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**WASTE MINIMIZATION APPLICATIONS
AT A REMEDIATION SITE**

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Waste Minimization Applications at a Remediation Site

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The Fernald Environmental Management Project (FEMP) is owned by the Department of Energy and was used for the processing of uranium. The facility is a 1,050 acre site in southwestern Ohio. In 1989 Fernald suspended production of uranium metals and was placed on the National Priorities List (NPL). Since production at Fernald formally ceased in 1991, the site's mission has changed from one of production to environmental restoration. A Remedial Investigation and Feasibility Study (RI/FS) is being conducted, along with other response actions under the 1990 CERCLA Consent Agreement with the EPA. This change in the mission forced many changes to occur in Management's operating philosophy. Many groups which were necessary for producing a product were deemed irrelevant for remediation work, including Waste Minimization.

Waste Minimization does not readily appear to be applicable to remediation work. Environmental remediation is designed to correct adverse impacts to the environment from past operations and generates significant amounts of waste requiring management. The premise of pollution prevention is to avoid waste generation, thus remediation is in direct conflict with this premise. Although greater amounts of waste will be generated during environmental remediation, treatment capacities are not always available and disposal is becoming more difficult and costly. This creates the need for pollution prevention and waste minimization.

Applying waste minimization principles at a remediation site is an enormous challenge. If the remediation site is also radiologically contaminated it is even a bigger challenge. Innovative techniques and ideas must be utilized to achieve reductions in the amount of waste that must be managed or dispositioned.

One concept utilized at Fernald was to shift the waste minimization paradigm from focusing efforts on source reduction to focusing efforts on recycle/ reuse by inverting the EPA waste management hierarchy. A fundamental difference at remediation sites is that source reduction has limited applicability to legacy wastes but can be applied successfully on secondary waste generation. The bulk of measurable waste reduction will be achieved by the recycle/reuse of primary wastes and by segregation and decontamination of secondary wastestreams. Each effort must be measured in terms of being economically and ecologically beneficial.

In Operable Unit 3, which consists of all the facilities and structures on the site, nearly 87% of the material to be dispositioned can be recycled. This includes heavy and light gauge metal such as equipment, lead flashing, ductwork, steel structures etc. The remaining waste will be disposed at the Nevada Test Site or an on-site disposal cell. The exact amount to be disposed is driven by effective project management.

During the decontamination and decommissioning ((D&D) of these facilities, secondary wastes will be generated. These secondary wastes include such things as anti-contamination clothing, wastewater, compactible trash, packaging materials, used equipment, tools, used chemicals, and a variety of other materials. The amount of secondary waste generated is dependent on how efficiently the project is planned and managed. Segregation techniques must be employed by project personnel in order to take materials and equipment into radiologically controlled areas and survey the materials back out as radiologically clean. By utilizing these techniques, materials are driven to the least-cost disposition, such as sanitary waste. Practicing segregation and practical decontamination will greatly reduce the amount of waste to be disposed, realizing a substantial cost savings.

Another effective concept employed at Fernald is the structuring of a dynamic waste Minimization Program in order to set the paradigm shift in motion. The program must be comprehensive, integrated, and proactive in order to capture opportunities early in the CERCLA process. Waste Minimization opportunities must be identified during each phase of the CERCLA process by integrating waste minimization/waste management personnel into the project teams. Project and design engineers must also be trained in the application of waste minimization techniques.

Starting at the Remedial Investigation, waste minimization opportunities exist during sampling activities, lab analysis, and treatability studies. Waste characteristics, waste quantities and potential dispositioning options are identified during this phase. Waste minimization plays a key role in defining the number and types of options available for conducting these activities.

During the Feasibility Study phase, additional analysis are performed to identify waste treatment and disposition options. Secondary waste generation becomes important during this phase and must be properly quantified.

The more tangible opportunities for waste minimization occur during the Remedial Design/Remedial Action phase. Design/Engineer/Construction (DEC) teams should be formed which include waste minimization personnel. This allows involvement up front in the design phase in order to coordinate, promote, identify, plan and implement all waste minimization opportunities. DEC teams offer invaluable access to all aspects of the remediation project.

The Waste Dispositioning Plan provided to the D&D contractor is another area where waste minimization opportunities can be identified. Segregation, decontamination, volume reduction and efficient packaging should all be discussed in the plan.

Finally, actual field presence by waste minimization/waste management personnel during project implementation is essential in order to assure all possible waste reduction techniques are utilized. This includes monitoring waste minimization boundaries, packaging activities, chemical usage, and segregation activities.

Effective project management has proven to be the most essential element in assuring waste minimization is applied to all remediation projects. Fernald has also determined that quantifying the actual amounts of wastes avoided or recycled/reused per project enables the effectiveness of the waste minimization program to be assessed. Quantifying these amounts was accomplished by developing specific performance measures for remediation activities. Typical waste minimization performance measures are based upon reductions in the amount of waste generated at a facility. At a remediation site this measure of effectiveness does not ensure proper accounting for reductions in secondary waste generation or recycle/reuse initiatives.

As an alternative to waste generation data, Fernald is tracking the initial (in situ) quantities of materials requiring management to the final quantities disposed, recycled, or reused from each remediation project. These three indices quantify the success of waste minimization applications and provide a benchmark for waste minimization in remediation activities. Remediation activities are tracked as nonroutine waste generating processes instead of as routine, on-going processes. Since each remediation activity is projectized, specific waste information is available. Activities are initiated with the approximate known quantities and types of waste in situ. This known quantity is used to calculate the following indices:

1. **Recycle Index** - This is calculated by taking the amount (volume or density) of the waste recycled over the amount of waste in situ.
2. **Reuse Index** - This is calculated by taking the amount (volume or density) of materials which are reused over the amount of waste in situ. This includes the reuse of equipment, supplies, and materials which can be quantified.
3. **Disposal Index** - This is calculated by taking the amount (volume or density) of waste that is disposed over the amount of waste in situ. This is tracked per waste type, such as demolition debris, metal, transite, and soil. This index enables the tracking of secondary waste generation, as well as packaging efficiencies and bulking factors.

Understanding what causes an increase or decrease in the amount of waste disposed leads to better project management. Tracking these three indices over time gives an accurate, graphical display for management to use in evaluating the waste management program. These indices should show a trend of more efficient management and cost savings as each project is completed and the lessons learned are applied to the next activity.

Fernald has realized the importance of applying waste minimization principles to remediation activities. Shifting the focus from source reduction to recycle/reuse of primary wastes and minimizing secondary waste generation has accomplished measurable reductions in wastes shipped for disposal. The success of this effort communicates to other facilities gearing-up for remediation and D&D activities that waste minimization is relevant during remediation and can be applied through effective project management.