APPENDIX A

DETAILED DESCRIPTION OF THE PROPOSED ACTION

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1.0 DETAILED DESCRIPTION OF THE PROPOSED ACTION

1.1 General Description of an FRC

As designed, an acceptable Field Research Center (FRC) would consist of a contaminated area and a background area, laboratory/analytical facilities, and office space/trailers. The FRC would be of sufficient size to accommodate multi-investigator studies over the ten-year lifespan of the Natural and Accelerated Bioremediation Research (NABIR) Program. To the maximum extent possible, the program would use existing office, laboratory, and field facilities, including access and infrastructure support, to reduce costs and environmental impacts, to make efficient use of existing Department of Energy (DOE) facilities and infrastructure, and to reduce the need for new construction.

The Field Research Center would consist of a contaminated area and a background area. Within these areas would be test plots. The development and operation of an FRC is the focus of this Environmental Assessment.

The Office of Environment and Biological Research (OBER) proposes to establish one FRC for a long-term (ten-year) field research program. The FRC would be used for much of the field research sponsored by the NABIR Program, and would thereby provide a focus for integrating the field-based program within NABIR. The FRC and supporting infrastructure would be used to facilitate long-term, interdisciplinary research. It would be available as a user site for investigator-initiated research by scientists funded through this and other programs (e.g., the Environmental Management Science Program.)

The FRC would provide NABIR investigators with field research sites containing a spectrum of waste types and subsurface environmental media (vadose zone and zone of saturation) that are representative of both background and contaminated conditions within the DOE complex. The FRC would offer a source for standardized subsurface samples for NABIR researchers, and locations for *in situ* research. Field scale research at the FRC would offer the researcher the opportunity to move laboratory-based research to the field, and observe and manipulate bioremediation processes involving heavy metals and radionuclides in a small-scale field setting.

The FRC would be staffed by a full-time FRC manager and several full and part-time technical and administrative staff. FRC staff would help facilitate the researchers' access to field locations at the DOE site, and ensure coordination of research activities and compliance with applicable DOE environmental, safety and health (ES&H) requirements. OBER would provide funding for infrastructure, staff, and additional characterization and field campaigns. It also would anticipate "in-kind" support from the host DOE site. In-kind support could include matching funding, staffing or facilities from the host DOE site.

During the first year of FRC operation, work done at the site would primarily focus on planning and field site development and characterization. By the second year, some *in situ* research might also be conducted. Because intrinsic bioremediation of radionuclides and heavy metals is a slow process, any activities focused on intrinsic bioremediation would be expected to be performed throughout the life of the FRC.

1.1.1 Potential FRC Research Activities

The expected workforce for the proposed FRC is anticipated to be small: possibly a staff of up to six individuals, some of whom would be part-time employees of the FRC. Interns and/or postgraduate students might be employed. The number of visiting scientists at any one time would be small, but could be as many as 24 on occasion.

The FRC would be a primary source for groundwater and sediment samples for NABIR investigators. Obtaining research-quality samples would be critical to the research conducted under the NABIR program at the FRC. Groundwater would be sampled by pumping water from existing wells or by installing new wells. Approximately 200 groundwater samples per year would be expected. These would be small quantity samples, approximately one liter each and totaling less than 20,000 gallons (76,000 L) per year, and would not change the groundwater flow rates or availability of groundwater. Approximately 600 core samples of sediments would be taken over the ten-year life of the proposed FRC through the use of a drill rig or split-spoon sampler. Again, the sediment samples would be small in volume (approximately less than one cubic meter) and the drilling holes would be backfilled when no longer needed.

Other DOE program offices and programs that have conducted such research activities include the DOE Office of Environmental Management, which conducts remediation investigations of subsurface contamination; the former Subsurface Science Program (SSP), which conducted small-scale field research studies to obtain basic information on the subsurface; and the current small-scale investigations at Oyster, Virginia, which focused on understanding bacterial transport in a sandy environment. Work also has been conducted through DOE’s Office of Environmental Management in collaboration with the Department of Defense, U.S. Environmental Protection Agency (EPA), and Dover Air Force Base, Dover, Delaware, to establish a groundwater remediation field laboratory to demonstrate and compare *in situ* detection, monitoring, and remediation technologies (Dover EA 1995). An environmental assessment prepared for the Dover project concluded that insignificant impacts to the environment and human health would be anticipated even if the proposed containment devices failed. Other examples of NEPA reviews that were conducted for those activities and Categorical Exclusions that were prepared are included in Appendix E. A description of how specific research activities would be incorporated into field studies at the proposed FRC contaminated and background areas is presented below in the general order in which field operations would be conducted.

1.1.1.1 Site Development and Characterization Activities at the FRC

Before any research activities would be undertaken, some “passive” surface and subsurface site characterization activities at both the background and contaminated areas would be initiated. Non-intrusive characterization of the subsurface might include the use of: a) ground penetrating radar (GPR) to determine moisture distribution and buried materials, b) electromagnetics to identify shallow contaminant plumes, and c) resistivity to determine lithology and geologic structure. Subsurface (intrusive) characterization might include: a) seismic tomography to determine geologic structure, fractures and moisture distribution; b) radar to determine clay and water content; c) direct-push (cone) penetrometer tests to determine mechanical properties of soils; d) creation of injection/extraction wells (Figure A-1); e) well logging to determine clay types, porosity, and aquifer characteristics; f) use of multi-level well samplers to collect groundwater samples and microorganisms; and g) installation of piezometers to measure fluctuating groundwater levels. (Examples of these characterization activities and their associated NEPA actions are presented in Appendix F and in the Dover EA 1995.) Uncontaminated sediment and core removed from the well/bore holes would be distributed in accordance with site-specific DOE requirements. Contaminated sediment and core would be handled and disposed of in accordance with applicable regulations (see Section 9.0, Applicable Environmental Regulations, Permits and DOE Orders).

Figure A-1 Standard drill rig used for characterization activities

In addition to specific characterization evaluations, "active" characterizations might occur at the contaminated and background areas. An "active" characterization can be defined as the addition of some substance to the subsurface under controlled conditions. Three kinds of "active" characterization tests would be proposed at the FRC. Most of these are standard types of subsurface characterization techniques.

Pump/slug tests. Once a specific series of wells is installed in a specified area, the hydraulic properties of the subsurface must be determined. To do this, a pump test would be performed. Water level indicators would be installed in wells along the perimeter of the test area. A pump would be placed into the central well and water would be pumped out of the central well. The water level indicators in the perimeter wells would measure the drawdown, or the drop in the water level. The flow rate of the pump would be monitored and a plot of the drawdown over time would be created. Simple groundwater equations for flow properties through the subsurface could then be solved. In a slug test, a water level indicator would be lowered into a well after noting the initial water level. A slug of known volume, made of plastic or metal, would be dropped into the well. The water level indicator would record the displacement. Once a new equilibrium is reached the slug would be removed and the displacement would be measured again. This information could also be used to solve simple equations to determine hydraulic properties.

Tracer Experiments. These types of characterization experiments are often used to obtain a detailed understanding of groundwater flow paths and the speed at which groundwater and other substances might move through an aquifer. In general, a small quantity of a tracer in the form of a solid (e.g., 1 gram of bromide) would be dissolved into water to achieve a concentration that might range from 500 to 10,000 parts per million. The tracer solution would then be injected into a well. In the case of a gas tracer such as helium or neon, a cylinder of the gas (ranging in size from 20 to 30 liters, depending on the research to be conducted) would be injected into a well. Groundwater samples would then be collected from downgradient wells at discrete time intervals. These samples would be analyzed for the tracer. Based on the time it takes the tracer to reach the downgradient wells and in which wells the tracer is detected, physical and chemical properties of the aquifer could be determined.

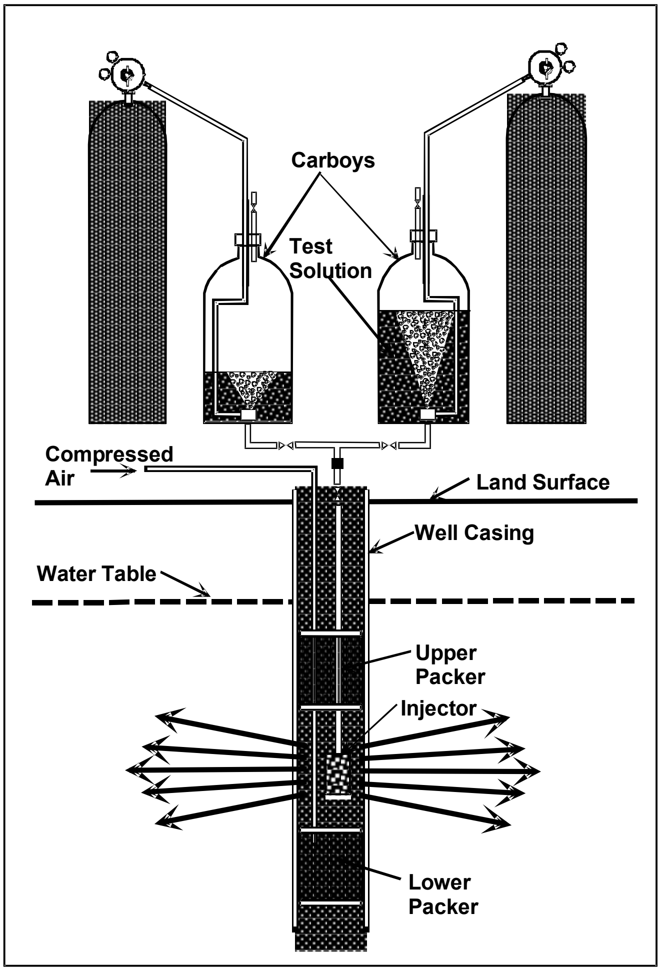

Figure A-2 Equipment used in field push-pull tests

Groundwater tracers used at the FRC would be nontoxic and are generally subdivided into two types: non-reactive and reactive. Non-reactive tracers are tracers that are inert and when extracted from a downgradient well are the same chemical or compound as that injected. A reactive tracer is a tracer that may interact with the groundwater, minerals in the subsurface sediments, or with microorganisms. When a reactive tracer is used, what is extracted from a downgradient well would not be the same chemical or compound as that injected. In general, NABIR investigators would use non-reactive tracers at the proposed FRC. The non-reactive tracer method would provide investigators with the information they would need regarding groundwater flow paths and other physical and chemical properties of the aquifer.

Push-pull experiments. A push-pull test is a relatively new technique that could be used to determine some additional chemical and physical properties of an aquifer. In a push-pull experiment, a few liters of water with a water-soluble tracer or some other type of solution (e.g., containing an electron acceptor) is injected ("pushed") into a single well and left for up to a couple of hours. The test solution and groundwater are then extracted ("pulled") from the same well until background concentrations are reached. Often up to 90 percent of the injected water is extracted. Groundwater samples collected during the extraction phase are then analyzed to obtain information concerning the transport of the tracer and/or rate of transformation of the injected solutes (Figure A-2).

1.1.1.2 Research-Quality Samples to be Collected at the FRC

Obtaining research-quality samples would be critical to the research conducted under the NABIR Program. Samples obtained from the FRC could be used by researchers in laboratories at the host DOE site or could be sent to researchers at universities or DOE labs. The samples would be used in the laboratory as "starting points" to gain the knowledge needed prior to taking research to the test plots at the FRC.

In January 1999, OBER issued a "Letter Request for Field Research Center Proposals." (See Section 2.2.5 of this EA.) Both ORNL and PNNL prepared responses to scenarios/questions concerning sampling that were posed in the OBER Letter Request. The responses provide details concerning the approaches to be used to obtain research-quality samples. A general summary of the responses to these scenarios/questions follows. (In addition, the Dover EA 1995 and Appendix E provide NEPA documentation applicable to other sites where activities similar to those at the proposed FRC have previously occurred.)

Collection of groundwater samples containing radionuclides to be used for research on natural communities of microorganisms.

The purpose of the collection method would be to ensure that samples would be representative of the target environment, that entrained microorganisms and geochemical constituents would be stable, and that any dangerous constituents would be safely handled. Although an existing well could be used, a new well might need to be drilled. In that case, a well would be drilled to the desired depth and a mechanical pump would be used to extract the groundwater. Investigators might use peristaltic pumps, argon-bladder pumps, or submersible pumps as applicable to the needs of the researchers and the environment from which groundwater would be collected. Water and entrained constituents extracted from the well would be considered representative of the *in situ* formation water.

All equipment that would come in contact with the sample water, such as hoses, pumps, and fittings, would be cleaned and subjected to antiseptic treatment (e.g., autoclaving, bleach and rinse, as practical) before sampling. Sample bottles and associated supplies would be prepared and sterilized in the laboratory before transport to the FRC. Prior to sampling for microorganisms, some groundwater might have to be purged to ensure a quality sample.

Collection of core samples from saturated zones containing a heavy metal constituent to be used for research on natural communities of microorganisms.

One of the most effective means for obtaining samples from the subsurface for microbiological analysis would be to drill and recover intact core samples. The drilling methods employed might be air-rotary, cable tool, or sonic. One way to obtain a minimally disturbed sample would be to push a split-spoon sampler out ahead of the drilling bit. Sterile lexan liners would be used in the split-spoon sampler to maintain the physical, chemical, and microbiological integrity of the samples and to permit examination of the sedimentary features of the core. All drilling tools would be cleaned before sampling. Immediately on retrieval of the drill string from the borehole, the core would be removed from the split spoon and airtight caps would be placed on the ends of the liner. Once sealed, the exterior of the lexan liner would be washed free of mud and debris, disinfected, and the core sample would be immediately transferred to the field laboratory.

While still at the field site, the core would be opened, logged, pared to remove the outer, potentially contaminated surfaces, subdivided, and packaged for archiving or shipment to investigators (Figure A-3). For analysis of strictly anaerobic microorganisms and for oxygen-sensitive solutes, core samples would have to be protected from atmospheric oxygen. A core-processing chamber filled with an anoxic atmosphere would be used to store, process, dissect and pack core samples. Some additional analyses might need to be initiated on-site in the field. Storage and shipping of samples would be handled in a manner similar to that described for the groundwater samples and would follow all applicable regulations. For core samples from

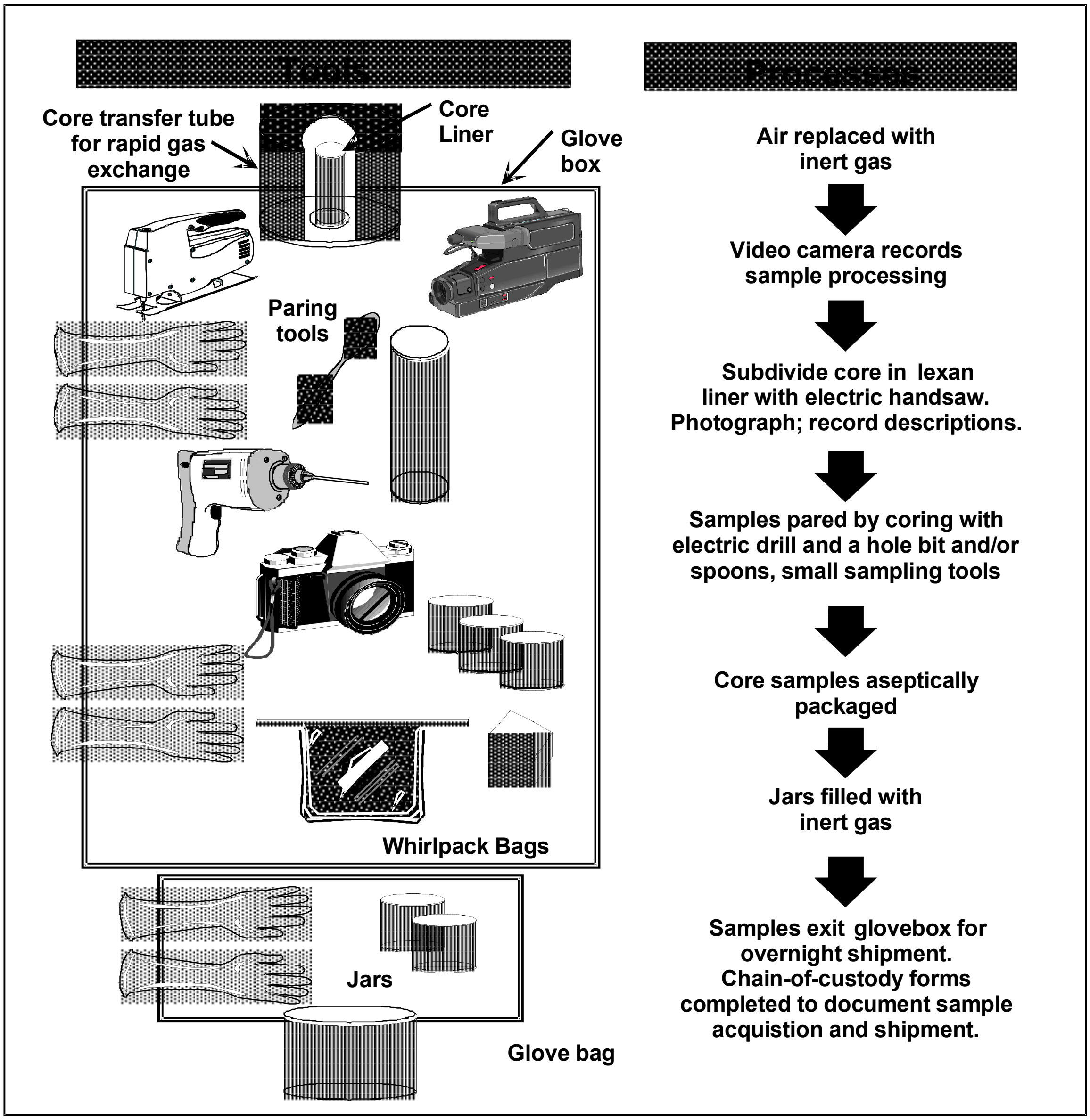

Figure A-3 Typical approach for processing of subsurface samples for microbiological and geochemical analysis

radioactively contaminated zones, special handling and training would be required (see Section 9.0, Applicable Environmental Regulations, Permits and DOE Orders).

1.1.1.3 Small-Scale In Situ *Research Activities at the FRC*

Because most of the activities at the proposed FRC would be undertaken in an area limited to less than an acre and a depth of 75 feet, the scale of *in situ* research activities is considered small.

(Examples of other studies in which similar activities have occurred, as well as their attending documentation, is presented in Appendix F and the Dover EA 1995.)

There are three standard ways to implement bioremediation as a remediation technology: a) intrinsic bioremediation, b) biostimulation, and c) bioaugmentation. *In situ* research at the proposed FRC would be oriented toward understanding the subsurface biogeochemical processes that control the success of any of these three technological approaches for remediating a site. Intrinsic bioremediation is an accepted remedial approach that relies upon the natural (intrinsic) activities of microorganisms to clean up a contaminated site. In contrast, biostimulation relies upon the addition of other substances (e.g., nutrients) to the subsurface to accomplish remediation. Bioaugmentation relies upon the addition of microorganisms to enhance any existing intrinsic processes in the subsurface to accomplish remediation. The primary focus of *in situ* research activities would be to understand subsurface biogeochemical processes associated with biostimulation and bioaugmentation.

Biostimulation

For a biostimulation experiment, a specific substance or set of substances would be introduced into the subsurface environment to stimulate existing microorganisms to bioaccumulate or transform a heavy metal or radionuclide (Figure A-4). Biostimulation activities might include: 1) the injection of electron donors (e.g., organic compounds such as acetate, lactate, glucose or molasses) or electron acceptors (e.g., oxygen, nitrate, methane or sulfate) to change a part of the chemical environment of the subsurface so that it is more favorable for microbial activity or growth; 2) the injection of nutrients (e.g., nitrogen, phosphorus) to stimulate the growth of

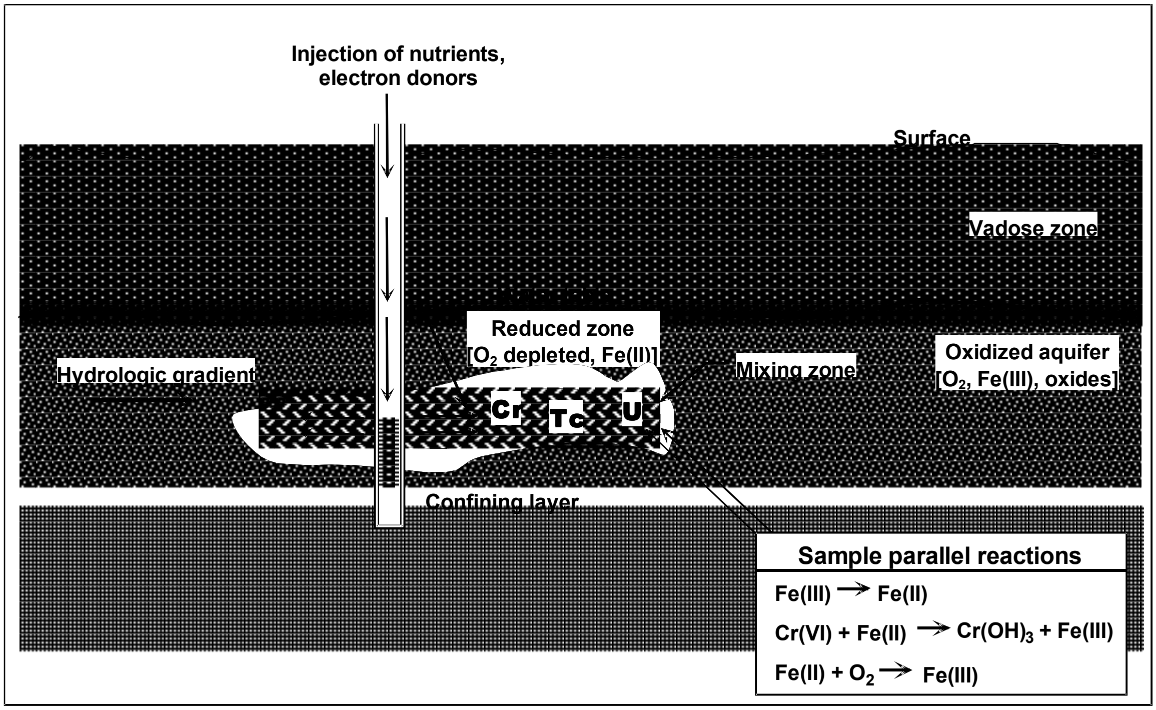

Figure A-4 In situ stabilization of metals through biostimulation

selected microorganisms; or 3) the injection of surfactants (e.g., rhamnolipids or other biopolymers) or chelators (e.g., nitrilotriacetic acid, ethylenediaminetetracetic acid, hydroxyapatite) to better mobilize or immobilize contaminants for removal.

Prior to a biostimulation experiment, NABIR investigators would obtain information concerning groundwater flow rates and patterns, microbial populations, contaminant distributions, and geochemical and mineral content of the field site. In addition, they would have conducted laboratory-based biostimulation experiments with cores from the field site. Using these data, the investigators would also have created computer models to simulate what they would expect to occur in a real field site experiment.

An example of a typical biostimulation experiment is shown in Figure A-4. Nutrients such as low levels of nitrogen or phosphorus, or electron donors such as sugars or hydrogen gas, are injected into the subsurface in an area contaminated with radionuclides or metals, such as Cr(VI). Cr(VI) is a soluble form of chromium that is toxic and carcinogenic. The reduced form of chromium (Cr[III]), however, is relatively non-toxic and can be immobilized in place through precipitation with iron minerals. Addition of nutrients and electron donors enhances the growth of metal-reducing bacteria and leads to immobilization of chromium, reducing risk to humans and the environment.

Another type of biostimulation experiment that might be conducted would involve the injection of electron acceptors. This type of experiment could be conducted in an anaerobic subsurface environment. By adding an electron acceptor such as nitrate, sulfate or carbon dioxide to the subsurface, a specific microorganism might be able to remove electrons from a heavy metal or radionuclide (i.e., oxidize the heavy metal or radionuclide) through a series of chemical reactions. Depending on the subsurface geochemistry, the transformed heavy metal or radionuclide might then be less mobile in groundwater.

A standard method to deliver nutrients and other substances into the subsurface could include using a pump to inject substances (e.g., carbon sources, electron donors or acceptors, and nontoxic tracers).

Bioaugmentation

Bioaugmentation-type activities would involve the injection of a small quantity (1.5×10^6 bacteria/gram of soil) microbial strain or mixed culture of microorganisms into the subsurface at the FRC (Saylor 1999). Bioaugmentation-type activities might include the injection of: 1) a specific strain or strains previously isolated from the site (native), 2) a specific strain or strains isolated from some other field site (non-native), or 3) a combination of the first and second approaches. However, while non-native microorganisms might be considered, no GEMs would be injected at the FRC.

Because the strains or mixed cultures that would be injected would have been previously shown (in laboratory experiments) to be able to bioaccumulate or transform a heavy metal or radionuclide, experiments at the FRC would be oriented toward determining whether the microbial strain(s) could be appropriately distributed in the subsurface, whether they could survive under field conditions, and/or whether they would bioaccumulate or transform heavy metals or radionuclides under field conditions. To date, most attempts to distribute a strain or mixed culture within the subsurface environment have not been highly successful. Both in the unsaturated and the saturated zones, microorganisms often do not move very far (a few meters) from the point of injection (Piotrowski and Cunningham 1996, Mosteller et al. 1997). The result is that the microorganisms often do not reach much of the contaminated area.

Perhaps of more importance, non-native microorganisms that are introduced into the subsurface often have difficulty surviving (ITRC 1998), and their population levels have been shown to decrease rapidly both in laboratory studies (Ramos et al. 1994) and in actual field studies (Krumme et al. 1994). In some cases, non-native microorganisms have been found to be undetectable in the subsurface after more than two years (Drahos 1991, Kluepfel et al. 1991), but in other cases, they have been shown to still be detectable at very low levels after two (Sayler 1999), four (Hirsch and Spokes 1994), and even six years (Ryder 1994). Among the reasons for the apparent rapid die off are factors such as predation by protozoans (Kuske 1995, Kinner 1998) and the poor ability of non-native microorganisms to compete with native microorganisms (ITRC 1998).

In spite of these difficulties, there are a number of commercial firms that "sell" bioagumentation approaches to organizations that are required to clean up sites that have organic contaminants in the subsurface (Boyd 1996, Fustos and Lieberman 1996). These commercial firms attempt to overcome some of the bioaugmentation limitations by performing multiple injections, by injecting microorganisms every few meters in a contaminated area, or by injecting large volumes of nutrients and microorganisms. In some cases, bioaugmentation for the remediation of organic contaminants has been shown to be successful (Duba et al. 1996, Stefan et al. 1997). In contrast, there is only limited understanding of bioaugmentation for heavy metals and radionuclides.

Prior to undertaking a bioaugmentation experiment at the FRC, NABIR investigators would require some understanding of the natural transport of microorganisms through the subsurface environment. For example, some NABIR investigators are planning studies of bacterial transport in the subsurface at a fairly simple environment (deposited sands) at an uncontaminated, non-DOE field site in Oyster, Virginia. At the Oyster site, NABIR investigators will be undertaking a series of tracer and bacterial transport experiments. For the bacterial transport experiments, bacteria to be injected are native. Knowledge gained in an uncontaminated environment with a simple geologic structure is expected to help NABIR investigators when it comes to the more complex geologic environment at either ORNL or PNNL. In addition to the field experiments, computerized models of the subsurface at Oyster and the expected patterns and rates of transport of the microorganisms will be created. The actual field experiments will be correlated with the models.

In the case of a bioaugmentation experiment at an FRC, a similar process would be employed. NABIR investigators would first seek to understand the natural transport properties of the groundwater by injecting nontoxic tracers. NABIR investigators would use core extracted from the field site to conduct laboratory-based experiments to examine the transport of microorganisms through the cores. Once sufficient preliminary understanding is obtained, a team of NABIR investigators would conduct a field experiment that would involve the injection of multiple nontoxic and non-reactive tracers and microorganisms. Monitoring and sampling for the tracers and microorganisms would be conducted at multiple levels in downstream wells. Investigators would also seek to determine how well or whether the injected microorganisms survive (i.e., whether they survive predation by protozoans or whether they are “stuck” in the interstitial or pore spaces in the sediments and are unable to move).

More complex bioaugmentation field experiments might follow and might include combining a bioaugmentation experiment with a biostimulation experiment (i.e., injecting microorganisms and nutrients). The concept behind such an experiment would be to retain microorganisms at a desired location in a contaminated area and to have them actively transform heavy metals or radionuclides such that they become less toxic or less mobile in the subsurface. The standard method to deliver nontoxic tracers and microorganisms to the subsurface is to use a pump to inject water or a nutrient solution that contains the tracers and/or microorganisms. Specific field experiments at the proposed FRC, such as those described above, could be undertaken only when appropriate permitting and NEPA reviews were completed.

1.1.2 Assessing and Managing Environmental, Health and Safety Risks at the FRC

A critical aspect of the current NABIR Program and its proposed field-based component on the preferred FRC site, is compliance with applicable ES&H regulations. The NABIR Program conducts research activities in a way that poses the least impact to the human environment. Following current DOE practice, the appropriate DOE Operations Office ensures compliance with all regulatory and permitting requirements before research funding is released and/or laboratory/field activities commence for all research activities conducted under the NABIR Program. This also would apply for all work that would be conducted at the proposed FRC. In addition to satisfying DOE's ES&H requirements, the appropriate Operations Office would comply with the requirements of other applicable federal, state, and local laws for each research project. For activities at the proposed FRC, the FRC Manager would provide the coordination necessary to ensure DOE ES&H requirements were met, all site policies and procedures were followed, and site training and security requirements were met.

1.1.2.1 NABIR NEPA Strategy

One tool that can be used to evaluate the potential impacts posed by research activities is the NEPA process. A NEPA document examines proposed activities and evaluates their potential impact on the human environment. The following paragraphs highlight how the use of the NEPA process within the NABIR Program would be used to assess risk, as well as what some of the potential areas of impact would be for conducting research under the NABIR Program. Although the NEPA process addresses, in detail, how risks to the human environment would be dealt with, there are management practices that NABIR Program management would implement to reduce the risks to acceptable levels. These also are discussed below.

The strategy for NEPA compliance associated with selection and operation of the proposed FRC is two-tiered. The first tier includes the preparation of this EA to evaluate the potential environmental impacts of selection and operation of the proposed FRC. This EA attempts to bound the type of work expected to occur at the FRC based on work that has occurred in other similar programs. This EA also bounds the potential environmental consequences expected from the proposed activities.

The second tier of the NABIR NEPA compliance process would be evaluation of the appropriate level of NEPA documentation that would be prepared for proposed specific field research. Resources that might require further NEPA evaluation might include groundwater, sensitive species, and archaeologic and historic resources. The Tier II evaluation would consider whether the proposed field research is bound by this EA. If, during the course of the Tier II evaluation, it was decided that the actions were not bound by this EA and could potentially significantly affect the human environment, appropriate NEPA review would be initiated.

1.1.2.2 Site Management and Peer Review

To ensure compliance with all applicable environmental rules and regulations, NABIR would, at a minimum: 1) implement all pertinent Tier II NEPA review requirements for specific FRC activities; 2) manage activities via field sampling plans, health and safety plans and any other pertinent operation plans as has been done at DOD field research sites (University of Michigan 1995 a,b,c); 3) evaluate FRC activities via a Field Research Advisory Panel (FRAP); and 4) implement a DOE Operations Office review process. The following paragraph describes review process activities for typical NABIR field activities.

For research that would involve intrusion into the soils and/or groundwater at the preferred DOE FRC site, there could be potential risks to the safety of the public and workers as well as potential risks to the surrounding natural environment. However, risks would be managed and reduced through the use of best management practices (BMPs) and by following applicable federal, state and local regulations as well as internal DOE requirements. The NABIR Program is committed to ensuring that BMPs and regulations are implemented in the course of FRC-funded research. A FRAP would be developed to review research work plans (see more on FRAP and work plans in Appendix C) for all FRC- related research activities. The FRAP would be coordinated through the NABIR Program Office. It would primarily consist of the FRC Managers, host site regulatory experts, appropriate DOE Operations Office staff, and at least three non-conflicted peer reviewers external to the NABIR Program Office staff and experts from the Lawrence Berkeley National Laboratory. Any activity that would have even a small potential risk to ongoing studies, regulatory limitations, and FRC resources would be evaluated by the FRAP.

1.1.2.3 Training

In addition to the development of an overall FRC Management Plan, an FRC Health and Safety Plan, and Field Sampling Plans, the NABIR Program would require the development an ES&H training program specific to the FRC activities prior to the initiation of any activities at the proposed FRC. Both the plans and the training programs would be reviewed for overall adequacy in addressing environmental and health and safety concerns and would be approved by the OBER Field Activities Manager, the FRAP, and the management at the appropriate DOE Operations Office. Further details on FRC health and safety planning, documentation, and training are contained in Appendix C.

Sampling activities at the FRC would require training at a level appropriate to the potential hazards. All groundwater samples would be handled according to regulatory requirements; the primary driver would likely be the potential for exposure to radioactivity. Sample collection in areas designated as having radioactive soil and sediments would be collected by personnel with Radiation Worker I or II training (Title 10, *Code of Federal Regulations* Part 835.) The outside of sample containers would be surveyed by a Radiological Control Technician for alpha, beta, and gamma radiation using field detection instruments. Appropriate shipping category, packaging, and preparation of appropriate documents to allow shipment of samples to other locations on the host DOE site would be prepared by qualified personnel (e.g., the Hazardous Material Transportation Officer). For off-site shipment, glass sample containers would be wrapped in bubble pack and inserted into a protective cardboard tube. The completed chain-of-custody and field record paperwork would be placed in the insulated containers holding the samples for overnight shipment to the appropriate researchers. Chain-of-custody documentation would be used to ensure samples do not get lost. Before shipment, qualified personnel (e.g., Hazardous Material Transportation Officer) would verify that the receiving organization possesses the appropriate authorizations (e.g., a current state radioactive material license) to receive the material.

1.1.2.4 Review Process for Chemical Toxicity

Research with chemicals toxic to humans would not be used. Information concerning the toxicity to humans of a specific chemical is available in the peer-reviewed toxicology literature. Material Safety Data Sheets would need to be examined. In cases where this type of information is available, this level of review would be the immediate responsibility of the FRC Manager with concurrence from the appropriate DOE Operations Office, and possibly the state regulatory agency and the appropriate regional office of the U.S. Environmental Protection Agency. For chemicals with limited safety data available, several types of review processes would be required for their use. The first level of review would be the FRC Manager. The second level would involve a scientific review by the FRAP. Because host site regulatory experts would be on the FRAP, the regulatory process would have early notification of this proposed activity. There would also be a NEPA review, and if applicable, a permit application process to the appropriate regulatory agencies.