SECTION E-5g Significant Missing Dose Issues

(e) Re: Contract No. 200-2004-03805, Task Order 1: Draft Issue Resolution Matrix Based on the SC&A Review of the NIOSH Hanford Site Profile as submitted by S. Cohen & Associates in June 2005 identifies the following specific issues relative to missing dose for Hanford Site Construction Workers:

Issue #1 - ORAUT-TKBS-0006-6 (Neutron Exposures)
Neutron exposures to reactor workers are not adequately characterized. There is a high potential for worker exposure to neutrons due to historic design and operations of reactors. Not all reactor operations personnel were monitored for neutrons. Number of non-reactor facilities with potential for neutron exposure is not addressed in TBD. (SC&A Report page 30)

Issue #2 - ORAUT-TKBS-0006-6 (Pre-1972 Exposures)
Neutron-to photon ratios are derived from very limited neutron measurements and depend on many assumptions. Neutron spectra and n/p ratios have facility-specific deficiencies and were based on no conservative assumptions; pre-1972 workers may have been exposed to radiation fields with neutron-to-photon ratios well in excess of those cited in TBD. (SC&A Report page 37)

Issue #3 - ORAUT-TKBS-0006-5 (Internal Dosimetry)
Questionable air sampling assumptions and lack of clear technical bases undercut the TBD's derivation of intakes in the years prior to implementation of routine bioassay programs at Hanford. More thorough evaluation is needed of uncertainties in the actual bioassay techniques, and instruments used to quantify internal dose and the MDAs. (SC&A Report page 46)

Issue #4 - ORAUT-TKBS-0006-6 (External Geometrics)
Use of correction factors, and uncertainty and bias factors for TLDs and film badge readings are not clear in the TBD. TBD presents options for determining missed photon dose, but these options could result in inconsistencies in dose reconstruction. Adjustment factors for the large variety of geometries at Hanford are not provided. TBD does not use same method (based on MDLs) to calculate missed photon and neutron dose. (SC&A Report page 51)

Issue #5 - ORAUT-TKBS-0006-6 (External)
TBD does not consider acute beta doses and routine non-penetrating doses for extremity, skin, gonads, and breast exposures. (SC&A Report page 55)

Issue #6 - ORAUT-TKBS-0006-5 (Internal)
There is a significant potential for missed internal dose that is not sufficiently addressed for potentially thousands of workers. Issues include: significant reduction on annual bioassays for site workers after 1959; estimation of uncertainties prior to 1986; and potential contribution of radioactive contaminants from recycled uranium in the 200 and 300 Areas. (SC&A Report page 57)

Issue #7 - ORAUT-TKBS-0006-4 (Stack Releases)
Modeling of occupational exposures due to Hanford environmental releases is not as claimant favorable as it should be because the RACHET model is apparently not

applied to daily episodic airborne releases; and is not necessarily applicable for particles greater than 0.5 micron. Also, large onsite worker dose estimates, particularly for inhalation of transuranics and non-volatile beta-internal doses of ionized radiation, etc. through the ingestion, inhalation of transhumances and non-volatile beta emitters released around the time of chemical separation stack releases in the 1940s and 1950s (as well as the 1960s and 1970s) have not been reconciled for potential claimants. (SC&A Report page 75 & 82).

Issue #8 - ORAUT-TKBS-0006-5 (Tank Farms)
The Tank Farm characterization in the TBD is inadequate for dose reconstruction guidance for several reasons, including: List of radio nuclides cited is incomplete, increasing the potential for missed dose; and TBD does not reflect complete description and characterization of past and current environmental restoration and waste management operations. (SC&A Report and NIOSH HHE Report – July 2004)

Issue #9 - ORAUT-TKBS-0006 -5, 6 (Thorium)
Worker doses are not accounted for properly for production of 233U in the 100, 200, and 300 Areas, as well as for thorium and polonium sources historically present in Hanford operations. (SC&A Report page 87)

Issue #10 - ORAUT-TKBS-0006 -4, 5, 6 (Burial Sites)
TBD is incomplete with respect to remediation and disposal sites. Numerous environmental waste streams and cribs that existed in the past are not addressed. D&D operations may have presented unusual internal and external exposures that were not monitored, or were not properly characterized, especially for site-wide workers/rovers. (SC&A Report page 93)

Issue #11 - ORAUT-TKBS-0006 (Health Endangerment)
The method of locating, evaluating, and integrating incident data into the dose reconstruction is not clear in the Hanford TBDs. Partial data on incidents indicate significant external and internal doses to reactor and waste management workers. Similar problems may have occurred at chemical separation facilities and 300-Area facilities. NOISH should search for records that can provide additional information on doses resulting from accidents and incidents. There is a need for a method to identify and assign doses to non-monitored workers involved in accidents/incidents who do not have dose records. (SC&A Report page 97)

SECTION E-5h & 5i BASIS OF PETITION

"Of particular note are three issues that point to the possibility of potentially significant "missing dose" for Hanford construction workers. The first is the finding that "historic neutron exposures of Hanford workers at the reactors and other facilities were not adequately characterized. . ."

Second, "there are significant findings for missed internal dose at Hanford that are insufficiently addressed in the TBD." Lastly, "the site profile does not adequately account for the production and processing of 233U production in the 1960s to 1970s, and for thorium in the 1950s to 1960s, and the extent they contributed to worker exposures."

THE 2005 HANFORD SITE REVIEW DEFINES THESE ISSUES THAT ESTABLISH THE BASIS FOR BELIEVING RECORDS AND INFORMATION CURRENTLY AVAILABLE ARE INADEQUATE TO ESTIMATE THE RADIATION DOSES INCURRED BY MEMBERS OF THE PROPOSED CLASS OF EMPLOYEES WITH ANY SUFFICIENT ACCURACY.

THIS PETITION IS ALSO BASED UPON SEVERAL FACTORS CONCERNING UNMONITORED, UNRECORDED AND/OR INADEQUATELY MONITORED OR RECORDED UNPLANNED EVENTS THAT RESULTED IN RADIATION EXPOSURES AND MISSING DOSE.

I AM ALSO PETITIONING BECAUSE CONSTRUCTION TRADE WORKERS WERE ALSO SEVERELY HARMED IN THE ROUTINE COURSE OF OPERATIONS FROM 1967 THROUGH 1971. WE WERE BEING HARMED EVERYWHERE. CONSTRUCTION TRADES WORKERS WERE HIGHLY EXPOSED TO PLANNED AND UNPLANNED WORK TASKS THAT EXPOSED US TO RADIOACTIVE CONTAMINATES, CATEGORICALLY IDENTIFIED IN THE 2005 HANFORD SITE REVIEW AS FOLLOWS:

Unmonitored Internal Dose

Carpenters and Apprentice Carpenter construction trade workers at Hanford worked primarily in maintenance and renovations of existing structures. Maintenance activities (and renovations) were conducted all over the Hanford site, thus they had the potential to be exposed to all sources of exposures on site, because they provided supportive services to the entire site. And construction carpenters and apprentice carpenters were not monitored internally between 1967 and 1971 at Hanford. Yet most of our work occurred in a contaminated facility or outside of one. Much of our work was performed in the excavated Hanford soil: holes, pits, ditches and trenches – which were highly contaminated.

There was no 'bioassay monitoring program or activities extended to our working Class. There was no Internal Dosimetry data recorded: No urinalysis, no fecal samples, no In Vivo measurements, no incident investigation reports (at least in my case), no breath radon and/or thoron testing, no nasal smear tests, etc. There was absolutely no monitoring or recorded data characterizing internal exposure for radionuclides and associated chemical forms; nor results of particle size distribution comparisons, nor were there any respiratory protection practices afforded to construction carpenters or apprentices, and no records of hand and arm exposures.

Yet, we were constantly in areas that handled 'curie-to megacurie quantities of many radionuclides, because we were in almost every Hanford facility at some time or another. At one time, home collection of excreta samples was started, but was not continued or completed.

Unmonitored and/or Inadequately Monitored Exposures

For approximately 30% of my Hanford work history, I worked in and/or on the soil of the Hanford site which was highly contaminated with toxins of all kind – for which I was improperly monitored. I also spent approximately 15% of my Hanford work history renovating and or tearing down contaminated structures – for which I was improperly monitored. For many years, (re: SCA-TR-Task1-0004 p.95) the solution to disposing of highly radioactive materials at Hanford was to bury them. . . some of these activities include tearing down buildings, removal of contaminated equipment and building structures (e.g. piping, ventilation systems), excavating burial sites and trenches, etc. . . *"If you don't find a surprise in the burial grounds, that is the only surprise you get."*

SECTION E-5h/i BASIS OF PETITION MISSING DOSE ISSUES

The possibility of underestimation of internal dose seems to be very real based upon the technological limitations and lack of validation and variability noted in the data. It does not appear to be possible to recreate the range and scope of potential exposures to this Class with our concurrent exposure data from the work sites without concurrent exposure data from the work sites with adequate quality assurance nor relevant scientific experimental data with adequate controls.

The radiation detectors used during the time period of this Class were not very accurate and poorly reflected actual employee exposure in most cases. A report* as recent as 1981 of controlled exposures indicated that film, dosimetry lacked both precision and accuracy and yielded underestimates of true neutron exposure approaching 80% in some instances. The film from the 1950s through mid 1970s produced even less accurate and precise estimates of the true personal exposure. For example, a study ** of film detector performance performed by Pacific Northwest Laboratories for the Atomic Energy Commission as late as the mid 1960s documented that the relative error of the film badge for common types of x-ray and neutron exposure exceeded 500%.

*Sims, C.S., Swaja, R.E. Personnel Dosimetry Intercomparisons Studies at the Health Physics Research Reactor: A Summary (1974-1980). Health Physics, 42(1): 3-18, 1982.

**Larson, H.V., Unruh, C.M., Bettle T.M., Keene, A.R. Factors Involved in Establishing Film Dosimeter Performance Criteria, in Radiation Dose Measurements, Their Purpose, Interpretation, and Required Accuracy in Radiological Protection. European Nuclear Energy Agency, pp. 191-208, 1967.

The majority of the exposed Class work force was not routinely monitored internally, especially during 1967-1971. It appears evident that throughout the history of the facilities' operations, radiation monitoring was inadequate for this Class in that neutron radiation monitoring was not performed; biological monitoring (urine, nasal swabs, etc.) was not performed; no extremity monitoring (ring or bracelet monitors) was performed for this Class of workers. No records have been located that indicate any individual monitoring of internal doses of radionuclides (i.e. plutonium, uranium or tritium) occurred between 1967 and 1971 for Hanford construction carpenters and apprentice carpenters.

(1) I am petitioning on the basis of the findings of the year 2005 scientific or technical Draft Review of the Hanford Site Profile #SCA-TR-TASK-1-0004. It was published and issued to the National Institute of Occupational Safety and Health Advisory Board on Radiation and Worker Health - prepared by S. Cohen & Associates - McLean, VA.

(2) I am also petitioning on the basis of a year 2004 NIOSH Health Hazard Evaluation Report of the Hanford Site hazardous waste materials disposal Tank Farm Sites. HETA 2004-0145-2941 (July 2004) -- CH2M Hill Hanford Group, Inc. And the U.S. Department of Energy, Office of River Protection - Richland, Washington.

NIOSH investigators determined a potential for significant occupational exposures and health effects from vapors released from the hazardous waste storage tanks. Although the concentrations of the compounds in the vapor will change over time and during waste movement activities, vapor constituents may be present at sufficiently high concentrations to pose a health risk to workers. Recommendations are given in this report to help protect workers, including providing, at a minimum, air purifying respirators to workers and routinely sampling the head space of the tanks and the personal breathing zones of the workers.

Unknowns and Missing Dose
The tank farm environment at Hanford is relatively unique in terms of potential exposures due to the mixture of compounds in the tanks and the resultant mixture of constituents in the vapors. Because of this, the health risks from exposure to the tank vapors have not been well documented. More data are needed to better identify and understand the potential health effects from these exposures. An important step in this process is CHG's pursuit of an expert panel to help develop the most appropriate medical monitoring for the Hanford tank farm workers. In addition, some health effects could be latent, i.e., might not manifest until some time (even years) after exposure has occurred. Therefore, long-term medical monitoring, even after retirement, would be prudent.

F. James Sensenbrenner, Jr., Chairman, House of Representatives Committee on the Judiciary – wrote on June 9, 2005: "...Due process and transparency are matters of significant sensitivity. It is well documented that defense nuclear workers were often put in harm's way without their knowledge or consent. The government used the guise of state secrets on nuclear weapons production activities to withhold information needed by workers to secure workers' compensation claims, to thwart demands for hazard duty pay and to avoid adverse publicity and embarrassment.

For example, a 1947 memo from the AEC Director of Oak Ridge operations to the AEC General Manager stated:

> *"Papers referring to levels of soil and water contamination surrounding Atomic Energy Commission installations, idle speculation on future genetic effects of radiation and papers dealing with potential process hazards to employees are definitely prejudicial to the best interests of the government. Every such release is reflected in an increase in insurance claims, increased difficulty in labor relations and adverse public sentiment..."*

Based on new findings that result from the 2005 Hanford Site Profile Review:

(1) It is not feasible to estimate with sufficient accuracy the radiation dose that the Class received; and

(2) There is a reasonable likelihood that such radiation dose may have endangered the health of members of the Class."

SECTION E-5i DEFICIENCIES IN THE TECHNICAL BASIS DOCUMENTS THAT HAVE THE POTENTIAL TO ADVERSELY IMPACT DOSE RECONSTRUCTIONS

Summary of Findings of Deficiencies that Adversely impact Dose Reconstructions

The 2005 Hanford Site Profile Review (See Page 14 of Document #SCA-TR-TASK1-0004), has identified the following deficiencies causing claimant-unfavorable impacts.

Finding 1: The NIOSH-derived neutron-to-photon dose ratios for use in pre-1972 neutron dose reconstruction are technically deficient and based on non-conservative assumptions, making them claimant unfavorable for use in dose reconstruction. For many Hanford workers, neutron exposure contributed a large fraction of the total dose derived from external radiation. In fact, when they are adjusted to account for the current International Commission on Radiological Protection (ICRP) neutron-weighting factor, neutron doses at the Hanford 200 and 300 Area plutonium facilities dominate the external dose. SC&A found various combinations of deficiencies that include: (1) the use of inappropriate data, (2) the use of incomplete or insufficient data, (3) the use of unconfirmed assumptions, and (4) the failure to account for critical variables, which limits the use of extrapolated data over time. It is also clear that historic neutron exposures to reactor workers in many areas are not adequately characterized.

Finding 2: The lack of bioassay data during the early period makes it difficult to properly quantify internal doses during that period. It is particularly a problem when dealing with the potentially high exposures that occurred during that time. Plutonium bioassay did not begin until September 1946; uranium bioassay did not begin until the first half of 1948. Fission product urinalysis data are unreliable until 1948. Uncertainties in the actual bioassay techniques and instruments used to quantify internal dose and the MDAs used in the years following 1946 need to be more thoroughly evaluated. Use of air monitoring data as a surrogate for worker intake during this early period is insufficiently substantiated, particularly given the lack of a basis for the assumed statistical distributions.

Finding 3: No guidance or direction for the dose reconstructor is provided regarding how adjustments are to be made or uncertainty factors calculated based on film badge and thermoluminescent dosimeter (TLD) error data provided in the TBD. In fact, no adjustments are recommended in recorded penetrating or gamma dose, with the exception of penetrating dose recorded for the two-element dosimeter used prior to 1957 for workers in the 200 Area. Likewise, adjustment factors are lacking for the large variety of exposure geometries experienced by workers at Hanford.

Finding 4: There is a significant potential for missed internal dose at Hanford that is insufficiently addressed in the TBD. Issues not adequately addressed include estimation of uncertainties for bioassay measurements prior to 1981, uncertainty corrections for whole-body counting prior to 1986 (and even default radionuclides until 1993), and potential contribution of radioactive contaminants in recycled uranium. The uncertainties in the case of plutonium in vivo counts are especially large. While the TBD recognizes the problem, the approach for dealing with them is not scientifically persuasive and does not appear to be consistently claimant favorable.

SECTION E-5 (cont.) SUMMARY OF FINDINGS OF DEFICIENCIES

Finding 5: Modeling of occupational exposures due to Hanford environmental releases is not as claimant favorable as it should be, because the RACHET puff advection model is apparently not being applied to daily episodic airborne releases. Given that there were a number of relatively large short-term, ground-level, and elevated atmospheric releases at Hanford, it is important that these are modeled as hourly, not continuous annual releases, as indicated by Tables A-1 through A-21 of the TBD (Scalsky 2003). Lack of adequate parametric modeling of episodic releases also presents a significant potential for missed dose if releases are treated as continuous releases, e.g., plutonium releases from the T and B reprocessing plants, 103 Ru and 106 Ru releases from the REDOX plant, and fission product releases as part of the Green Run and other operational release episodes.

Finding 6: The Tank Farm characterization in the TBD (Bihl 2004) is inadequate for dose reconstruction guidance in several respects. The list of radionuclides cited in the TBDs is incomplete, increasing the potential for missed dose. The site profile relies primarily on ORIGEN calculations to identify radionuclides that occur in large quantities and has not consulted field characterization data to verify the calculations (see Attachment 2 of this report). The TBD also does not reflect a complete description and characterization of past and current environmental restoration and waste management operations from which radiation exposure is likely to result.

Finding 7: Hanford was involved in both minor and major special campaigns, most notably those involving production of thorium and polonium. NIOSH needs to provide a detailed revision in the Hanford Occupational Internal and External Dosimetry TBDs to properly account for doses from the production of 233 U in the 100, 200 and 300 Areas, particularly in the 1960s to 1970s during peak production of 233 U. For workers exposed to thorium in the 1950s and 1960s, NIOSH needs to confirm such thorium exposures by urinalysis data for individual claimants, and dose reconstructors should carefully review potential doses in the 1960s and 1970s from irradiated thorium.

Finding 8: The TBD is incomplete with respect to remediation and disposal sites. Although NIOSH has included descriptions of key production and storage facilities, they have not addressed the numerous environmental waste streams and cribs that have been cleaned up in the past at Hanford disposal sites (e.g., ERDF). These areas pose radiological risks to those workers involved in the remediation and disposal process. Also, as these areas continue to age, the radionuclides of concern may be different from those in the original operations. Dose reconstructors need to take into account the risks associated with these areas at the Hanford site and the variability in radionuclide concentrations.

Finding 9: The method of locating, evaluating, and integrating incident data into the dose reconstruction is not clear in the Hanford TBDs. The Hanford occupational internal dose TDB (Bihl 2004) gives no specific information as to the spread of contamination in the reactor building, 231-Z Plutonium Isolation Facility, concentrator buildings, and uranium metal fabrication shops during the period 1943 -1946. NIOSH should search for records that can provide additional information on doses resulting from accidents and incidents.

*NOTE:
According to a 2000 DOE assessment of recycled uranium at Hanford: Of the facilities that were identified to have involved the handling of recycled uranium includes, the 313 and 314 building complex in the 300 area which was primarily involved in the fabrication of aluminum-clad reactor fuels:

The 313 and 314 buildings are the locations where injuries to my body consisted of a 'puncture of my left hand in building #314 in 1968, and a cut and scratch on my right arm in building #313 in 1970. These injuries are verified by 'Hanford Environment Health Doctor's Reports that I filed with my claim.' These reports can be located in my NIOSH Case File.

Uranium is found frequently in the 300 Area of Hanford. Yellowcake is commonly encountered in the soil at remediation sites. The uranium tends to bind with the soil preventing it from being an airborne hazard in many cases. It is easily detected due to the high-energy beta emitter of its 234 Pa daughter. There are numerous forms of uranium on the site; however, most of the uranium is found as UO2. Other forms observed in remediation include U3O8 and uranyl nitrate. The gamma dose rate for a drum of concentrated uranium is about 3 mrem/hour. The open-window reading taken with an ion chamber has been observed as high as 250 mR/hour. Although it is not often encountered during D&D, recycled uranium is easily distinguished from other uranium by the detection of 99 Tc. Large concentrations of 230 Th and 232 Th are also present in the 300 Area sediment.

SECTION E-5k Significant and Critical Missing Dose Issues

WASTE MANAGEMENT BURIAL GROUNDS

The Burial Grounds waste handling facilities were also present to handle the high-and low-level radioactive wastes produced in the various processes mentioned above." Burial sites also exist in the 100 and 200 Areas. The 100 Area burial sites contained materials and equipment from the reactors. For example, 118-B-1, a remediation site by B-reactor, contains reactor garbage, irradiated wire, and expended fuel. Liquid tritium capsules have also been bound in BC Burial Grounds. Mercury was found in some burial grounds. Hanford staff suspect that some of the material found in the burial grounds were originally from other DOE facilities, but underwent processing in Hanford labs.

(I worked about 6 of the 11-months at or around the various Burial Grounds Facilities)

The Hanford Solid Waste Operations Complex -
This operation includes eight burial grounds and covers approximately 1,400 acres. These burial grounds contain more than 38,000 drums and boxes of transuranic wastes buried with soil. From 1998 -2001, DOE and its contractor removed more than 1,400 contact-handled transuranic drums stored on pads in the burial grounds. Several containers of remote-handled transuranic barrels await removal. Of current concern are drums in burial ground 4C, which contain significant amounts of 238 Pu in oxide form. Centerline temperatures in these storage containers are estimated to reach as high as 682 ° F. The Defense Nuclear Facilities Safety Board estimated that a single drum conflagration accident could deliver a dose of 260 rem to an exposed worker.

Radionuclide List and Waste Management Operations -

The list of radionuclides used in some of the dose reconstructions appears to be incomplete, resulting in the potential for missed dose. In the context of Hanford's high-level radioactive waste tanks, the TBD provides guidance that is neither accurate nor complete relative to radiation exposures to workers handing these wastes. Between 1944 and 1988, Hanford generated high-level wastes containing more than 830 million curies of radioactivity.

Moreover, exposure to transuranics from wastes in Hanford tanks could be quite significant. For instance:

There are three 1-million-gallon capacity tanks that contain significant amounts of soluble transuranics – more than half of all soluble transuranics in Hanford tanks. In these three tanks, transuranics are bound in organic complexants.82 The interaction of radioactivity with water and organics in these tanks generate gases that are likely to contain significant amounts of soluble transuranics.

SECTION E-5I Uncertainty Corrections and Significant and Critical Missing Dose

Uncertainties
In reference to the 2005 Hanford Site Profile Review, an issue not adequately addressed includes estimation of uncertainties for bioassay measurements prior to 1981, uncertainty corrections for whole-body counting prior to 1986, and potential contributions of radioactive contaminants in recycled uranium.

Finally, the site profile does not adequately account for the production and processing of ^{233}U, thorium, and polonium, and the extent they contributed to worker exposures, particularly for the peak years of ^{233}U production in the 1960s to 1970s, and for thorium in the 1950s to 1960s.

Section 2.1.1.3 of OCAS-IG-001 discusses the **uncertainty** of personnel dosimeters. It provides the following statement for film badges (discussed in Subsection 2.1.1.3.1):
*A technical committee appointed by the National Academy of Sciences outlined three components (**laboratory, radiological**, and **environmental**) of uncertainty in personal dosimetry for film badge dosimetry* In summary, the NRC/NAS Committee identified the three separate components for uncertainty: laboratory, radiological, and environmental. The following discusses issues of concern related to each of the three components *employed, since routine monitoring is generally more precise than large sampling events such as atmospheric test monitoring. . . .*

OCAS-IG-001 provides no technical support for this nonconservative/nonclaimant-favorable assumption that excludes the additional uncertainty associated with exposures of less than 200 mrem. The referenced "Section 2.1.3," in fact, provides a discussion of occupational medical dose and makes **no** mention of environmental uncertainty. It is likely that the intent was to identify Section 2.1.4, *Environmental Dose*, along with Section
Issue 1: Laboratory Uncertainty

*This category includes all the uncertainties introduced in film calibration, chemical processing of films, reading their optical densities, comparing these densities with the densities of unexposed and calibration films, and in interpreting the measured densities in terms of exposure. Even under the best controlled laboratory conditions, laboratory uncertainties [K(E)] are a strong function of exposure levels, **particularly at low exposure levels**.* [Emphasis added.]
*These factors are to be combined with uncertainties from other sources as usual, including the "standard" laboratory uncertainty factor, which is **1.2 or 1.3** for most test series.* [Emphasis added.] The cited table from NRC (1989) not only identifies **standard uncertainties** (i.e., K(E) that parallel the assumed value of 1.3 by OCAS-IG-001, but also additional uncertainties (i.e., K*(E)) for exposures below 0.2 R. However, OCAS-IG-001, Section 2.1.1.3.1, states that:

Issue 2: Radiological Uncertainties ***— DCFs for Posterior to Anterior (PA) Exposure Geometry*** NRC 1989 identifies the following three areas of uncertainty in behalf of the radiological category: photon energy, body wearing position, and radiation backscatter. It states the following:
. . . A film badge is normally expected to be worn on the chest. At such a position, it is not experiencing the same radiation field as if it were freely exposed in air because body attenuates radiation from the back. The presence of the body on which a badge is worn [also] increases the radiation field . . . because the body backscatters photons. OCAS-IG-001 considers photon energy and discusses radiological uncertainties in Section 4.4 in behalf of four exposure geometries; and Appendix B provides tissue/organ DCFs in behalf of three energy intervals and four exposure geometries.

SC&A's review of radiological uncertainties and exposure-geometry-specific DCFs presented in Appendix B of OCAS-IG-001 has led to the conclusion that PA geometry DCFs are in error, as explained below. DCFs for PA Exposure Geometry. OCAS-IG-001, Section 1.5 (page 11), states that ". . . typically, film

badge and TLDs were worn on the upper front torso of the body." Therefore, on the assumption that personnel dosimeters were commonly worn on the chest, the DCFPA values given in Appendix B for photons and neutrons appear in error. SC&A has concluded that DCFs for PA geometry given in Appendix B wrongly assumed that the measured dosimeter dose was worn on the posterior of the torso instead of the anterior.

Issue 3: Radiological Uncertainties and Potential Errors with Other Exposure Geometries/DCFs
A similar discrepancy for cited DCFs appears to apply to the rotational and isotropic exposure geometries. Under rotational exposure geometry, a dosimeter would be subject to a small fraction of photons that define the undisturbed radiation field. The balance of photons would be variably attenuated, as determined by the amount of tissue that must be traversed prior to reaching the dosimeter. With linear attenuation, a tissue/organ (e.g., lung) that falls at or near centerline to the vertical axis of the body would be expected to receive a dose that is essentially equal to the recorded deep dose (HP(10)) of a dosimeter.

Issue 4: Radiological Uncertainty ***— Angular Sensitivity***
A serious limitation involving personnel dosimeters (film and TLD) used to assess photon and neutron exposures concerns angular sensitivity, as determined by body-wearing position relative to the radiation field. When personnel dosimeters are calibrated, the incident radiation is normal (i.e., 0 E) to the plane of the dosimeter, yielding a dose response (i.e., calibration factor) that is optimal. At incident angles

SECTION E-5 Uncertainty Corrections and Significant and Critical Missing Dose

that deviate from 0 E , the response of the dosimeters can be greatly diminished, which leads to an underestimate of the true exposure that is measured.

Issue 5: Dosimeter Uncertainty — Environmental The third and final category of uncertainty associated with personnel dosimeters was termed environmental by the NRC/NAS Committee (NRC 1989). Environmental uncertainty is the collective impact of environmental factors that include high temperatures, humidity/moisture, light, pressure, reactive chemicals, and radioactive contamination to which the dosimeter may be exposed in the field during the wear period. For adverse environmental conditions, the environmental uncertainty (KENV.) was estimated at 1.3 (NRC 1989).

As previously mentioned, OCAS-IG-001, Section 2.1.1.3.1, identifies environmental uncertainty in the following passage:
A technical committee appointed by the National Academy of Sciences outlined three components (laboratory, radiological, and environmental) of uncertainty in personal dosimetry for film badge dosimetry used during atmospheric nuclear test (NRC, 1989). The uncertainty in the environmental component is discussed in section 2.1.3 . . . [Emphasis added.]

The referenced "Section 2.1.3," in fact, provides a discussion of occupational uncertainty in OCAS-IG-001, therefore, appears incomplete and leaves several questions unanswered as to what was and what was not included, and whether the more restrictive treatment of uncertainty is truly claimant favorable.

Richardson D, Wing S, Watson J, Wolf S

SECTION E-5m - Missing Annual External Radiation Data Among Hanford Workers

"Epidemiological studies of workers employed at the Hanford Site have been underway for nearly 30 years. Although the external radiation dosimetry program at Hanford has been fairly comprehensive, some workers included in previous epidemiological analyses have periods of employment during which there are missing annual external radiation dosimetry records. In this report, employment history records and annual external dosimetry records have been used to investigate the extent of missing annual external dosimetry records for workers at the Hanford facility. A "nearby" procedure for estimating values for missing annual external dosimetry records was evaluated. Among the 33,459 workers who were employed at least 180 days and had at least one annual external dosimetry record, annual external dosimetry records were missing for 8% of the years of employment (32,323 missing annual external dosimetry records). Missing annual external dosimetry records were more common for female Hanford workers than for male workers, and for workers employed in the early years of Hanford's operation than for workers employed in later years of operation. The nearby procedure provided reliable estimates of values for missing annual external dosimetry records. Using this procedure, 18,937.5 mSv were estimated for missing annual external dosimetry records; this was 2% of the total recorded cumulative external radiation dose for these workers. Missing annual external dosimetry records should be considered as a potential source of bias and uncertainty in investigations of radiation – cancer associations among Hanford workers.

Richardson W, Wing S, Watson J, Wolf S [1999]. Missing Annual External Radiation Dosimetry Data Among Hanford Workers.

J of Exp Analysis and Environ Epi., 9:575-585."

SECTION E-5n Special Issue: Recorded Unplanned Incidents and Acidents

The following 29 noted incidents may not be documented in an employee's personal dosimetry file and these are the types of incidents that have occurred and do routinely occur (e.g. skin and clothing contamination, changes in radiological conditions which lead to higher posting levels, etc.) This constitutes a 'failure of radiological control' over periods of time during the endangerment of the health of Class workers. For example, a review of several hundred Radiation Occurrence reports from the Hanford reactor area, railroad operations, Tank Farm, and Burial Grounds between 1967 and 1971 found numerous instances of excessive exposures to construction trades workers. Some of the radiation incident reports reviewed are identified as follows:

1. Chemical Processing Division - 241 SX Tank Farm - Radiation Occurrence Reports June 14, 1971
2. Chemical Processing Division - 242 T Facility - Radiation Occurrence Reports January 26, 1967, April 3, 1967, March 10, 1968, November 3, 1968, April 13, 1971
3. Chemical Processing Division - 241 T Tank Farm - Radiation Occurrence Reports February 7, 1967, March 25, 1967, May 24, 1967, August 31, 1967
4. Chemical Processing Division - 241 TX Tank Farm - Radiation Occurrence Reports April 4, 1967, April 11, 1967, August 26 to September 28, 1967, September 9, 1967, October 28, 1970, January 7, 1971
5. Chemical Processing Division - 244 AR Area Off-Normal/Radiation Occurrence Reports January 27, 1968
6. Chemical Processing Division - 204 S Area - Radiation Occurrence Reports December 21, 1967, January 10, 1968, July 17, 1968
7. Chemical Processing Division - 241 AX Tank Farm - Radiation Occurrence Reports January 30, 1968, January 2, 1970
8. Chemical Processing Division - 241 B Tank Farm - Radiation Occurrence Reports January 4, 1968, January 12, 1968, March 7, 1968, June 14, 1968
9. Chemical Processing Division - 241 BY Tank Farm - Radiation Occurrence Reports June 2, 1970
10. Chemical Processing Division - 241 CR Tank Farm - Radiation Occurrence Reports July 24, 1967, November 20, 1970,

NOTE: Although I am the petitioner hereof, I am not aware of whether or not I was within the areas affected at the times of these occurrences. I also cannot identify any other member of the class who was within the areas affected at the times of these occurrences. As construction trades workers, we were not notified or otherwise informed when unplanned releases occurred. However, these events occurred during the work timeline of the Class. Members of the Class may have been exposed to radiation during these incidents which are likely to have involved levels of exposure similarly high.

SECTION E-5o Special Issues (Continued)

SPECIAL CAMPAIGNS

1967 – "Extrapolated leakage rates . . . show that B and D leakage rates have improved whereas leakage rates for F and H reactors have increased in magnitude since the most recent previous report [April 15, 1965]... This is believed to be the result of having charged thoria in the fringe of B and D reactors which reduced the shield temperatures and so reduced the leakage rates, while at F reactor the shields were allowed to operate at slightly higher temperatures..."

Hanford was involved in both minor and major special campaigns. Larger campaigns included irradiation of thorium and production of polonium and 233 U . The Irradiation Testing Group did experimental testing in the reactor areas.

Overall, the Hanford TBD (Bihl 2004) does not adequately address the production of 233 U. Production at Hanford was extensive and involved laboratory facilities, fuel fabrication facilities, several reactors, chemical separations operations, irradiated thorium recycling, and waste management activities.

A preliminary review indicates that Hanford produced more than 800 kg of 233 U.96 Given the magnitude of production at Hanford, the possibility that Hanford produced the preponderance of DOE's current excess 233 U inventory of some 2 metric tons should not be ruled out. From the mid-1960s to the early 1970s during peak production, hundreds of kilograms of 233 U were made into uranyl nitrate solutions at a concentration of approximately 300 grams of 233 U per liter.

Early in 1964, Hanford's 233 U production program began on a large scale, with the arrival of virgin thorium from the National Lead Company of Ohio, and with the initial test irradiation of six tons of thoria targets in D reactor. After favorable results, four more tons were tested in F reactor in September 1964. A core loading at F reactor containing two tons of thoria followed shortly thereafter.106 By February 1965, thoria "blankets" were being irradiated in the B, C, D, KE, and KW reactors, which continued through the early 1970s.

It appears that fuel processing/fabrication of thorium occurred in the 306, 321, 313, and 314 Buildings. Exposure to other radionuclides present in virgin and recycled thorium should not be ruled out for workers in the 300 Area and NIOSH should determine the extent to which recycling of thorium might have taken place relative to fuel fabrication.

In April 1967, a review of the experience of thorium fuel fabrication and irradiation at Hanford reported: "The handling of thoria presents radiological hazards because of gamma emission and the tendency for accumulation of inhaled or ingested thorium in the bones. Between 1964 and 1967, workers in the 300-Area processed and fabricated about 180,000 thorium reactor fuel elements in open faced hoods without the use of respirators.

SECTION E-5 Special Issues (Continued)

The potential dose, as demonstrated above, can be significant. NIOSH should examine in greater detail the radiological impacts on workers from the production of 233 U at all Hanford facilities.

These operations represent a significant work commitment at Hanford that should be adequately characterized. More needs to be done to assess what appears a significant source of missed dose.

By June 1967, at least eight test-scale recycling campaigns of irradiated thoria were conducted at the 224 U.S. UO3 facility. Again, NIOSH should determine if the conversion of uranyl nitrate hexahydrate (UNH) solutions of irradiated thorium to UO3 in the U.S. facility led to radiation exposures not addressed in the TBD.

By August 1968: . . .*the K reactors are currently involved in producing approximately 460 kg of 233 U for [the AEC]... Atlantic-Richfield Hanford Company reported in August 1967 that it had approximately 200 tons of thorium on-site, in the form of thoria nitrate solutions resulting from the chemical processing of previously irradiated thoria elements in production operations.* Hanford's use of thorium came to an end in the early 1970s. An online history of Hanford, for example, notes "shortly after [1970]...thorium oxide fuel was ruled out for large scale development.

Polonium Campaigns
It is likely that 210 Po was made at Hanford during World War II and into the early 1950s (Marceau et al. 2002). Early 210 Po production seems to have been omitted 3 and no bioassay data are mentioned in the TBD (Bihl 2004) to quantify worker dose to 210 Po. Bihl 2004, page 30, states the following:

There is an indication of work with pure 210 Po in the 308 Building in 1968 and again in 1975. Whether the work in the 308 Building was continuous through that period or just in those two years was not determined. Inference can be made that there was work somewhat prior to 1968 based on a handwritten note documenting a telephone conversation in November 1967 in which it was stated that the 210 Po starts in the process in the soluble form but is converted to the insoluble form.

SECTION E-5p Special Issues (Continued)

Dose Reconstruction Issues

"Of particular note are three issues that point to the possibility of potentially significant "missing dose."

The first is the finding that "historic neutron exposures of Hanford workers at the reactors and other facilities were not adequately characterized. . ."

Second, "there are significant findings for missed internal dose at Hanford that are insufficiently addressed in the TBD."

Lastly, "the site profile does not adequately account for the production and processing of 233U production in the 1960s to 1970s, and for thorium in the 1950s to 1960s, and the extent they contributed to worker exposures."

THE 2005 HANFORD SITE REVIEW DEFINES THESE ISSUES THAT ESTABLISH THE BASIS FOR BELIEVING RECORDS AND INFORMATION CURRENTLY AVAILABLE ARE INADEQUATE TO ESTIMATE THE RADIATION DOSES INCURRED BY MEMBERS OF THE PROPOSED CLASS OF EMPLOYEES WITH ANY SUFFICIENT ACCURACY.

PART F-1

YES, I HAVE ATTACHED A 'NIOSH HEALTH EVALUATION REPORT' THAT INDICATES THAT RADIATION EXPOSURES AND RADIATION DOSES THAT WERE POTENTIALLY INCURRED BY MEMBERS OF THIS CLASS, THAT RELATE TO THIS PETITION, WERE NOT MONITORED, INTERNALLY, AND/OR RECEIVED INADEQUATE PERSONAL AND/OR AREA MONITORING.

Construction Trade Workers on the Hanford Site were not monitored internally for radiation or contaminates between 1967 and 1971 - during my class of workers. Therefore, internal monitoring records on the radiation exposure experienced at the Hanford Site are not available for Construction Trades Workers, more specifically Journeyman Carpenters and Carpenter Apprentice. These doses are significantly missing.

The NIOSH Health Hazard Evaluation Report 'HETA 2004-0145-2941' of the Hanford Tank Farms dated July 2004 specifies the basis for believing that these documented limitations might prevent the completion of dose reconstructions for the class under 42 CFR Part 82 and related NIOSH technical implementation guidelines.

This report specifically identifies dosimetry and related information that are unavailable due to a lack of monitoring, for estimating the radiation doses of employees covered by this petition. http://www.cdc.gov/NIOSH/hhe/reports/pdfs/2004-0145-2941.pdf

NIOSH has documented in the evaluation that it cannot complete the dose reconstructions related to Construction Trades Workers in this petition. The basis of this finding is specified in the NIOSH Health Hazard Evaluation Report (attached). This report verifies that NIOSH does not have sufficient information to estimate either the maximum radiation dose incurred by any member of the class or to estimate such radiation doses more precisely than a maximum dose estimate.

Example of Unmonitored Exposures:
"Construction Trade Workers were instructed to keep, store and reuse tools and equipment at the Tank Farms and Burial Grounds that were tested and known to be highly radiation contaminated. No matter how highly contaminated these implements were, we were instructed to reuse them 'over and over, day after day.' And, no matter how much we coughed, sneezed or had nose bleeds - most Construction Trades Workers just 'self medicated' themselves and kept on working to keep from experiencing 'down time and missed work, and ultimate firing.'

Unmonitored Exposure to Radiation Dose from Incidents and other Mishaps:
I have previously certified, and I herewith declare, that in many instances I was not monitored for exposure to radiation at Hanford; and/or was monitored inadequately for exposure to radiation at Hanford; and that my records of exposure to radiation at Hanford are incomplete and/or of poor quality.

SECTION F-1

F-1 (Continued)
I declare and certify that the nature of my carpenter's work was quite complex, and there was great potential for internal doses of ionized radiation, etc. through the ingestion, inhalation and/or absorption of radioactive and other toxic materials.

Some of the more complex radiation and toxic exposures for which I was not monitored are listed below:

1. Working in (building 313-314) For approximately 3-weeks, we were tearing down old walls, partitions and ceilings and putting up metal framing and metal covered asbestos and/or sheetrock walls and suspended ceilings. We were cutting and grinding steel studs and sheeting, and drilling holes for screws and rivets. We were isolated from the Fuels Preparation crew by sheets of plastic but we were not wearing protective clothing or masks.
2. Working for approximately 3-weeks over a massive open concrete contamination storage pit filled with (beautiful aqua) contaminated water - we were erecting a tube-lock scaffold over the entire pit. We were instructed that "any tools that we dropped would be lost because of the contaminated water." We were dressed in 'double protective clothing' and gas masks on this job. We were never told what would happen to us if we fell into this contaminated water pit.
3. In the 300 Area, working inside (two separate occasions) 'drained and supposedly cleaned' massive concrete contamination storage pits. We were covering and sealing them with (I think ¼") sheets of rubber that we had to overlap and cement together. We used a lot of solvents and rubber cement on this project. Each pit took about 3-weeks to complete. We were dressed in 'double protective clothing' and gas masks on this job.
4. Working in the Tank Farm areas off and on for approximately 5-6 months, caused a lot of headaches and flu-like symptoms because of the high concentrations of toxic chemical and radiological wastes. I was constantly building forms for pouring concrete around waste pipes and pipes containing (?) "hot materials." We were dressed in 'double protective clothing' and gas masks which didn't help much. I was exposed to vapors daily.
5. Working in the 300 Area where the concrete stack pipes were constantly 'spewing' a toxic sulfur-like cloud of gases and particles into the atmosphere that we had to breath with no protective gear. This went on at least 2 to 3 days each week for years. We always ate our lunch in this location and environment.
6. While working underground in the 'T-Canyon' a (4-inch ?) asbestos covered pipe with toxic contents under pressure busted and spewed a high pressure steam-like liquid substance and steam or air directly behind me, less than ½ foot away. I was stunned by the incident and the loud noise that it made, to the point of 'being frozen and unable to move.' My journeyman co-worker (named ?) who was in front of me, grabbed me by my protective clothing and yanked me forward and out of harms way. We were dressed in 'double protective clothing' and gas masks on this job. Afterwards, I was never examined or monitored for contamination.

7. In the 313 building, cutting, drilling and constructing metal framing for partitions and ceilings. My co-worker apprentice (?) was on the stepladder drilling holes in the steel for rivets and screws - I was holding the ladder secure to keep him safe from falling. was using a 3/8" electric drill with a 1/8" hardened steel drill bit when he suddenly brought his arm down while still operating the drill, and he accidentally tore the flesh between my thumb and finger on my 'left hand' with the drill bit.

Underground Process Canyon - Based upon the type of work I performed at the 'Canyon Underground' location, and the known nature of the Canyon Pipe Gallery, my radiation exposure was not factored correctly into the dose reconstruction exposure data. Through research of the DOE/Hanford web site, I find that this canyon was an extension of the PUREX solvent extraction (tributyl phosphate) system which operated from January 12, 1956 until the end of September 1972, to separate and decontaminate uranium, plutonium, and neptunium produced by the Hanford reactors.

While in the Pipe Gallery, I was working in close proximity to a transfer 'pipe rupture' and a large contamination spray. An over pressurization and blowback occurred while working underground in the 'T-Canyon.' A (4-inch ?) asbestos covered transfer pipe with toxic contents under pressure busted and spewed a high pressure steam-like liquid substance and steam or air directly behind me, less than ½ foot away. I was stunned by the incident and the loud noise that it made, to the point of 'being frozen and unable to move.' My journeyman co-worker (named ?) who was in front of me, grabbed me by my protective clothing and yanked me forward and out of harms way. We were dressed in 'double protective clothing' and gas masks on this job. Afterwards, I was never examined or monitored for contamination.

Concrete Smoke Stack Emissions (33-months)
My exposure as a result of working and eating near and/or around the smoke stacks was frequent and constant. Working in the 300 area where the concrete stack pipes were constantly 'spewing' a toxic sulfur-like cloud of gases full of particles into the atmosphere. We breathed, ingested, inhaled, and absorbed this pollution week after week without any filter masks. This went on at least 2 to 3 days each week for 33-months, and we always ate our lunch in this location and environment.

"For more than 40 years, the U.S. government produced plutonium for nuclear weapons at the Hanford Site. The process of separating the plutonium caused the smoke stacks to release polluted 'hot particles' to the air and the ground. These particles were called 'hot' because they were radioactive. The Hanford Environmental Dose Reconstruction Project has 'cumulative release estimates' for 1944 – 1972."

Other radioactive materials were also present, but in lower concentrations. Most of the particles were rust or other non-radioactive material. Hanford documents reported the release of as many as 100 million particles per month. Because of their size and weight, many of the particles landed on the ground within the Hanford Site boundaries. Construction workers were not issued filter masks."

"For plutonium, the latency period is estimated to be more than 30 years, but may vary depending on the dose received. Plutonium in a soluble form acts differently in the body than the insoluble form. Instead of remaining in the lungs and the lymph nodes, as the insoluble form does, soluble plutonium enters the blood relatively quickly and deposits on bone surfaces and in the liver."

"About 40 percent of the plutonium that enters the blood goes to bone surfaces, 40 percent to the liver and the remaining 20 percent to muscle."

Working in the 300 Area where the concrete stack pipes were constantly 'spewing' a toxic sulfur-like cloud of gases and particles into the atmosphere that we had to breath with no protective gear. This went on at least 2 to 3 days each week for years. We always ate our lunch in this location and environment.

Issue #7 - ORAUT-TKBS-0006-4 (Stack Releases)

Modeling of occupational exposures due to Hanford environmental releases is not as claimant favorable as it should be because the RACHET model is apparently not applied to daily episodic airborne releases; and is not necessarily applicable for particles greater than 0.5 micron.

Large onsite worker dose estimates, particularly for inhalation of transuranics, and non-volatile beta-internal doses of ionized radiation, etc. through the ingestion, inhalation of transhumances, and non-volatile beta emitters released around the time of chemical separation stack releases in the 1940s and 1950s (as well as the 1960s and 1970s) have not been reconciled for potential claimants. (SC&A Report page 75 & 82).

SECTION F-1 (continued)

HANFORD ENVIRONMENTAL HEALTH ENDANGERMENT DOCUMENTATION

Chronology of Attached Substantial Documents Supporting Evidence of Causation

a. Hanford Environmental Health 'Doctor's Reports' verifying start of irritations to throat, eyes, lungs and chest. The symptoms were similar to a head/chest cold, but after a while the doctor documented that he doubted I had a cold. I believe I was beginning to feel the effects of absorbing, ingesting and/or inhaling toxins.
b. There is evidence of a 'drill bit' puncture that went entirely through my left hand. This probably caused some absorption and/or intake of toxins through the wound.
c. Abrasions and Scratches to the right arm. This probably caused some absorption and/or intake of toxins through the wound.

Date	Doctor's Report and Diagnosis
-68	Throat Irritation/Cold-like Symptoms
-68	Cold-like Symptoms
-68	Drill Bit Puncture through Left Hand (314 Building)
-68	Hand Follow-up
-68	Hand Follow-up
-68	Hand Follow-up
-70	Cold-like Symptoms
-70	Cold-like Symptoms
-70	Lumbar Injury
-70	Cold-like Symptoms and Lumbar Spasms
-70	Cold-like Symptoms – Dr. doubts I have a cold
-70	Lumbar Injury/Muscle Spasms
-69	Lumbar Strain Treatment Continues
-70	Lumbar Strain Treatment Continues
-70	Lumbar Strain Treatment Continues
-70	No Muscle Spasms/Same Lumbar Strain
-70	Laceration to Right Forearm (313 Building)
-70	Laceration Follow-up

NOTE:

Hardcopies of the above doctor's reports have been submitted for my dose reconstruction and can be found in my NIOSH/FAB Case File. However, I am also forwarding (attaching) hardcopies to this petition.

PART F-2

This part of the petition is 'NOT APPLICABLE'

PART F-3

This part of the petition is 'NOT APPLICABLE'

PART F-4 Attached Scientific or Technical Reports

YES, I have attached four scientific or technical reports, one issued by NIOSH, and two issued by S. Cohen and Associates a contractor of NIOSH, and one issued by the Washington State Dept. of Health. These reports identify dosimetry and related information that are unavailable (due to a lack of adequate monitoring and significant missing dose) for estimating the radiation doses of the employees covered by this petition. What I have attached are: (Hyperlinks for:)

(1) Re:Contract No. 200-2004-03805, Task Order 1: Draft Issue Resolution Matrix Based on the SC&A Review of the NIOSH Site Profile for the Hanford Site. (Dated January 16, 2006)
http://www.cdc.gov/NIOSH/ocas/pdfs/abrwh/hanmatrx.pdf

(2) NIOSH Health Hazard Evaluation Report - HETA 2004-0145-2941 CH2M Hill Hanford Group, Inc. And U.S. Department of Energy, Office of River Protection - Richland, Washington. (Dated July 2004)
http://www.cdc.gov/NIOSH/hhe/reports/pdfs/2004-0145-2941.pdf

(3) Task 1. Supplement to SCA-TR-TASK1-0001
Draft Review of the 2005 Hanford Site Profile
(Dated June 10, 2005)
http://www.cdc.gov/NIOSH/ocas/pdfs/tbd/spreview/hanford.pdf

(4) Washington State Dept. of Health: Hanford Health Info Network's 'The Release of Radioactive Materials from Hanford: 1944 through 1972. *
http://www.doh.wa.gov/Hanford/publications/history/release.html - Hanford

- This report presents information on the release of radioactive materials into the environment from Hanford's historical operations from 1944 through 1972 (covering the timeline of this Class of workers). The publication provides a brief historical sketch and describes Hanford's releases into the air, water and soil, and the range of uncertainties in the estimated amounts of radioactive material released, such as:

Iodine-131,	Tritium (H-3),	Cobalt-60,	Krypton-85,
Stronntium-89	Strontium-90	Zirconium-95	Ruthenium-103
Iodine-129	Tellurium-132	Xenon-133	Cesium-137
Cerium-144	Plutonium-239	(and other contaminants not listed)	

I herewith certify that I am not attempting to use the SEC process as a route for appealing a FAB decision. I have come to realize that filing a SEC petition is what I should have done in the first place – I am just now finding that out. I am filing this SEC-B petition because I now realize that this is the route I should travel for the good of the Class. (*I recognize that my previous federal employment as a 'Position Classification Analyst' may give me an advantage over some of my Class peers when it comes to researching, organizing and preparing this petition.)* In that regard, I recognize that it is incumbent upon me to file a SEC-B petition for the Class.

Although I have previously filed a claim that is currently pending the FA B review – a decision has not yet been rendered. I don't when a decision will be forthcoming, but I am confident that the FAB will follow the recommendations of the 2005 Hanford Site Profile Review and will recognize that:

(1) It is not feasible to estimate with sufficient accuracy the radiation dose that the Class received; and

(2) There is a reasonable likelihood that such radiation dose may have endangered the health of members of the Class."

PART G - Signature of Petitioner

Signature Date

Notice:
Any person who knowingly makes any false statement, misrepresentation, concealment of fact, or any other act of fraud, to obtain compensation as provided under EEOICPA or who knowingly accepts compensation to which that person is not entitled, is subject to civil or administrative remedies; as well as felony criminal prosecution, and may under appropriate criminal provisions be punished by a fine or imprisonment or both. I affirm that the information provided on this form is accurate and true.

Mailed To:
SEC Petition -
NIOSH Office of Compensation Analysis and Support
4676 Columbia Parkway, MS-C47
Cincinnati, OH 45226
FAX: (513) 533-6826