

SITE SPECIFIC HEALTH AND SAFETY PLAN

Project Name/Description: **300 Area Integrated Field-Scale Subsurface Research Challenge (IFC) Project (# 51805)**

Multi-Scale Mass Transfer Processes Controlling Natural Attenuation and Engineered Remediation: An IFC Focused on Hanford's 300 Area Uranium Plume

This site-specific Health and Safety Plan (HASP) covers field activities associated with the IFC Project at the Hanford 300 Area near Richland, Washington. The overall objective of the project is to evaluate scientific questions related to the effects of mass transfer on transport of uranium in the 300 Area. A series of science questions on mass transfer have been posed for research that relate to the effect of spatial heterogeneities; the importance of scale, coupled interactions between biogeochemical, hydrologic, and mass transfer processes; and measurements/approaches needed to characterize and model a mass-transfer dominated system. Three site-specific hypotheses will be evaluated that take advantage of the unique hydrogeologic characteristics of the 300 Area. The hypotheses will focus on multi-scale mass transfer processes in the vadose and saturated zones, their influence on field-scale uranium biogeochemistry and transport, and their implications to natural attenuation and remediation. The project will leverage previous investments and field infrastructure by DOE Richland as part of the RL-30 funded Limited Field Investigation of the 300 Area uranium plume and an EM-20 funded Uranium Plume Treatability Demonstration Project to evaluate polyphosphate injections. The IFC within the 300 Area is located to represent waste sources in the vadose zone as well as contaminated groundwater regions. The IFC Project will conduct field experiments that will involve both PNNL project participants as well as external collaborators. The results will provide data, knowledge, and coupled hydrologic and biogeochemical reactive transport models that will be used by DOE Richland Operations to guide future remediation decisions in the 300 Area.

Location: 300 Area at Hanford Site, Richland, WA

Facility Name/Number: 300-FF-5/300-FF-1 Operable Units, Hanford

Objective of Project:

ERA

Drum Sampling

Drilling

- | | | |
|---------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| <input type="checkbox"/> RIFS Characterization | <input checked="" type="checkbox"/> Sampling | <input type="checkbox"/> UST Removal |
| <input type="checkbox"/> RCRA | <input type="checkbox"/> Soil Removal | <input type="checkbox"/> Treatability Test |
| <input checked="" type="checkbox"/> Scoping Study | <input type="checkbox"/> Soil Gas Sampling | <input checked="" type="checkbox"/> Well Injection |
| <input type="checkbox"/> Reconnaissance | <input type="checkbox"/> Remediation | <input checked="" type="checkbox"/> Well Monitoring |
| <input type="checkbox"/> Spill Response | <input checked="" type="checkbox"/> GW Sample | |

Site Description/History/Disposal Practices:

A groundwater plume containing uranium from past-practice discharges of liquid waste associated with nuclear fuel fabrication activities has persisted beneath the Hanford Site 300 Area for many years. The persistence of this plume is enigmatic for several reasons, including (1) discharges containing uranium-bearing effluent to ground disposal sites ended in the mid-1980s; (2) contaminated soil associated with these waste sites was removed during the 1990s, with backfilling complete by early 2004; and (3) the aquifer is comprised of highly transmissive fluvial sediment, suggesting rapid movement of groundwater. Also, a water supply well located within the southern portion of the plume has been in operation since 1980, with no observable effect on uranium concentrations.

SITE SPECIFIC HEALTH AND SAFETY PLAN
KEY PERSONNEL, JOB TITLE, AND TRAINING/SITE ENTRY REQUIREMENTS

Job Title and/or Name	Training Requirements	Misc. Information
Field Team Leader	B, D, E, F, Q.	
Task Leads and Technical Field Support	B, D, F, Q.	Note: If assigned to support zone, only Q applies.
External Collaborators and Visitors	Q and R. Visitors will be allowed for short periods of time provided they have: 1) previously made arrangements with the Field Team Leader to visit the site; 2) are escorted by trained site personnel; 3) have a need to enter the zone; 4) receive safety plan briefing; 5) wear required safety equipment.	

NOTE: Evidence of training must be provided to the Field Team Leader prior to start of work. This site is thoroughly characterized in terms of contamination. Therefore, a minimum of 24 hr hazardous waste training is required for working in Exclusion and Contamination Reduction Zones.

List the letter(s) of training requirements (classes) required for individuals(s) named above.

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A. HGET</p> <p>B. 8/24 Haz. Waste</p> <p>C. Rad. Worker Training</p> <p>D. 1 Day OJT</p> <p>E. 8 Hr Supervisor</p> <p>F. 8 Hr Refresher</p> | <p>G. Site Orientation</p> <p>H. SCBA</p> <p>I. First Aid/CPR</p> <p>J. Noise Control</p> <p>K. Mask Fit</p> <p>L. Haz. Waste Worker Medical Exam</p> | <p>M. Bioassay</p> <p>N. Whole Body Count</p> <p>O. Chest Count</p> <p>P. Asbestos Worker</p> <p>Q. Read Safety Plan</p> <p>R. Escorted</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

SITE SPECIFIC HEALTH AND SAFETY PLAN
WASTE TYPES, WASTE CHARACTERISTICS, AND HAZARD CONCERNS

Waste Types: Liquid Solid Gas Unknown Other Specify:

Waste Characteristics:

<input type="checkbox"/> Chemical	<input type="checkbox"/> Biological	<input checked="" type="checkbox"/> Radiological (Per RCT direction)
<input type="checkbox"/> Corrosive	<input type="checkbox"/> Flammable	<input type="checkbox"/> Unknown
<input type="checkbox"/> Toxic	<input type="checkbox"/> Volatile	<input type="checkbox"/> Other <i>specify</i> :
<input type="checkbox"/> Inert	<input type="checkbox"/> Reactive	<input type="checkbox"/>

Hazards of Concern:

<input type="checkbox"/> Temperature Extremes	<input type="checkbox"/> Noise	<input checked="" type="checkbox"/> Compressed Air
<input type="checkbox"/> Fire Hazards	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Off-road Vehicle Use
<input type="checkbox"/> Unusual Conditions	<input checked="" type="checkbox"/> Lifting	<input type="checkbox"/> Radioactive Sources/RGDs
<input type="checkbox"/> Remote Work Area	<input checked="" type="checkbox"/> Sanitation	
<input checked="" type="checkbox"/> Chemicals	<input type="checkbox"/> Fall Protection	
<input checked="" type="checkbox"/> Pinch Points	<input checked="" type="checkbox"/> Biological (snakes, wasps, etc.)	
<input type="checkbox"/> Overhead Hazards	<input checked="" type="checkbox"/> Walking/Working Surfaces	

OVERALL RISK CLASSIFICATION: High Medium Low Negligible Unknown

JUSTIFICATION: Uranium is present in vadose zone sediments and groundwater in concentrations which present low health risk to site personnel (see MSDS in Attachment A). The primary route of exposure is ingestion of groundwater. The aqueous Polyphosphate Amendment used by the EM-20 project, composed of Orthophosphate, Pyrophosphate, Tripolyphosphate and Sodium Bromide, and aqueous Calcium Chloride Amendment, will already be injected into the ground and reacted, so an MSDS are not required. As additional tracer constituents and other chemicals are identified in characterization plans, their MSDSs will be added to Appendix A.

SITE SPECIFIC HEALTH AND SAFETY PLAN

When new activities are anticipated that are not described in this procedure, the new activities must first be evaluated. Staff members have the right and responsibility to stop work immediately, when convinced a situation exists that places themselves, their coworkers, or the environment in danger.

<p>TEMPERATURE EXTREMES</p> <p>Monitor work periodically. Adjust work/rest regimen according to WBGT (http://hms.pnl.gov/lastob.htm). Minimize/Maximize clothing where possible. Drink cool/warm liquids as appropriate. Discuss signs/symptoms of cold/heat stress. NOTE: Temperature extremes are related to seasonal climatic changes. Any introduced temperature extremes require SSO evaluation and approval.</p>	<p>COMPRESSED AIR</p> <p>Hoses and components have proper pressure rating. PRV in place and tested. System in good condition. Operators manual available.</p>	<p>FIRE HAZARDS</p> <p>Flammable liquids stored properly. Combustible materials accumulation controlled/minimized. Fire extinguishers in place/inspected. Ignition sources eliminated or protected.</p>
<p>PERMITS</p> <p>RWPs for neutron probe logging and radioactive tracers Excavation Permit for drilling and vadose zone experiment. NOTE: Obtain all necessary permits prior to initiation of work.</p>	<p>EXCAVATION</p> <p>Personnel allowed in excavation when it has been properly protected and barricaded Excavation will be properly sloped or shored when applicable and a means of egress (stairway, ladder, or ramp) will be provided Sloping will be checked for evidence of failure (e.g. soil distress, structural member damage, soil fissures) Personnel allowed within four (4) feet of excavation edge Protect excavation spoils from blowing</p>	<p>CHEMICALS</p> <p>Current MSDS available for Uranium MSDS for other chemicals will be added when know. Containers labeled and properly stored. Workers apprised of new chemical hazards.</p>
<p>PINCH POINTS</p> <p>Assure guards in place. Brief site personnel on location of potential pinch points. Identify or post areas where guarding is not appropriate or feasible. Plan ahead to avoid pinch points when handling/moving equipment and materials. Think about consequences of your actions prior to moving heavy objects.</p>	<p>ELECTRICAL</p> <p>GFCI in outdoor/wet locations. Grounding of equipment where required. Tools and cords in good condition. Cords protected. Exposed wiring guarded or covered. Lock out and tag out energy sources during maintenance or other activities when workers are exposed.</p>	<p>NOISE</p> <p>Hearing protection worn during drilling or other activities. Signs posted where required. Personnel advised in proper use of hearing protection.</p>
<p>WALKING/WORKING SURFACES</p> <p>Carry out daily housekeeping efforts. Keep walkways/work areas clear. Designate walkways/routes where appropriate. Flag or post problem areas where necessary. Keep tools in proper storage area.</p>	<p>SANITATION</p> <p>Portable toilets on site if needed. Potable water/cups on site. Wash water, soap, and towels on site. Eating/smoking in designated areas only. Empty trash and waste food receptacles daily.</p>	<p>LIFTING</p> <p>Use proper lifting techniques. Use buddy system for awkward/heavy loads. Use mechanical lifting devices as appropriate.</p>
<p>BIOLOGICAL</p> <p>Control rodent intrusion and harborage. Be cognizant of poisonous reptiles and insect harborages. Report allergic reactions to bee stings to supervisor and carry medications.</p>	<p>OVERHEAD HAZARDS N/A</p>	

SITE SPECIFIC HEALTH AND SAFETY PLAN
KNOWN CONTAMINANTS

KNOWN CONTAMINANTS*	PEL/TLV mg/m ³	STEL mg/m ³	WARNING PROPERTIES /CONCENTRATION (ppm or mg/m ³)	1. TARGET ORGANS 2. EXPOSURE SYMPTOMS	IMMEDIATE FIRST AID MEASURES
Uranium 238	PEL = 0.05 TLV = 0.2	0.6	N/A	1. K, L, CD in high concentrations. 2. May be detected via urine.	See RWP if one is required

NA = Not Available U = Unknown NE = Non Established N/A = Not Applicable WARNING PROPERTIES A = Odor B = Visual C = Irritant	TARGET ORGANS L = Liver K = Kidney LS = Lungs E = Eyes S/A = Skin Absorption CNS = Central Nervous System R = Respiratory System CA = Carcinogen H = Hemopoietic (Blood) O = Other	EXPOSURE SYMPTOMS D = Dizziness I = Skin/Eye/Respiratory Irritant C = Confusion F = Fatigue H = Headache CD = CNS Depression N = Nausea W = Weakness V = Vomiting O = Res. Irr	1ST AID MEASURES IrW = Irrigate with (H ₂ O) FA = Get to Fresh Air MA = Medical Aid IS = Wash Soap and Water
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* See Attachment A for Material Safety Data Sheets for tracer chemical.

SITE SPECIFIC HEALTH AND SAFETY PLAN
MONITORING STRATEGY/ACTION LEVELS

Instrument	Frequency of Use	Action Level	Specific Actions
See RWP for neutron probe logging See RWP, for Uranium monitoring requirements and isotopic tracers			

Where appropriate list the letter or number corresponding to the instrument or monitoring frequency in spaces above.

- | | | |
|---------------------------|---------------------------------|-------------------------|
| A. PID | H. Monitoring Not Required | 1. Hourly |
| B. FID | I. Personal Exposure Monitoring | 2. 15 Min. |
| C. GGI/LEL O ₂ | J. Biological Monitoring | 3. Continuous |
| D. Detector Tubes | K. Halide Detectors | 4. AM/PM |
| E. Dust Monitor | L. CO Monitor | 5. Per Site Safety Rep. |
| F. Odyssey | M. | 6. |
| G. GC | N. | 7. |

* Note: There are no surface contaminants in work area. Recent uranium concentrations have typically been around 30 ug/L (i.e. at the drinking water standard) at this location and have been observed to increase four fold to 120 ug/L during higher water table conditions. Thus, the maximum level of uranium expected in groundwater is 120 ppm. There is minimal exposure during GW sampling and analysis, which is plumbed from submersible pumps via tubing directly to the trailer for analysis. Airborne exposure over TWA of 0.05 mg/m³ is unlikely as long as water sampling does not generate aerosols or mists. While it might be possible for an incident to aerosolize sufficient water to reach the TLV (0.4 L/m³), it is inconceivable that sufficient ground water could be aerosolized in an event that would exceed the short term exposure limit (50L/ m³)..This is beyond the capability of the system to deliver and the air to carry.

SITE SPECIFIC SAFETY HEALTH AND SAFETY PLAN
PERSONAL PROTECTIVE EQUIPMENT

Job Task	Work Zone/Location	PPE Level
Taking sediment and water samples	7, 9	Level D
Injection of chemical and radioisotopic tracers	9	Level D
Decontamination of Equipment	N/A	
<p>List the letter or number corresponding to the requirement in the appropriate space above or fill in pertinent information. Underline necessary PPE.</p> <p>1. Sampling 7. Support Zone 2. Excavation 8. CRZ 3. Decontamination 9. Exclusion Zone 4. Observation 5. Monitoring 6. Drilling</p>		<p>Level "C" *Full-face APR (organic) *Hooded chemical-resistant clothing *Gloves, chemical-resistant *Boots (outer), chemical-resistant (boot-covers can be worn)</p> <hr/> <p>Level "D" *Work clothing, coveralls or lab coats *Gloves, chemical resistant if handling liquid samples *Boots/shoes, chemical-resistant *Safety glasses or chemical splash goggles (if handling liquid samples)</p>

SITE SPECIFIC SAFETY HEALTH AND SAFETY PLAN
SITE ACCESS AND WORK ZONES

1. Exclusion Zone – The exclusion areas around injection wells in use will be roped off and marked per Field Team Leader.
2. Contamination Reduction Zone – N/A
3. Support Zone - That area outside of the control zone for trailer, vehicles, support equipment and materials. No special training requirements apply in this area.
4. Control Zone – All areas within the roped waste site operations boundary.

Note: Emergency evacuation will be accomplished with voice commands or audible or visual signals. The Field Team Leader will establish an emergency staging area upwind of work activities during safety briefings. A first aid kit and fire extinguisher will be located in a site trailer.

SITE MAP

See Attachment B

SITE SPECIFIC HEALTH AND SAFETY PLAN
DECONTAMINATION PROCEDURES

Personnel Decontamination	Sampling Equipment Decontamination	Support Equipment
Wash hands prior to eating lunch and at end of shift.	Because the sampling pumps and tubing will remain fixed equipment, there will be minimal decontamination of equipment necessary. When required, decontamination equipment will include 7 and 15.	1, and 3 are located in a site trailer. Other equipment needed includes 2, 5, 6, and 8.

EQUIPMENT REQUIREMENTS CHECKLIST (Underline required items or add others)

- | | | |
|-----------------------------|---------------------------|----------------------------------------------------------|
| 1. <u>First Aid Kit</u> | 6. Signs-PPE, Zones, Etc. | 11. Portable Toilet (or use facility restrooms if close) |
| 2. <u>PPE</u> | 7. Decon Equipment | 12. <u>Potable Water/Cups</u> |
| 3. <u>Fire Extinguisher</u> | 8. <u>Radio/Phone</u> | 13. Wash Water |
| 4. Wind Indicator | 9. Breathing Air | 14. Spill Kit (in lab) |
| 5. Eye Wash (in lab) | 10. Signal Device | 15. Liquid Washing Solution and Waste Container |

SITE SPECIFIC HEALTH AND SAFETY PLAN
EMERGENCY PROCEDURES

CONTINGENCY PLANS

FIRE: Call 375-2400 on cellular phone, put out fire if able to do so safely. Notify PNNL Field Team Leader and Site Safety Representative immediately. The Field Team Leader will make additional notifications including the Field Site Manager (if necessary). The Field Team Leader will be on-site commander until relieved by Fire Department Personnel or other emergency response personnel.

SAFETY RELATED WORK STOPPAGE: Any person may shut down operations based on health or safety concern.

PERSONAL INJURY: Call 375-2400 on cellular phone if more than first aid is required. Administer first aid if trained. Make notifications per emergency contacts list.

CHEMICAL EXPOSURE: Get to fresh air and make notifications per emergency contacts list.

EMERGENCY CONTACTS NAME PHONE

All Emergencies: Fire/Patrol/Ambulance	ALL		375-2400
Safety Representative:	John Piatt		376-1176
PNNL Field Team Leader And Site Safety Officer	Vince Vermeul	Work Cell	371-7170 438-6545
PNNL Field Site Manager	Mark Freshley	Work Cell Home	372-6094 438-4792 374-7474

SPILL CONTROL PLAN

Contacts: Report all spills related to activities under this HASP to Single Point Contact 375-2400 and Vince Vermeul (Field Team Leader).


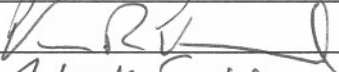
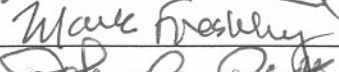

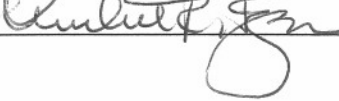
Containment Kit Located: Plastic located under injection system for containment of spills.

Actions to Take: If a leak or other spill of injection chemicals occurs, shut system down, contain chemicals if it can be safely accomplished, keep personnel upwind until spill is abated.

MEDICAL FACILITIES / LOCATION

See Emergency Plan (Attachment C)

Approval

Role	Print Name	Signature	Date
Project Manager	John Zachara		1/10/2008
Field Team Leader	Vince Vermeul		1/10/2008
Field Site Manager	Mark Freshley		1/11/2008
S&H Rep	John Piatt		1/10/2008
Product Line Manager	Mike Thompson		1/16/2008

**SITE SPECIFIC HEALTH AND SAFETY PLAN
FIELD CHANGE AUTHORIZATION**

Section to be Changed:

Page No.:

Person Requesting Change:

Verbal Authorization from Field Team Leader Date and Time:

Description of Change:

Justification for Change:

Approved by:

Field Team Leader/Print Name

Signature

Date/Time

Project Team Brief on Change by:

Print Name

Signature

Date/Time

SUBSTANCE: URANIUM

TRADE NAMES/SYNONYMS:

URANIUM, PYROPHORIC; URANIUM I; URANIUM METAL, PYROPHORIC; URANIUM 238; U-238; UN 2979; OHS24610; RTECS YR3490000

CHEMICAL FAMILY: metal, radioactive

CREATION DATE: Sep 23 1986

REVISION DATE: Jun 20 2003

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: URANIUM

CAS NUMBER: 7440-61-1

EC NUMBER (EINECS): 231-170-6

EC INDEX NUMBER: 092-001-00-8

PERCENTAGE: 100

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=3

EMERGENCY OVERVIEW:

COLOR: white, gray

PHYSICAL FORM: solid

MAJOR HEALTH HAZARDS: No significant target effects reported.

PHYSICAL HAZARDS: May explode if exposed to shock, friction or heating. Extremely flammable. May ignite spontaneously on exposure to air. May react on contact with water.

POTENTIAL HEALTH EFFECTS:



INHALATION:**SHORT TERM EXPOSURE:** nausea, vomiting, diarrhea, drowsiness, sterility, blood disorders, kidney damage, convulsions**LONG TERM EXPOSURE:** lung damage**SKIN CONTACT:****SHORT TERM EXPOSURE:** irritation**LONG TERM EXPOSURE:** same as effects reported in short term exposure**EYE CONTACT:****SHORT TERM EXPOSURE:** irritation, eye damage**LONG TERM EXPOSURE:** no information on significant adverse effects**INGESTION:****SHORT TERM EXPOSURE:** kidney damage**LONG TERM EXPOSURE:** same as effects reported in short term exposure**CARCINOGEN STATUS:****OSHA:** No**NTP:** No**IARC:** No

SECTION 4 FIRST AID MEASURES

INHALATION: Protective equipment required. Remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention immediately.**SKIN CONTACT:** Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.**EYE CONTACT:** Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.**INGESTION:** Never make an unconscious person vomit or drink fluids. Allow vomiting to occur. When vomiting occurs, keep head lower than hips to help prevent aspiration. Retain any fluids for examination and monitoring. Get medical attention immediately.**NOTE TO PHYSICIAN:** For inhalation, consider need for decontamination.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Flood with fine water spray.

FIRE FIGHTING: Move undamaged containers from fire area.

FLASH POINT: flammable

SECTION 6 ACCIDENTAL RELEASE MEASURES

SOIL RELEASE:

Wear personal protective clothing and equipment.

OCCUPATIONAL RELEASE:

Do not touch spilled material. Damage to outer container may not damage inner container. Small liquid spills: Absorb with sand or other non-combustible material. Dike for later disposal. Evacuation radius: 150 feet. Consider downwind evacuation if material is leaking. Keep unnecessary people away, isolate hazard area and deny entry. Decontaminate personnel, spill area and all tools and equipment. Only personnel trained for the hazards of this material should perform clean up and disposal.

SECTION 7 HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

URANIUM:

See U.S. NRC 10 CFR 20 and U.S. OSHA 29 CFR 1910.1096.

URANIUM, INSOLUBLE COMPOUNDS (as U):

0.25 mg/m³ OSHA TWA

0.2 mg/m³ OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

0.6 mg/m³ OSHA STEL (vacated by 58 FR 35338, June 30, 1993)

0.2 mg/m³ ACGIH TWA

0.6 mg/m³ ACGIH STEL

0.2 mg/m³ NIOSH recommended TWA 10 hour(s)

0.6 mg/m³ NIOSH recommended STEL

VENTILATION: Provide local exhaust or process enclosure ventilation system. Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Contact lenses should not be worn.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

Measurement Element:

Uranium (U)

At any detectable concentration -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Escape -

Any air-purifying respirator with a full facepiece and a high-efficiency particulate filter.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

[SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES](#)

PHYSICAL STATE: solid
COLOR: white, gray
ODOR: Not available
MOLECULAR WEIGHT: (238)
MOLECULAR FORMULA: U
BOILING POINT: 6904 F (3818 C)
MELTING POINT: 2070 F (1132 C)
VAPOR PRESSURE: Not applicable
VAPOR DENSITY: Not applicable
SPECIFIC GRAVITY (water=1): 19.0
WATER SOLUBILITY: insoluble
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: acetone, acids
Insoluble: alkali, alcohol

[SECTION 10 STABILITY AND REACTIVITY](#)

REACTIVITY: Finely divided material may ignite spontaneously. Closed containers may rupture violently. May react on contact with water.

CONDITIONS TO AVOID: Package design temperature is 800 C.

INCOMPATIBILITIES: oxidizing materials, halogens, metals, bases, halo carbons, acids

URANIUM:

CHLORINE: Violent reaction.

AIR: Violent reaction.

FLUORINE: Violent reaction.

NITRIC ACID: Reacts explosively or with the formation of an explosive surface

coating or residue.
NITROGEN OXIDE: Ignites.
DINITROGEN TETRAOXIDE: Explodes or forms an explosive surface coating or residue.
SELENIUM: Reacts violently or incandescens.
SULFUR: Reacts violently or incandescens.
WATER: Violent reaction hazard.
AMMONIA: Reacts violently or incandescens at dull red heat.
BROMIUM TRIFLUORIDE: Violent reaction.
TRICHLORO ETHYLENE: Violent reaction.
NITRYL FLUORIDE: Violent reaction or glowing or white incandescence.
CARBON DIOXIDE: At 750 C interaction is so rapid that ignition will occur with the finely divided metal, and at 500 C the massive metal will ignite.
CARBON TETRACHLORIDE: Use of a carbon tetrachloride fire extinguisher on a small uranium fire led to an explosion.
CHLORINE: Ignites at 150-180 C
BROMINE VAPOR: Ignites at 210-240 C
IODINE VAPOR: Ignites at 260 C
ACIDS: Reacts with liberation of hydrogen and formation of salts of tetravalent uranium.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: miscellaneous decomposition products

POLYMERIZATION: Will not polymerize.

[SECTION 11 TOXICOLOGICAL INFORMATION](#)

URANIUM:

TOXICITY DATA:

750 mg/kg unreported-rat LD50

CARCINOGEN STATUS: ACGIH: A1 -Confirmed Human Carcinogen (Soluble and insoluble compounds, as U)

ACUTE TOXICITY LEVEL: Insufficient Data.

TARGET ORGANS: kidneys

HEALTH EFFECTS:**INHALATION:****ACUTE EXPOSURE:**

URANIUM: Uranium may enter the body through inhalation of fine particles that are approximately 1 micron in diameter. Uranium poisoning is characterized by generalized health impairment. It may cause changes in the kidneys, liver, lungs, and cardiovascular, nervous, and hemopoietic systems, and disorders of protein and carbohydrate metabolism. Symptoms may include oliguria, hematuria, albuminuria, and jaundice.

RADIATION SICKNESS: Whole body doses of 100-200 rem may cause anorexia, nausea, vomiting, diarrhea, and reduction in leukocytes within a few hours. An asymptomatic period of 24-36 hours may be followed by lymphopenia and slowly developing neutropenia. Thrombocytopenia may become prominent within 3-4 weeks. Doses of 200-400 rem may cause hemorrhaging and hair loss. Damage to the lymph nodes, spleen, and bone marrow may occur. If bone marrow depression reaches a critical level, death may occur from overwhelming infection. Nausea, vomiting, and diarrhea leading to severe dehydration, vascular collapse, and death may also occur. Whole body doses of 400 or more rem may be fatal due to gastrointestinal or hematopoietic malfunction. With whole body absorption in the 400 rem range, 50-70% will die within 30 days. Exposure to 400-1000 rem will produce death in 60-95% of those exposed within 30 days. With doses greater than 1000 rem, nausea, vomiting, listlessness, prostration, tremors, convulsions, ataxia, and death are likely. Exposure to 1000-5000 rem produces death within 10 days in 100% of those exposed. Doses greater than 5000 rem may cause death within hours. The gonads are particularly sensitive to radiation. A single dose of 50 rem may produce temporary sterility in men. A dose 300-400 rem may result in permanent sterility among women.

ALPHA RADIATION: Alpha particle radiation is densely ionizing and energetic, but can travel only a few centimeters in air. It will kill cells immediately adjacent to the source of contact. Being relatively non-penetrating, the greatest threat from alpha emissions is through inhalation of either dust coated with the emitter or the emitter itself. Depending on the solubility and particle size of the specific radioactive compound, it may be absorbed directly into the bloodstream, irradiating the entire body as it continues to decay. Insoluble compounds and heavier particles usually remain at or near the site of deposition and may be brought back up the throat via ciliary action and consequently swallowed. Lighter particles may penetrate deeply into the alveolar sacs and remain in contact with lung tissue. Cellular damage depends on susceptibility of tissue, the dose, and the speed at which it was delivered. A single large dose may lead to radiation sickness.

CHRONIC EXPOSURE:

URANIUM: Workers exposed to high average levels of uranium dust in a plant at oak ridge have not had increased mortality rates from lung cancer, leukemia, bone cancer, or diseases of the respiratory and genitourinary systems. Lung cancer in uranium miners is probably the result of inhalation of radon daughters found in these mines. Chronic poisoning gives chest findings of pneumoconiosis, pronounced blood changes and generalized injury. Cancer of lymphatic and blood forming tissues

may result. See the following sections regarding the effects of inhalation of an alpha emitter, and radiation sickness.

RADIATION SICKNESS: Delayed effects of radiation may be due either to a single large overexposure or cumulative low-level exposure and may include various cancers, genetic effects, and cataracts. Cancer is observed most frequently in the hematopoietic system, thyroid, bone, and skin. Lung cancer may occur due to inhalation of radioactive particulates which then remain in the lungs. Genetic effects may range from point mutations to severe chromosome damage such as strand breakage, translocations, and deletions. If the germ cells have been affected, the effects of the mutation may not become apparent until the next generation, or even later.

ALPHA RADIATION: The damaging effects of all types of radiation, including alpha particles, are cumulative. If enough exposure occurs over time, radiation sickness may occur.

SKIN CONTACT:

RADIATION SICKNESS: The clinical course of radiation sickness depends upon the dose, dose rate, area of the body affected, and time after exposure. External and internal radioactivity of any type may cause radiation sickness. Radiation sickness may cause effects consisting of three (3) clearly defined syndromes which are described in detail in the inhalation section.

ACUTE EXPOSURE:

URANIUM: There is no evidence that insoluble uranium compounds can be absorbed through the skin; insoluble salts produced no signs of poisoning after skin contact. Uranium may irritate the skin.

ALPHA RADIATION: Because it has little penetrating ability and can travel only a few centimeters in air, alpha particle radiation is not usually an external hazard. It will kill cells immediately adjacent to the source of contact, and local damage may occur at the site of a wound. Absorption or penetration through damaged skin may result in radiation sickness.

CHRONIC EXPOSURE:

URANIUM: Prolonged skin contact with insoluble uranium compounds should be avoided because of potential radiation damage to basal cells. Dermatitis has occurred as a result of handling some insoluble uranium compounds. See the following sections regarding alpha radiation and radiation sickness.

ALPHA RADIATION: The damaging effects of all types of radiation, including alpha particles, are cumulative. Sufficient exposure may lead to radiation sickness.

EYE CONTACT:

RADIATION SICKNESS: The eyes are very radiosensitive; a single dose of 100 rads may cause conjunctivitis and keratitis. It is unlikely that a dose sufficient to cause radiation sickness would occur if only the eyes were irradiated. However, if eye damage

by ionizing radiation occurs, it may be best to assume that other parts of the body have also been contaminated. Radiation sickness may cause effects as described in the inhalation section.

ACUTE EXPOSURE:

URANIUM: Dust may be irritating to the eyes. A variety of soluble and insoluble compounds of uranium were tested on the eyes of rabbits. The insoluble compounds caused the mildest degree of injury. The effects of eye contact with any uranium compound tend to be necrosis of the conjunctivae and eyelids, and ulceration of the cornea.

ALPHA RADIATION: Exposure of the eye to alpha particle emissions may result in corneal inflammation and conjunctivitis. A single exposure of 100 rem of alpha radiation may cause conjunctivitis and keratitis, inducing cataract formation later. Cataract formation may begin anywhere from six months to several years post-exposure, although growth of the opacity may stop at any point. The rate of growth and the degree of opacity are dose dependent.

CHRONIC EXPOSURE:

URANIUM: Prolonged exposure to uranium may produce conjunctivitis, or the symptoms of radiation injury, such as cataracts. See the following sections regarding the effects of alpha radiation on the eyes, and radiation sickness.

ALPHA RADIATION: Repeated or prolonged exposure to alpha particle radiation may result in cataract formation as described above. Of the well-documented late effects of radiation on man, leukemia and cataracts have been observed at doses lower than those producing skin scarring, cancer, or bone tumors.

INGESTION:

RADIATION SICKNESS: The symptoms of radiation sickness depends upon the dose received. It may result from acute or chronic exposure to any form of radiation. The symptoms are described in the inhalation section.

FIRST AID FOR URANIUM COMPOUNDS: Although chelating agents act on uranium, they should not be used because the increased migrant fraction leads through renal precipitation to a greater kidney burden than would be received if there were no treatment at all; there is thus the risk of serious toxic nephritis. The basic treatment should be administration of a bicarbonated solution given locally and in intravenous perfusion (one bottle of 250 ml at 1.4 %). From IAEA safety series # 47 - manual on early medical treatment of possible radiation injury - 1978. Pg. 28.

ACUTE EXPOSURE:

URANIUM: Feeding studies on animals indicate that insoluble uranium is much less toxic than soluble uranium compounds. Uranium entering the bloodstream will become stored in the bone marrow, but the majority will become lodged in the kidney, which is the major site of toxicity. More than a year and a half is required to rid the body of an accidental high dose of uranium, after which time measurable uranium is present in the bone and kidney.

ALPHA RADIATION: Ingestion often occurs through ciliary action on inhaled particulates. Depending on the solubility and particle size of the radioactive compound, alpha particles may be absorbed directly into the bloodstream. As they continue to decay, whole body irradiation may occur. If the exposure is sufficient, radiation sickness may occur.

CHRONIC EXPOSURE:

URANIUM: The toxic action of uranium resides more in its chemical action on the renal tubules, rather than radiation effects. Rats injected with uranium metal in the femoral marrow developed sarcomas, whether this was due to metalocarcinogenic or radiocarcinogenic cation could not be determined. See the following sections regarding ingestion of alpha emitters, and radiation sickness. Also see the first aid section for uranium compounds.

ALPHA RADIATION: The damaging effects of all types of radiation, including alpha particles, are cumulative. Effects as described in acute ingestion may appear if enough exposure occurs over time. See also radiation sickness.

[SECTION 12 ECOLOGICAL INFORMATION](#)

Not available

[SECTION 13 DISPOSAL CONSIDERATIONS](#)

Dispose in accordance with all applicable regulations.

[SECTION 14 TRANSPORT INFORMATION](#)

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Uranium metal, pyrophoric

ID NUMBER: UN2979

HAZARD CLASS OR DIVISION: 7

LABELING REQUIREMENTS: 7; 4.2



CANADIAN TRANSPORTATION OF DANGEROUS GOODS: No classification assigned.

LAND TRANSPORT ADR: No classification assigned.

LAND TRANSPORT RID: No classification assigned.

AIR TRANSPORT IATA: No classification assigned.

AIR TRANSPORT ICAO: No classification assigned.

MARITIME TRANSPORT IMDG: No classification assigned.

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65): Not regulated.

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:

EC CLASSIFICATION (ASSIGNED):

T+	Very Toxic
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EC Classification may be inconsistent with independently-researched data.

DANGER/HAZARD SYMBOL:



T+

EC RISK AND SAFETY PHRASES:

R 26/28	Very toxic by inhalation and if swallowed.
R 33	Danger of cumulative effects.
R 53	May cause long-term adverse effects in the aquatic environment.
S 1/2	Keep locked-up and out of reach of children.
S 20/21	When using, do not eat, drink or smoke.
S 45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 61	Avoid release to the environment. Refer to special instructions/Safety data sheets.

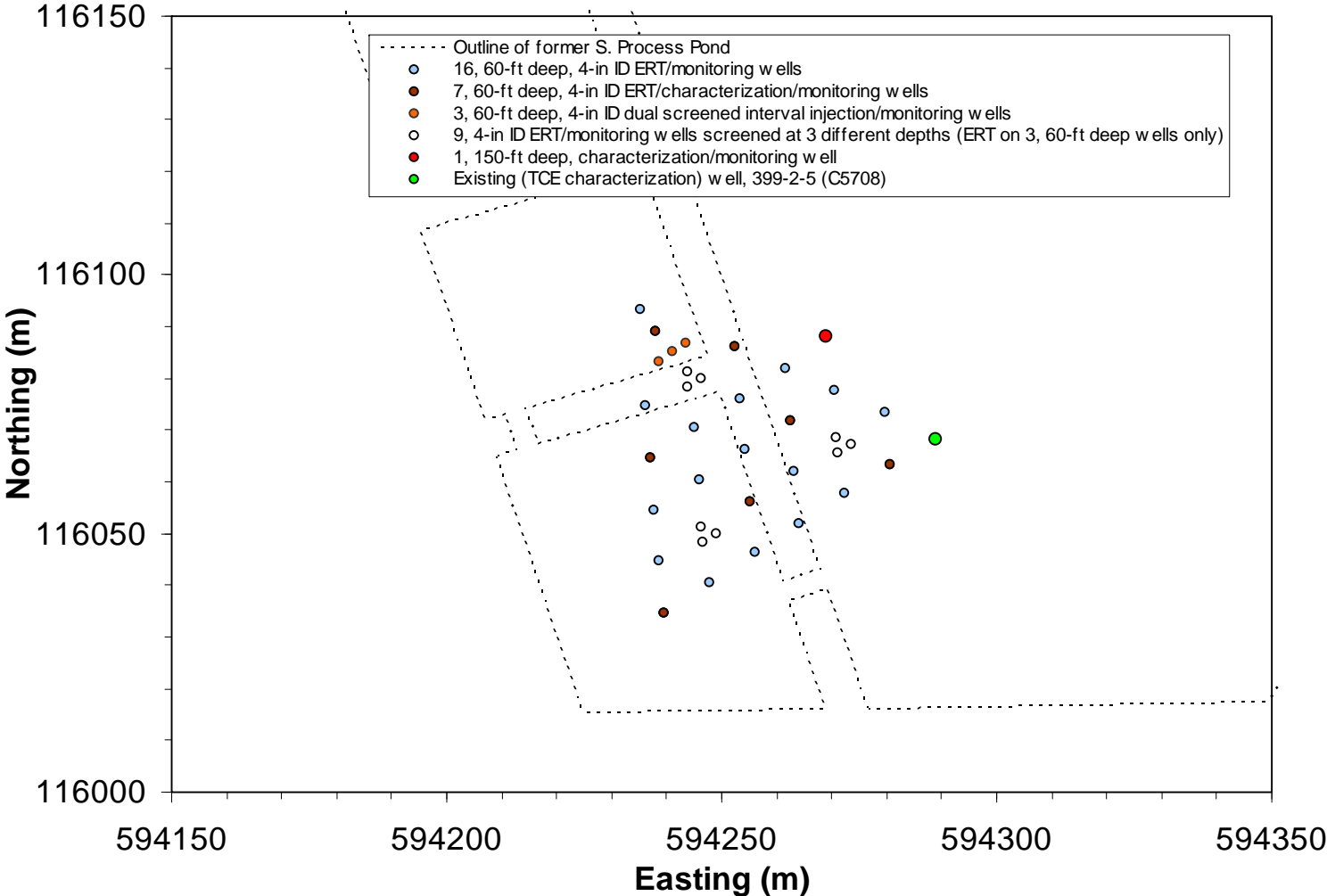
NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

Attachment B: Site Plan

Planned Layout of Hanford 300 Area IFC Well Array



Attachment C: Emergency Phone Numbers

Emergency Contacts and Phone Numbers

Organization	Contact	Phone Number
PNNL Single Point Contact	For all incidents, injuries, chemical spills, etc.	375-2400
Local Medical Emergency Facility (AMH)	1979 Snyder Street Richland, WA 99354	376-3333
Field Team Leader/Site Safety Officer	Vince Vermeul	371-7170 or 438-6545
Field Site Manager	Mark Freshley	372-6094 or 438-4875

Local Medical Emergency Facility(s)

Name of Hospital: Southwest Washington Medical Center

Address: Kadlec Hospital, 888 Swift Blvd, Richland, WA

946-4611

Route to AdvanceMed Hanford



AdvanceMed Hanford
Occupational Health Services



Located in the Evergreen Office Buildings, off of Stevens Dr

As you enter the West entrance exams are to your right
Behavioral Health Services are down the left hallway on the left.
Health Education and Physical Performance – Enter through the North entrance

