Idaho Operations Office
Technology Needs

Spent Nuclear Fuel (SNF) Program

Detect and Mitigate Microbiologically Induced Corrosion in Dry Storage Containers (ID-1.1.02)

There is a need to develop technology to remotely detect microbiologically induced corrosion and if present, mitigate its effects on metal clad or canned SNF to prevent degradation of cans or spent nuclear fuel in dry sealed storage. This technology is needed for both existing spent nuclear fuel and the foreign research reactor spent nuclear fuel that will be received at the Idaho National Engineering and Environmental Laboratory (INEEL).

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Detect Interactions Between SNF Materials & Storage Containers (ID-1.1.05)

The SNF at INEEL (currently stored underwater as bare fuel elements or in storage cans) will be moved to dry storage. If the SNF is not sufficiently dry before placement of the SNF into dry storage, the damp corrosion product and sludge material can slough off the fuel element and come into contact with the fuel storage container. Material interactions between heavily corroded SNF and the storage container must be understood and if need be, mitigated, in order to ensure the safe long term sealed dry storage and transfer of highly corroded spent nuclear fuel.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Detect Moisture Remaining Within a Complex Geometry Fuel Element (ID-1.1.07)

The SNF at INEEL (currently stored underwater as bare fuel elements or in storage cans) will be moved to dry storage. Develop the capability to detect moisture levels with a complex geometry fuel element before placement in dry storage to prevent the corrosion of the SNF and the degradation of the sealed dry storage container from the inside out.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Small Standardized Primary Container of Degraded SNF (ID-1.1.08)

Development of a small, standardized primary container is needed for the confinement of corroded, disrupted, and crumbled spent nuclear fuel prior to placement into a dual purpose container for long-term sealed, dry storage and transportation.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Dry Physically Entrained Water in SNF (ID-1.1.11)

There is a need to develop a process that consistently dries corroded spent nuclear fuel elements without damaging the spent fuel. In order to move the spent nuclear fuel into sealed dry storage, the SNF elements must be dried to remove moisture to prevent continued corrosion in the sealed dry storage and the degradation of the sealed dry storage container from the inside out.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Non-Destructive Assay (NDA) Methods for SNF Using Gamma Neutron (ID-1.1.09)

There is a need to develop non-destructive assay methods for SNF in order to determine both qualitatively and quantitatively the radioisotopic inventory in the SNF. Required in order to comply with NRC, DOT, and IAEA requirements and to qualify spent nuclear fuel for repository acceptance. To be effective, the system must be able to characterize, non-destructively, the fissile material content, as well as the source term and burn up, of spent fuel with a wide range of geometries, dimensions, enrichment, burn up, and chemical composition. System calibration requirements cannot be sensitive to such factors as size, geometry, enrichment or composition.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Non-Destructively Determine Fissile Material Content of SNF (ID-1.1.10)

There is a need to develop a system to non-destructively assay spent nuclear fuel to determine the fissile material content of the spent nuclear fuel. Required in order to comply with NRC, DOT, and IAEA requirements and to qualify spent nuclear fuel for repository acceptance. To be effective, the system must be able to characterize, non-destructively, the fissile material content, as well as the source term and burn up, of spent fuel with a wide range of geometries, dimensions, enrichment, burn up, and chemical composition. System calibration requirements cannot be sensitive to such factors as size, geometry, enrichment or composition.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

SNF End-of-Life Values & Burn-up (ID-1.1.12)

A computer code needs to be developed that can take specific results from non-destructive assay efforts and use the information to calculate end-of-life isotopic concentrations and burn up information for spent nuclear fuel. This information is required for validation of calculations for NRC licensing and repository acceptance.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Dry Physically Entrained Water in Crushed or Rubblized SNF (ID-1.1.15)

Technology needs to be developed to safely dry physically entrained water in crushed or crumbled (material that has been deformed, melted, crushed, or otherwise had its physical dimension changed) spent nuclear fuel elements to prevent unknown/uncontrolled amounts of water from entering the dry storage environment. Need to be able to dry high surface area spent nuclear fuel material such as sludge material (fine UO_2 particulate suspended in water). The technology must be able to dry the material without causing a loss of material into the surrounding hot cells and off-gas systems due to entrainment in the off-gas stream.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Develop Technology to Measure Integrity of Dry Storage Canisters (ID-1.2.06)

Technology needs to be developed to examine the contents of dry storage canisters to assure safe conditions exist for long-term storage of spent nuclear fuel. The technology must be able to determine the deterioration of the canisters (currently in dry storage) either in situ or with minimal handling requirements. The technology will be used to determine the deterioration of stainless steel, aluminum, or other canning material to meet the repository acceptance criteria and achieve criticality safety.

Contact: Claude Kimball @ 208-526-3695 or Brandt Meagher @ 208-526-9767

Mechanically Dry Carbon/Graphite SNF (ID-1.1.16)

A system needs to be developed for mechanically drying carbon containing and graphite containing spent nuclear fuel. The carbon and graphite containing SNF is currently stored in underground storage vaults that have had water intrusion. Before this spent fuel type can be safely placed into sealed dry storage, the carbon/graphite material must be dried to prevent the buildup of flammable gases in a sealed storage system. If not this spent fuel type is not dried concentration of gas to be generated and then movement of the storage canister could cause detonation of the flammable gas causing a rupture of the storage canister and a release to the environment.

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High-Level Waste Program

Reduction in Liquid HLW (ID-2.1.01)

Technology development is needed to reduce the amount of radioactive liquid waste that is generated through ICPP activities. The ICPP generates radioactive liquid waste which is routed to the tank farm from a number of sources, including: (1)Decontamination of operating equipment for maintenance, (2) Decontamination of deactivated facilities, (3) Storm water collection in radiation areas, (4) Operation of Calcination and Off-gas Cleanup facilities, and (5) Operation of Fuel Storage Facilities. The liquid waste ranges from slightly contaminated water to highly radioactive waste containing many hazardous components. Current technologies used are chemical cleaning, CO_2 pellet blasting, liquid abrasive blasting, mechanical scabbling, strippable coatings. Application specific development is needed on systems such as laser ablation and ultra high liquid nitrogen. Much of this waste contains high sodium or potassium levels which create solutions requiring dilution with cold chemicals to allow calcination thus increasing final waste volumes.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Method to Separate Undissolved Solids from Sodium-Bearing Waste & Dissolved Calcine (ID-2.1.04)

Technologies to remove undissolved solids from tank waste and dissolved calcine need to be developed. The solids must be removed to ensure the separation processes can achieve NRC Class A LLW criteria.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Dissolution of Future Calcines (ID-2.1.05)

Technologies to dissolve calcine need to be developed. The calcine must be dissolved to put it in a form readily amenable to aqueous separation technologies. Calcine must be dissolved to put it in a form that is compatible with radionuclide separation technologies. Parameters affecting dissolution efficiency must be defined and scale-up and design of a calcine dissolver must be completed.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Solvent Extraction & Ion-Exchange to Remove TRU, Sr, Tc & Cs from Liquid HLW (ID-2.1.06)

There is a need for removal of TRU, Sr, and Cs from tank waste and dissolved calcine. Solvent extraction and ion-exchange technologies must be demonstrated on actual INEEL radioactive waste streams to ensure full-scale processes will adequately recover the active constituents to convert the bulk of the waste to LLW, TRUs, Cs and Sr comprise less than one percent of the total INEEL radioactive waste volume. If these elements can be removed from the bulk (inert) elements in the waste, a significant reduction in the volume of HLW would be realized.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Immobilize ICPP Low-Activity Wastes (ID-2.1.07)

Technology needs to be developed for grouting the low-level waste (LLW) generated at ICPP. These wastes include the LLW from separations operations, facility decontamination solutions, and low-level process equipment wastes. LLW from the separation of high activity wastes will be acidic and high in nitrates. Both of these are detrimental to grout chemistry; thus, basic research is needed to develop grout formulations that will solidify and stabilize these wastes. Annually, about 100,000 to 150,000 gallons of liquid waste are added to the tank farm inventory from decontamination and process equipment wastes, much of which could be grouted. Grout formulations and qualified waste forms are also needed for these waste streams.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Remove & Transport Calcine (ID-2.1.09)

Development is needed of an efficient system for retrieving radioactive calcine from storage bins and transferring it to a future calcine treatment facility. Retrieval must be performed remotely, due to the high radiation fields generated by the calcine. Calcine retrieval development is needed to support operation of a full scale treatment facility.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Characterize & Remove RCRA Listed Wastes from High & Low Activity Fractions (ID-2.1.11)

Solvent extraction and ion-exchange technologies need to be developed to remove RCRA metals from the high and low activity tank waste and dissolved calcine. RCRA metals have BDAT treatment technologies specified. In order to meet the BDAT treatment requirements, and to produce high and low activity waste fractions that will not be classified as mixed waste, RCRA metals must be separated from the radioactive wastes.

Contact: Diane Croson @ 208-526-3402 or Brandt Meagher @ 208-526-9767

Waste Management Program

Development of Waste Form Standards (ID-3.1.14)

Development is needed of final waste form performance standards, a performance model, and data to qualify proposed treatment technology, address potential licensing and permitting issues, and to prove treated product performance characteristics to support treated waste handling system improvements and outyear planning (storage, shipment, disposal, etc.).

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Mobile Waste Container Assay, Characterization, Venting and Gas Analysis Equipment (ID-3.1.26)

There is a need for development of a mobile system for assay and characterization. This system must include venting and gas sampling/analysis equipment to characterize waste boxes/containers/drums in the field. The configuration should be flexible to allow access to vaults and similar hard-to-reach areas at various sites. The system must be able to obtain sufficient data for shipment of waste to treatment centers.

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Develop Disposal Processes for Site Specific Disposal Problem LLW (ID-5.1.01)

Technology development may be required for processing Site Specific Disposal Problem Low-Level Wastes (SSDP LLW) so that they will meet the INEEL site specific disposal requirements (SDR) or the WAC for processing by another EM product area. Waste descriptions are presented in the INEEL report 94/0065 Rev. 1. System engineering studies are initially needed.

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Develop Real-Time RCRA Analysis Methods (ID-3.2.12)

There is a need to develop real-time, in-line analytical capabilities to more rapidly and cost effectively perform RCRA analysis (VOCs, SVOCs, metals, PCBs) on sampled sludge waste in accordance with quality assurance program plan requirements. Build on exisiting efforts employing x-ray diffraction, and additional possible methods include fiber optics and laser spectroscopy.

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Develop Non-Intrusive RCRA Analysis of Drums (ID-3.2.13)

There is an opportunity to develop an improved non-intrusive RCRA analysis method for VOCs, SVO-Cs, metals, and PCBs in debris waste.

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Develop In Situ Hydrogen and VOC Reduction in Waste Drums (ID-3.2.23)

There is an opportunity to develop an in situ hydrogen and VOC filter or catalytic filter to ensure relief from the limit on the shipment of untreated waste drums.

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Develop Improved Method to Remove NOx and SOx from Thermal Process Offgas *(ID-3.2.33)*

There is an opportunity to develop a polishing capability to remove dioxins, Hg, toxic metals, NOx, SOx and hazardous hydrocarbons from offgas at low temperatures.

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Develop Thermal Treatment Unit Offgas CEM Monitors (ID-3.2.32)

There is an opportunity to develop continuous emission monitor (CEM) systems foro offgases, toxic metals, dioxins, radionuclides, and thermal treat-ment processes. CEM performance must exceed anticipated EPA contaminant emission standards.

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Develop Advanced Air Pollution Control Methods for Thermal Treatment Units (ID-3.2.15)

There is an opportunity to develop advanced air pollution control methods that improve control of emissions (e.g., volatilized metals, radionuclides, dioxins, particulates, acid gases) below future potential limits and achieve ALARA. High temperature thermal treatment processing most likely system.

Contact: Lynn Ball @ 208-526-1429 or Brandt Meagher @ 208-526-9767

Develop a Rapid Wood Radiological Contamination Monitor (ID-4.2.02)

There is an opportunity to develop technology that can quickly determine the level and type radioactive contamination in cracks and crevices on large pieces of wood so that uncontaminated pieces can be separated and not require disposal of in an LLW disposal facility.

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Environmental Restoration Program

In Situ Debris Characterization for Partial Retrieval (ID-6.1.01)

A technology, or combination of technologies, that would allow locating specific high-risk COCs in buried waste is needed so that site-specific risk drivers could be located and removed with the minimum volume of secondary, i.e., uncontaminated, waste. Such a system would substantially decrease the overall cost of remediation (currently estimated at $1.5 B), allow timely completion of remediation, and significantly reduce worker exposure by reducing the amount of contamination to which workers would be exposed. Currently, there are no off-the-shelf systems that meet the functional performance requirements. The technology or system supplied shall be able to detect and locate debris that is contaminated with one or more of the following contaminants: actinides (especially Pu, U, and Am), VOCs, C-14, Tc-99, Sr-90, Cr, Hg, Nitrates, or Ni-59. The contamination detection technology or system shall be integrated with the waste debris removal system that is not yet designed. The technology or system will be able to detect and locate the aforementioned contaminant(s) within buried debris prior to removal or disturbance of the debris; the debris is currently buried at a maximum depth of 20 ft, including soil overburden. The technology or system supplied must be capable of operating in all environmental conditions at the INEEL including: temperatures ranging from -40F to 110F, wind speeds to 60 mph and an arid environment that has, on occasion, experienced rainfalls of up to 1 inch per hour during thunderstorms. The technology or system must operate for continuous operation, 7 days/week, 52 weeks/year, for the duration of the remediation (anticipated to be 10 to 15 years); use of replacement units is acceptable as long as the downtime associated with installing the replacement unit does not significantly detract from remediation efforts, overall project cost, schedule, or worker exposure.

Contact: Barbara Broomfield @ 208-526-3528 or Brandt Meagher @ 208-526-9767

Real-time field Instrumentation for Characterization for Radioactive and Metal Contaminated Soils (ID-6.1.02)

Real-time field instrumentation for characterization, excavation control, and cleanup verification of radionuclide and metal contaminated soil. Radioactively contaminated soils are distributed across many sites at the INEEL and include typical fission products. The INEEL envisions retrieving most of these soils and placing them in a repository. It is important to retrieve only those soils above risk based levels. A rapid and accurate monitoring device is needed to identify the extent of contaminated soils, to verify that only risk free soils remain after retrieval, and that soils going to the repository meet regulatory limits. Instrumentation must (1) be field useable, (2) must reliably quantify (within 1 pCi/g) Cs-137 at 16 pCi/g, Sr-90 at 60 pCi/g, Co-60 at 1.8E+5 pCi/g, and Eu-152 at 140 pCi/g, and (3) quantify metals at TCLP levels. Analyses must be completed within 15 minutes. The instrumentation must be rugged and useable in a retrieval situation.

Contact: Barbara Broomfield @ 208-526-3528 or Brandt Meagher @ 208-526-9767

In Situ Treatment of TCE Contaminated Groundwater in Deep Fractured Rock (ID-6.1.04)

Development of an in-situ method for treating VOC contaminated groundwater is needed. The groundwater is contained in fractured basalt and is contaminated with volatile organic compounds including trichloroethene (TCE), dichloroethene (DCE), and perchloroethene (PCE). Pumping and ex situ treatment technologies are currently being used for remediation. It is anticipated that an in situ technology will reduce overall remediation cost and schedule while remaining compliant with the maximum contaminant levels. The in situ treatment system shall be functional in fractured basalt at the INEEL at depths ranging from 200 to 400 feet below land surface. The system shall reduce the current concentrations of the contaminants from a maximum of 200 mg/L to the Maximum Contaminant Levels (MCLs). The treatment system shall be primarily passive in nature (requiring minimal maintenance) between the years 2025 and 2095; during the passive phase of the remediation, MCL achievement may be facilitated by natural attenuation through advection and dispersion of the contaminant plume. Any material added to the groundwater by the in situ treatment method must also meet MCLs by the year 2095. The treatment system shall minimize the generation of secondary waste streams. Secondary waste streams must meet Land Disposal Restrictions and the Universal Treatment Standards.

Contact: Barbara Broomfield @ 208-526-3528 or Brandt Meagher @ 208-526-9767

In Situ Treatment of TNT/RDX Contaminated Soil (ID-6.1.18)

A method for the in situ degradation or remediation of TNT/RDX and other explosives is needed. Large fragments have already been retrieved but erosion and degradation products still remain in the soil surrounding and beneath former locations of large fragments. Small chunks of explosive are a particular problem. Technology exists for retrieval and degradation in a reactor or by composting, but chunks are the problem. Method for in situ treatment, possibly biological, is needed. The method must work in situ so that we can protect the fragile desert environment from retrieval of contaminated soil and be able to deal with small chunks of material in the 1 to 3 inch diameter range.

Contact: Barbara Broomfield @ 208-526-3528 or Brandt Meagher @ 208-526-9767

Characterization of Cs, Sr, and Co in Contaminated Soils (ID-6.2.08)

There is a need for characterization of the chemical and physical manner in which Cs, Sr, and Co and associated (bound) with soil particles. Determine if there is an exploitable characteristic and develop treatment technology (possibly portable) as appropriate. Characterization must yield information on the mechanism for binding Cs, Sr, and Co in INEEL soils that can lead to an innovative treatment method. Useful information could include; determining which minerals are associated with which contaminants, determining if a chemical bond or an electrostatic attraction holds the contaminants, and determining where on soil particles the mineral/contaminant exists. Cs, Sr, and Co in some soils are very tightly bound and have proven almost impossible to remove from soil particles except by complete particle dissolution. Although there is some belief that contaminants have migrated into the mineral structure of soil particles, it is more probable that contaminants are bound to minerals in some very tight manner. The characterization will understand the manner in which the contaminants are bound.

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In Situ Immobilization of Radionuclides in Groundwater (ID-6.2.11)

Onsite groundwater is contaminated with various radionuclides, principally Cs-137, and Sr-90 with, lower concentrations of U, Pu, and Co-60. Under the 100 year future residential intrusion scenario, these contaminants may pose an unacceptable risk to residents. Removal of these radionuclides from the water is very expensive and technically challenging (see also ID-6.1.09). A method or system is needed that could immobilize the radionuclides in the groundwater using in situ methods. The method or system used must treat the contaminants in situ; pumping and treating the contaminants is not the focus of this need statement. The method or system must treat water that is highly contaminated with Cs and Sr; Cs-137 and Sr-90. Concentrations at the TAN TSF-05 injection well have been observed as high as 92,600 and 16,800 pCi/L respectively. The method or system developed must enable the radionuclide concentrations projected in 100 years to be compliant with the EPA Maximum Contaminant Levels (MCL). Any additional substance added to the groundwater must also meet MCLs in 100 years. The treatment system shall minimize the generation of secondary waste streams; any secondary waste streams generated must meet Land Disposal Restrictions and the Universal Treatment Standards. The in situ treatment system shall be functional in fractured basalt at the INEEL at depths ranging from 200 to 400 feet below land surface. The in situ treatment shall immobilize Cs-137, Sr-90, U, Pu, and Co-60.

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Ex Situ treatment of Ca/Mg rich groundwater contaminated with radionuclides (ID-6.2.09)

An ex situ method for treating groundwater that is naturally rich in calcium and magnesium to remove the radioactive contaminants Sr-90, Cs-137, Co-60, U, and Tc-99 needs to be developed. Currently used treatment methods employ ion exchange resins, however the naturally present Ca and Mg ions are of similar valence states as the radionuclides to be removed; this competition for ion exchange sites results in very low radionuclide removal efficiencies and high secondary waste generation. An alternative radionuclide removal technology is needed to: a) reduce overall remediation cost, b) reduce secondary waste generation, c) ensure compliance with the maximum contaminant levels. The ex situ groundwater treatment system for radionuclides shall treat groundwater contaminated with Cs-137, Sr-90, Co-60, U, Pu and Tc-99. The method or system must treat water that is highly contaminated with Cs and Sr; Cs-137 and Sr-90 concentrations at the TAN TSF-05 injection well have been observed as high as 92,600 and 16,800 pCi/L respectively. The treated water from the method or system developed must have radionuclide contaminants that are compliant with the EPA Maximum Contaminant Levels (MCL). Any additional substance added to the water must also meet MCLs. The treatment system shall minimize the generation of secondary waste streams; any secondary waste streams generated must meet Land Disposal Restrictions and the Universal Treatment Standards. The treatment technologies must be successfully demonstrated prior to March 31, 1998 in order to support a key OU 1-07B project decision point that is currently scheduled for October 1, 1998; at that key decision point, either the baseline technology (continued pumping and treating with reinjection of radionuclide contaminated water) or the alternate technology will be chosen and operated for a maximum of 30 years.

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Increasing efficiency of Vapor Vacuum Extraction (ID-6.2.16)

he current Vapor Vacuum Extraction (VVE) system deployed at INEEL's Radioactive Waste Management Complex (RWMC) is designed to prevent the organic contaminants known to be present in the vadose zone from migrating to the Snake River Plain Aquifer (SRPA). The duration of remediation is limited by the diffusion rate of the contaminants in the vadose zone and is projected to last another four to six years. A system or method is needed to increase the effective diffusion rate of the organic contaminants in the vadose zone, thereby shortening the remediation duration resulting in a corresponding cost savings.

The system must decrease the effective diffusion rate for the following organic contaminants: CCl_4, TCE, PCE, 1,1,1-TCA, and chloroform. Any chemical or material additions to the vadose zone must be shown by modeling or other demonstration data to not further degrade the SRPA. The treatment system employed shall minimize the generation of secondary waste streams; any secondary waste streams generated must meet Land Disposal Restrictions and the Universal Treatment Standards. The technology or system supplied must be capable of operating in all environmental conditions such as: temperatures ranging from -40F to 110F, wind speeds to 60 mph and an arid environment that may experience rainfalls of up to 1 inch per hour during thunderstorms.

Contact: Barbara Broomfield @ 208-526-3528 or Brandt Meagher @ 208-526-9767

Method for Determining the Human Health Toxicity of Contaminants for Which no Toxicity Data Exists (ID-6.2.20)

Information is needed to more completely assess exposures of receptors to radioactive and nonradioactive contaminants at a site in an arid environment. This may include, but is not limited to, actual measurements of fugitive dust released from soils at sites, food crop uptake factors in alkaline soils, sorption coefficients, effects on dose-response from exposure to mixtures of contaminants (both various nonradionuclides and nonradionuclide and radionuclide), identification of representative species for developing toxicity reference values for ecological receptors at an arid environment, development of short-term toxicity values to be used to evaluate worker risk remedial actions.

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Uncertainty in Dose Response Relationships for Contaminants of Concern (ID-6.2.21)

Currently, risk assessments use conservative assumptions to ensure that the point estimate given in the baseline risk assessment is protective of human health. The amount of conservatism is currently unknown. One of the largest sources of uncertainty, and hence one of the potentially most conservative assumptions, in a risk assessment is the dose response relationship. Monte Carlo methods can be used to quantify the uncertainty in the risk assessment and provide the risk managers with much needed information on what the potential range of risk is. For a potentially multi-billion dollar remediation, such as WAG-7, knowing the risk distribution could save billions by not requiring cleanup to overly conservative levels. The methodology used must account for the uncertainty in the extrapolation factors (e.g. high dose to low dose, animal data to human data) as well as the experimental data used to derive the final toxicity information. The dose-response distributions for the priority contaminants (C-14, Tc-99, Sr-90, Cs-137 and Carbon tetrachloride) are required.

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Decontamination and Decommissioning Program

Concrete Decontamination (ID-7.2.03)

Traditional concrete decontamination has involved scabbling and/or jackhammers, development of new or significantly improved techniques is desired. Contaminated concrete exists in many forms, geometries, and degrees and types of contamination. Therefore a wide variety of functional requirements apply. For large contaminated surface areas it is generally desirable to uniformly remove 1/8 to 1/4 inch of concrete from the surface in an economical and safe manner. Other situations require the removal of large amounts of concrete, typically up to two inches. In general, this application will require a different type of technology than the removal of shallow layers. Yet another concrete decontamination requirement involves the removal of contaminants and/or concrete from cracks, seams, and fissures. In general, the removal of contamination associated with these features involves depths up to 10 inches. For all of these applications decontamination must be complete so that the remaining concrete can be released for unrestricted use. An immediate need exists and continues through at least the year 2010.

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Metal Decontamination (ID-7.2.04)

There is an opportunity to develop new or significantly improved decontamination techniques for stainless steel, iron, various types of structural steel, and galvanized siding. The desire is to be able to decontaminate this piping either while it is part of an operating system, or after it has been segmented and removed. The goal is to decontaminate the piping to the point where it can be released for unrestricted use or disposed of as non-radioactive waste. Partial or incomplete decontamination is not acceptable because secondary waste streams are usually generated in the process, and the piping material still has to be disposed of as radioactive waste. The decontamination process must be cost effective and not generate large quantities of secondary waste. Stainless steel and iron piping having various wall thickness', diameters ranging from one inch to 24 inches, and lengths from one to seven feet are typically generated during decommissioning of INEEL contaminated facilities. These pipes are contaminated with a variety of radioactive isotopes but the primary ones are isotopes of Cobalt, Cesium, and Strontium. Isotopes of other elements such as Europium, Silver, Uranium, and sometimes Plutonium are encountered in these pipes but usually at very much lower levels than those of Cobalt and Cesium. Radiation levels inside the piping is usually a result of plateout of system crud and has not penetrated the metal any significant amount. Radiation fields within the pipes range from a few mR/hr to several R/hr. Although the need for this metal decontamination process exists now, large amounts of piping decontamination will not be needed at the INEEL until decommissioning of the Engineering Test Reactor starts in FY-1999.

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Waste Recycle (ID-7.2.05)

There is an opportunity to recycle or reuse materials from facility decommissioning would result in significant reductions in the volume of waste requiring disposal. Many wastes are generated in the process of decommissioning a contaminated nuclear facility. Typically, large amounts of concrete, steel, soil, construction materials (i.e., roofing, asphalt, asbestos, lumber, tile, siding, and sometimes electronic equipment) are encountered as waste. To develop the technologies and processes necessary to permit the recycle or reuse of at least 70% of the wastes generated by typical D&D projects. The basic types of wastes considered are concrete, steel, soil, and various building materials. This capability is needed immediately but will become extremely important by the time large structures such as the ETR and MTR facilities are decommissioned starting in FY-1999.

Contact: Richard Messervey @ 208-526-1834 or Brandt Meagher @ 208-526-9767

Remote Demolition (ID-7.2.07)

There is an opportunity to improve methods of remote demolition to accomplish fast, cost effective ways of dismantling metal structures, piping, machinery, and concrete structures. The goal is to reduce the requirement for hands-on dismantlement by decontamination and decommissioning (D&D) workers while reducing the cost of such operations. Must be able to work effectively with ten inch "I" beams, machinery of various sizes, and with concrete up to several feet in thickness.

Contact: Richard Messervey @ 208-526-1834 or Brandt Meagher @ 208-526-9767

Remote Characterization (ID-7.2.06)

There is an opportunity to develop several technology improvements in the area of remote characterization and surveying. Including improved means to obtain samples remotely from difficult-to-access places such as underground tanks and piping systems, and in areas having high radiation (fields of 1mr/h to a few thousand R/h) or other hazardous situations. Characterization devices must be able to enter openings having diameters as small as six inches and extend as much as 40 feet into the regions to be characterized. Real time video images of the area being characterized should be provided. The capability of collecting small sold and liquid samples (from a few cubic centimeters to a few hundred cubic centimeters) should be provided. Isotopes encountered will be standard fission products, i.e. Co, Cs, Sr, etc. and also isotopes of uranium and plutonium. There is also a great need to remotely examine and characterize the interiors of pipes, and to provide positive identification of the routes of piping which is buried underground or under the floors of buildings. Piping having diameters as small as one inch will be encountered and it may be filled with liquid. Tracing of the location of this piping may be necessary for distances of up to a few hundred feet. The piping may be buried to depths of 10 feet. This technology is needed immediately.

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Robotics for D & D (ID-7.2.08)

Robotic technology capable of utilizing multiple end effectors to perform universal work tasks in high radiation areas is needed. Two basic types of robotic technologies are required to assist with D&D operations work. The first must be relatively small and mobile and be capable of performing light duty tasks associated with the inspection and characterization of facilities. End effectors having a maximum weight of 50 pounds will be used to photograph, probe, collect samples, perform radiation and other surveys, and move light objects. The arm to which the various end effectors will be attached should extend 20 feet from the base unit. The base unit itself can be either stationary or mobile. If it is stationary it should be easy to relocate using other robotic equipment. The entire unit should be constructed such that the end effectors are easy to interchange. In addition, the entire unit must be constructed for ease of decontamination following its use in contaminated areas. It should operate continuously in radiation fields of up to 1000 R/h, and at temperatures of up to 110º F. If a tethered design is used arrangements must be provided for ease in decontaminating the tethering cables and to reduce self entanglement during operation. The second type of robotic technology required is for the remote demolition of massive facilities. It is thus required to be of a much more robust construction and capable of handling much heavier end effectors and lifting load. End effectors of up to 1000 pounds will be used with the device and it must be capable of lifting weights of up to 4000 pounds. Reach, radiation, temperature environments, tether and decontamination requirements are similar to those of the previous robotic device. These devices should be ready to deploy in April 1998.

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