PHILOSOPHY AND OVERVIEW OF THE INEL WASTE MANAGEMENT PROGRAM

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ABSTRACT

The INEL philosophy of "get the job done; do it right -- the first time" will be described as it applies to all phases of waste management activities. In addition, an overview of INEL's waste management programs and projects -- low-level waste management operations and technology development; transuranic waste management operations and technology development; high-level waste management operations and technology development; spent fuel storage operations and equipment/technology development; transportation operations, technology development, and prototype cask procurements -- will be discussed. Emphasis will be placed on the application of the INEL philosophy to the successful initiation and continuation of INEL waste management activities.

OVERALL PHILOSOPHY

The INEL philosophy can be stated in simplistic but profound terms: "get the job done; do the job right -- the first time." As the name implies, the Idaho National Engineering Laboratory (INEL) has emphasized engineering and hardware development throughout its long history. Even the site's original mission and name: National Reactor Testing Station, placed emphasis on hardware development and testing.

In the area of waste management, INEL has concentrated on successful operations, demonstrations, and test results. This has been accomplished while adhering to the following principles:

- Protect the health and safety of employees and the public
- Protect the environment
- Continuously monitor the environment and operations to assure the above is being accomplished

One of our contractors, EG&G, embarked upon an internal campaign to increase employee awareness to the INEL philosophy. They emphasized the following tenets in their extensively publicized approach:

Values: We are proud of being a Government team member

We believe people are the key to our success

We keep our commitments

We value integrity and open communication

We have the highest standards for service

We value innovation

Another key aspect of the INEL philosophy is the encouragement by all team members to take risks. Not health and safety risks, but program management risks, i.e., cost and schedule risks. If one wants to look good, all one needs to do is sufficiently increase cost and schedule contingencies to allow for worst case "Chicken Little" scenarios. While this may assure an activity will be completed within the baseline, it very possibly is counterproductive and not cost effective. Our philosophy at INEL primarily with waste management activities has been to take a 50-50 approach in the initial planning, i.e. half the time, we will end up ahead of schedule and under budget; the other half, we may exceed budget and schedule. Nevertheless, we will have done something -- we will have got the job done.

Another way to look at the INEL philosophy is to say we are looking for good solutions, not the ultimate best solution. To quote Winston Churchill: "The enemy of a good solution is a potentially better solution -- then nothing is accomplished!" INEL has been accomplishing things and will continue to do so.

Approach to New Initiatives

INEL's approach to securing new waste management initiatives has been to pursue activities that we have accomplished successfully in the past. Since INEL has had experience and success in all forms and phases of waste management activities except for repository related tasks, INEL has actively sought new activities in all non-repository areas of waste management.

In conjunction with our technical approach to securing new initiatives, we have without exception kept our institutional interfaces informed of our plans. This institutional interface has been accomplished at the embryonic stage of our planning. In other words, when we have the hint of a new project or program, we consult with our state and federal representatives to keep them informed and allow them to express their concerns, if any. It is our philosophy not to pursue a new initiative without at least tacit approval from the institutional sector.

The next aspect of our philosophy for obtaining new initiatives is to provide a management commitment to "get the job done." In addition, we try to provide realistic estimates based on the information available. Not optimistic "buy-in" estimates; not pessimistic worst case estimates; but estimates that reflect our best idea of a 50-50 chance of being correct.

Approach to R&D Activities

While R&D Activities are essentially "paper studies," we try to focus our R&D towards activities that will produce results. These results can then be channeled towards proof of principle tests and/or hardware development. We feel particularly satisfied when R&D can be focused on improving on-going or future waste management operations.

Innovation is encouraged. Solving the impossible is recognized as a challenge. However, the underlying theory is still "get the job done."

Approach to Design and Construction

The INEL approach in this area can be summarized by the guideline to "maximize operator involvement." This means to take steps throughout the project, especially at the initial stages, to assure facilities are what the operator(s) want. It seems fruitless to us to have an excellent design, as perceived by design engineers; to have a successful construction project as perceived by constructors; only to have the facility not do what the operators want. In other words, a successful construction project is only successful if it works the way the operators want it to work.

Regardless of the approach used to project management/strategy, i.e. firm-fixed price, cost plus, or turn-key, the underlying goal is to "get the job done" and this means providing a facility that will work. All too often, operations personnel are too concerned with day-to-day operating problems to be concerned about future projects. INEL has taken positive steps through its award fee contracts with the operating contractors to require and assure operations involvement through all stages of a project. It seems only logical that those who will be required to operate a facility should have significant input into how the facility will be designed and built.

Approach to Operations

The basic approach which the INEL takes in waste management production operations stems from one overall goal: "manage and operate the facilities in an exemplary manner." Several important tenets of this approach are:

- Maintain the highest standards of quality. The establishment, within each employee, of a positive and professional attitude of "doing the job right -- the first time," a philosophy of performance that begins with and emanates from the top manager and extends down to all levels of management, operations, and administration and all related activities including interfaces with contractors, subcontractors, and vendors.
- Operation as a "model" facility to demonstrate that the operations can be conducted safely and effectively. Strive for performance far beyond minimally acceptable requirements. Establish an expectation of excellence.
- The implementation of a system of policies, procedures, and practices covering all facets of facility management, operations, and administration; and the strict, disciplined compliance with these written documents and verification of adherence with their intent.
- Staying at least one step ahead of nationally accepted standards of performance, especially in areas such as safety and environment, recognizing that these standards are constantly increasing. Be above criticism in these areas rather than constantly being on the defensive.
- Maintaining an orientation toward improving all aspects of the operation. Have specific assessments of goals and objectives for each area. Identify shortcomings in each area, and specify plans to correct shortcomings and achieve the goals and objectives.
- Promotion, communication, and enforcement of the philosophy "safety is first" in the conduct of all activities, events, and operations. This philosophy will not be compromised regardless of schedular demands, budget restrictions, and/or desire to utilize improved techniques and equipment before all safety aspects are evaluated and proven acceptable. Maintain the highest standards of safety.

Approach to Institutional Relations

The INEL approach to institutional relations focuses on three areas:

1. Relations with our customers
2. Relations with the public
3. Relations with elected local, state, and federal officials

The keystone of the approach to working with our customers is to develop a cooperative working relationship with the program personnel (i.e., DOE Headquarters and other DOE Operations Offices, or other sponsoring organizations) with respect to being highly responsive to their requests and requirements, providing timely communications for information and possible action, and participation in key activities such as long-range planning or put simply "keep the customer satisfied."

Relations with the public involves regular press briefings by our Operations Office Manager, public tours of our facilities, an active outreach program, and a posture of keeping the media informed of new developments or programs.

As alluded to in the section on new initiatives, the INEL approach is to keep public officials informed on all new initiatives and on-going operations. A yearly presentation of INEL activities and information is made to the state legislature. This year it was attended by 80 legislators.

OVERVIEW OF INEL WASTE MANAGEMENT ACTIVITIES

Low-Level and Transuranic (TRU) Waste Management Programs

Various strategies of waste storage and processing are studied and implemented at the site's Radioactive Waste Management Complex (RWMC). The 144 acre, fenced RWMC incorporates many different areas of low-level waste study and storage. Existing since 1952, the area lies in the site's southwestern section and is divided into the Transuranic Waste Storage Area (TSA) and the Subsurface Disposal Area (SDA). Since 1970, solid waste contaminated with long-lived transuranic radioisotopes, principally plutonium-239, has been stored above ground at the RWMC's 56 acre TSA. This waste primarily consists of broken laboratory glass, coveralls, shoe covers, rags, and process sludges.

Plans are to retrieve TSA waste stored above the ground and transfer it to the Waste Isolation Pilot Plant (WIPP) in New Mexico, beginning about 1989.

Transuranic wastes received at the INEL are packaged in fiberglass reinforced, polyester-coated boxes, metal boxes or in polyethylene liners inside 55-gallon steel drums. These storage containers must pass rigid quality and endurance tests to ensure their integrity during transport and for at least 20 storage years. The packaged wastes are brought to the area by truck or rail.

Within the TSA, the waste containers are stacked on a drainage-sloped, above ground asphalt storage pad. The containers are stacked in cells separated by earthen walls and then covered with plywood, tough nylon reinforced polyvinyl, and two to three feet of soil. This storage pad is covered by an air support building during stacking to protect workers and waste containers from the weather until the pad is ready to be covered.

The cells also contain monitoring devices positioned to obtain temperature, humidity, and contamination data. Environmental monitoring and sampling indicate the TSA storage conditions are ensuring the containers' integrity.

From 1954 to 1970, transuranic waste was buried below at least two feet of soil in large RWMC pits and trenches. Research and development programs in 1974 and 1975 investigated the feasibility of safely retrieving the wastes -- the necessary methods, equipment, and costs. The studies were conducted inside an air support structure providing weather protection. Both programs supplied valuable information on the waste conditions and the problems associated with the safety, equipment and waste handling/retrieval techniques.

Buried waste studies are ongoing in the areas of in situ assay, in situ stabilization, and the development of safe and cost-effective exhumation equipment and procedures.

Various waste materials contaminated with short-lived radioisotopes are boxed or wrapped and buried in the RWMC's fenced 88 acre Subsurface Disposal Area (SDA). More than 90 percent of the buried waste has half lives measured in days. A small percent of the SDA buried waste has half lives of up to 30 years. During reactor operations, some nonradioactive metals (reactor core structural materials, for example) become radioactive. When the materials are no longer usable, they are buried at the SDA. The material's radionuclides are immobile, as the radioactivity is contained in the metal.

Three new facilities for waste processing are being developed at the INEL: the Waste Experimental Reduction Facility (WERF), the Stored Waste Examination Pilot Plant (SWEPP), and the Process Experimental Pilot Plant (PREPP).

WERF's purposes are to reduce the volume of low-level beta/gamma waste for the RWMC's SDA, and to demonstrate that melting and incineration are safe and effective processes to reduce the volume and stabilize low-level radioactive waste. The facility started processing low-level radioactively contaminated iron-based metal waste in August of 1983, demonstrating the method achieves a ten-to-one volume reduction. The facility typically processes about 8,000 pounds of INEL metal waste per week. WERF is also used to process combustible materials. A large incinerator has shown this process can achieve a twenty-to-one volume reduction. WERF is located in a decontaminated former reactor building near the Power Burst Facility.

SWEPP, constructed at the RWMC, will be used to inspect INEL contact-handled TRU waste filled barrels and boxes, for shipment to the DOE WIPP facility in New Mexico. Nondestructive examinations, such as Real Time Radiography, an X-ray imaging technique, will be performed on the waste containers ensuring they meet WIPP acceptance criteria. Waste containers not meeting acceptance criteria will be sent to PREPP for processing. SWEPP became operational in 1985.

PREPP, currently being constructed in Building 607 at Test Area North (TAN), will serve as a pilot plant demonstrating safe and cost-effective TRU waste volume reduction and processing methods to meet WIPP acceptance criteria. Construction is scheduled for completion in 1986. Experimental nonradioactive testing will start in 1987. Packaged waste will be shredded and incinerated, with the ash solidified in concrete in new 55-gallon drums. The new waste packages will be inspected at SWEPP before shipment to WIPP.

INEL's philosophy can best be demonstrated by the TRU facilities projects, SWEPP and PREPP. These facilities, with a combined cost of approximately $50M, took the place of a proposed $500M facility. The $500 SPI or transuranic waste treatment facility was proposed for 1982; however, it was unaffordable. INEL engineers then developed the relatively simple SWEPP and PREPP facilities to do essentially the same task. These facilities should be able to process 90% of the TRU waste for 10% of the proposed cost, a vivid example of getting the job done with a simple solution.

High-Level Waste Management Program

Government-owned spent fuel has been reprocessed at ICPP since 1953. Spent fuel arrives at ICPP in heavily shielded shipping casks. This fuel is temporarily stored either under water or in a dry air-cooled facility.

At ICPP, reprocessing of spent fuel and management of the resulting waste involve these steps:

- Receipt and storage of spent fuel
- Spent fuel is dissolved in acid
- A chemical process separates the uranium from the acid solution
- Recovered uranium is shipped to other DOE facilities for reuse
- The remaining liquid -- high-level waste -- is stored in stainless steel tanks encased in concrete vaults.
- The high-level waste is eventually changed into a solid using a method called calcination.
- The solid calcine is stored in stainless steel bins, encased in reinforced concrete vaults.

High-level liquid waste at ICPP has been changed into calcine since 1963. This process involves spraying liquid waste into a heated vessel. As water and other substances in the waste vaporize, the remaining waste collects on solid particles inside the vessel. Nearly all radionuclides are removed from the vapor before its release to the atmosphere. The resulting radioactive solid waste is called calcine.

Physically, calcine resembles a mixture of powder and sand. It contains both nonradioactive and radioactive materials. The primary nonradioactive chemical components of calcine are aluminum oxide, zirconium oxide, and calcium fluoride. Some calcine also contains small amounts of toxic cadmium and mercury. The primary radioactive materials (radionuclides) in calcine are cesium-137 and strontium-90. These radionuclides will decay to a very low level after several hundred years. Other radionuclides, such as plutonium-239, will take thousands of years to decay to a very low level.

Through January 1986, 5.3 million gallons (or 719,000 cubic feet) of liquid waste had been converted to 105,000 cubic feet of calcine. An additional 1.8 million gallons of liquid waste currently stored at ICPP will be calcined, along with liquid waste from future reprocessing.

Calcine is stored underground at ICPP in stainless steel bins within reinforced concrete vaults. These bins and vaults have been designed to resist damage from natural catastrophes such as earthquakes, tornadoes, and floods. The storage facilities are expected to remain intact for at least 500 years.

To ensure public and environmental safety, the surrounding environment is constantly monitored for the presence of toxic chemicals and radionuclides. Samples of air, water, soil, plants, and animal life from surrounding areas have been analyzed since the early 1950s. Studies of these samples have not detected radioactivity above federal and state standards.

At present, it cannot be ensured that the calcine bins will remain intact forever. If not properly contained, calcine could be dispersed by wind or dissolved in water. Therefore, a long-term plan is needed to ensure that the high-level waste remains isolated from the environment.

Three basic long-term ICPP high-level waste management alternative strategies are currently under evaluation:

1. Disposal of all immobilized HLW in a repository,
2. Disposal of all immobilized HLW in a near surface facility on-site, or
3. Disposal of annually produced HLW in an immobilized form in a repository and disposal of existing stored HLW in a near surface facility on site.

INEL's philosophy of exemplary operation and foresight are demonstrable by the High-Level Waste Management Program. The New Waste Calcining Facility (NWCF) has far exceeded design capacity and has worked off all available backlog. The relatively inexpensive storage bins are accepted by the public as an adequate interim storage solution for high-level waste. In fact, the current operations at INEL for high-level waste are so successful that INEL is the last of DOE's high-level waste sites to be addressed for long-term immobilization (2007).

Spent Fuel Storage and Transportation

The following activities make up this program:

- The VP/DOE cooperative agreement
- The NFS project
- TAN silo modifications
- E-MAD/BCL fuel transfer
- The prototypical spent fuel consolidation equipment demonstration project
- Transportation systems acquisition program
- Transportation technology development

A summary description of these activities follows:

The VP/DOE PWR cask performance testing project objectives are to conduct heat transfer and shielding tests with two storage casks with unconsolidated spent fuel assemblies and two casks with consolidated spent fuel rods, and to provide test information to DOE and PNL in support of Virginia Power's (VP) at-reactor dry storage licensing effort. The supporting objectives are to properly administer the project, provide the necessary facilities and equipment, perform the cask testing, and provide long-term monitoring and surveillance for the casks.

The objective of the NFS spent fuel shipping/storage cask demonstration is to demonstrate the feasibility of packaging, transporting, and storing aged spent fuel in the same dry storage cask.

The purpose of the TAN-607 silo modification is to provide a temporary dry storage facility for commercial fuel assemblies. This dry storage facility will support the research and development activities for the spent nuclear fuel cask demonstration program

and associated nuclear fuel rod consolidation efforts and the prototypical consolidation demonstration project.

The Department of Energy (DOE) needs to relocate DOE-owned commercial spent fuel assemblies from the Engine Maintenance Assembly and Disassembly (E-MAD) facility in Nevada and the Battelle Columbus Laboratory (BCL) facility in Ohio to the INEL for interim storage. Seventeen pressurized water reactor (PWR) fuel assemblies in Nevada and two PWR fuel assemblies in Ohio will be relocated to the INEL. The nineteen spent fuel assemblies will be temporarily stored in the modified TAN silo lag storage facility until they can be consolidated with other spent fuel assemblies in a spent fuel dry storage cask.

The purpose of the prototypical spent fuel consolidation equipment demonstration project is to expedite the development and demonstration of prototypical rod consolidation equipment, ensure that QA requirements for NRC licensing are met, and provide for a competitive, private sector design effort. This or similar equipment will ultimately be installed at above ground facilities at a repository or in a Monitored Retrievable Storage (MRS) facility, if one is authorized. The INEL objectives are to properly administer the project and to manage the design, fabrication, installation, and checkout of required TAN-607 facility modifications in support of the consolidation hot demonstration phase of the project.

The transportation systems acquisition program (Phase I) objective is to develop a complement of NRC certified prototype casks for shipment of spent pressurized water reactor (PWR) and boiling water reactor (BWR) fuels and hardware from existing and proposed reactor facilities to a repository or a MRS. This development will form a base for procurement of a fleet of casks in Phase II.

The objective of the technology development program being conducted by Sandia with overview by INEL is to provide the independent source of technology development, data systems, and test support needed by the Office of Civilian Radioactive Waste Management (OCRWM) and DOE-ID to ensure that transportation equipment is available. These actions will complement and support cask development actions by private industry. The technology development, data systems, and test support activities are divided into the following major task areas: (1) cask acquisition support, (2) technical issue resolution, (3) system concepts, (4) testing, (5) applied technology, (6) miscellaneous technical support, and (7) program management.

The INEL philosophy of getting the job done was applied to the above activities. A testimony to the success of this approach is that two years ago, we had no work and little specific experience in the aforementioned areas. Now we are setting the national standards. This is true in even the most sensitive area of spent fuel transportation where we successfully transported 45 fuel assemblies in 15 shipments through 17 states, using extremely simple "courtesy communication" procedures.

CONCLUSION

The INEL with its basic philosophy of "getting the job done" has made significant real progress in all areas of waste management. The INEL has demonstrated actual transportation, hardware, and procedures (not just paper studies) with low-level waste, transuranic waste, high-level waste, spent fuel, and abnormal waste. The INEL is where the real action is!