

**NOT JUST A CHEMICAL INTERACTION:  
COMPLEMENTARY ROLES OF THE GEOLOGIST AND ENGINEER  
ON A HAZARDOUS WASTE REMEDIATION PROJECT**

By

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Brookhaven National Laboratory (BNL) has been under extreme political and community pressure within the last year to improve its environmental practices. The diverse and complex nature of wastes discovered during investigation of a former waste disposal area required innovative methods for excavating, processing, sorting, characterizing, storing, and handling the materials. Remediation of the landfill area was performed as a removal action under the Interagency Agreement between BNL, the United States Department of Energy (DOE), the United States Environmental Protection Agency (USEPA), and the New York State Department of Environmental Conservation (NYSDEC). The ability of geologists and engineers to operate as a cohesive unit enabled the project to be completed safely and on schedule.

The project included the remediation of 55 waste pits used for the past disposal of chemical wastes. In addition to the coordination of 9 teams, the diversity of waste discovered and the delicate, calculated methods needed to safely excavate these materials presented a major challenge. These wastes, found in all phases (solid, liquid, and gas), included

- ◆ radiological - alpha, beta, gamma radiation
- ◆ biological - animal carcasses, flesh, bones, feces, blood
- ◆ medical - sharps
- ◆ hazardous - toxicity, reactivity, corrosivity
- ◆ shock sensitive materials - pressurized gases

Despite the extremely hazardous conditions listed below, approximately 21,600 man hours were logged without serious accidents or injuries. Severe project circumstances included

- ◆ 12-week deadline
- ◆ heat stress (June, July, August)
- ◆ physical hazards (excavation and processing equipment, dust)
- ◆ chemical, radiological, biological hazards
- ◆ Level A<sup>1</sup>
- ◆ Level B (an average of 18 people per day continuously)<sup>2</sup>

Many different types of professionals were involved with the remedial action phase of the project. It was primarily the engineers and geologists, however, who were involved from the very beginning, investigating the area for several years to gain as much knowledge as possible about the types and extent of wastes. Together, engineers and geologists played an integral role in a project that presented many complex challenges.

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<sup>1</sup> The highest level of protection mandated by OSHA.

<sup>2</sup> The second highest level of protection mandated by OSHA.

## INVESTIGATION PHASE

### *Geophysical Survey*

- Nature:** The preliminary investigation involved geophysical survey techniques utilizing electromagnetic and ground penetrating radar equipment.
- Objectives:** To locate and determine how many individual waste pits existed and to define, to the extent possible, the width and depth of the pits for the purpose of calculating waste volumes.
- Geologist:** Responsible for coordinating and conducting electromagnetic survey utilizing EM-31. Field data was downloaded to a PC and evaluated to define the location and horizontal extent of each waste pit. Areas believed to contain waste pits were then further evaluated utilizing ground penetrating radar to define the depth of the pits.
- Engineer:** Responsible for developing grid system for geophysical data collection points, digital logging of field readings, and conversion of data to visual displays.

### *Soil, Soil Gas, and Groundwater Investigation*

- Nature:** Soil, soil gas, and groundwater samples were collected along the perimeters of the waste pits utilizing direct push technology.
- Objectives:** To gain insight into the types and severity of contaminants that may be present in the waste pits.
- Geologist:** Responsible for the collection and field screening of environmental samples.
- Engineer:** Responsible for locating sampling points utilizing information obtained from the geophysical surveys; assisted with the evaluation and reduction of resulting data.

## REMEDIATION PLANNING PHASE

### *Evaluation of Alternatives*

- Nature:** Proven and experimental remedial technologies were evaluated.
- Objectives:** To determine the most feasible approach for remediation of the waste pits. The chosen method must protect workers and allow for complete elimination of wastes.
- Geologist:** Responsible for evaluating the effectiveness of the alternative relative to its potential to remove the body of waste in the pits and provide the flexibility to remediate contaminated soil surrounding the waste pits to within regulatory standards.
- Engineer:** Responsible for evaluating the feasibility of the alternative relative to available infrastructure such as electricity, water, fuel, etc.

### *Preparation of Excavation Plan*

- Nature:** Based upon the recommendations from the evaluation of alternatives, excavation and waste segregation were chosen as a remedial action. A plan was then needed to outline exactly how excavation should be performed.

**Objectives:** To develop a safe and effective excavation method or plan that allowed waste material to be screened in the field, sampled, and segregated. The method must utilize conventional equipment and provide opportunities to thoroughly remediate waste pits and minimize resulting waste streams.

**Responsibilities:** This phase of the project utilized the skills of both the engineer and the geologist in a much more seamless manner than previous phases of the project. Drawings were generated detailing the excavation process, staging, stockpiling and processing areas, logistical routes, slope cutting approach, and clearing, grubbing and grading boundaries. Estimates were made of quantities of materials to be excavated and stockpiling areas were designed for size, segregation, location, and hazard minimization.

## **REMEDIATION PHASE**

### ***Field Application of Excavation Plan***

**Nature:** Tight time constraints required the simultaneous excavation of two to three waste pits at one time.

**Objectives:** To ensure a safe work environment, thorough and timely job completion, and to properly document the findings of the remedial effort for regulatory review.

**Responsibilities:** The geologist and the engineer prepared daily progress reports to substantiate the findings of the remedial efforts. Because unique conditions arose frequently, the geologist and engineer worked together with other specialists on the job to overcome difficult challenges such as extreme weather conditions (summertime heat, dry, arid), deep excavations (over 30 feet), and diverse waste streams (hazardous, radioactive, biological, etc.).

**Geologist:** Responsible for sampling, classification, and characterization of materials that were excavated, processed, sorted, stockpiled, and eventually disposed of.

**Engineer:** Responsible for overseeing, coordinating, monitoring, and reporting field activities as well as logistics and excavation safety.

### ***Waste Characterization and Management***

**Nature:** Waste streams that were previously segregated based upon field observation, now required further, more formal, characterization as well as proper storage.

**Objectives:** To properly characterize the different waste streams for disposal and provide adequate temporary storage facilities.

**Geologist:** Responsible for the collection of waste characterization samples and classification of stockpiled materials.

**Engineer:** Responsible for the evaluation and design of temporary storage facilities for waste materials.

## **PROJECT CLOSURE**

### ***Preparation of Closure Report***

**Objective:** To produce a report for regulatory and public review that was comprehensible and accurately documented remedial efforts and results.

**Responsibilities:** This phase of the project again brought the geologist and the engineer together to work as a seamless unit. Shared duties included the reduction and summarizing of analytical data, evaluation of data relative to established remedial goals, and an assessment of the overall effort.

***Site Restoration***

**Objectives:** To restore the project site as pristine as possible and continue to evaluate long range effectiveness of the remedial action.

**Geologist:** Responsible for establishing groundwater well networks for long term monitoring of the area.

**Engineer:** Responsible for creating a Restoration Plan to allow the site to be used for recreation. Plan included proposed topographic maps, drainage and erosion controls, roadways, etc.

The ability of geologists and engineers to operate as a cohesive unit is a tribute to some of the basic training requirements required by both professions at educational and career development levels. By employing the specific expertise of team members, BNL was able to not only complete the project safely and on schedule, but gain much needed confidence in the DOE from local politicians and civic groups.