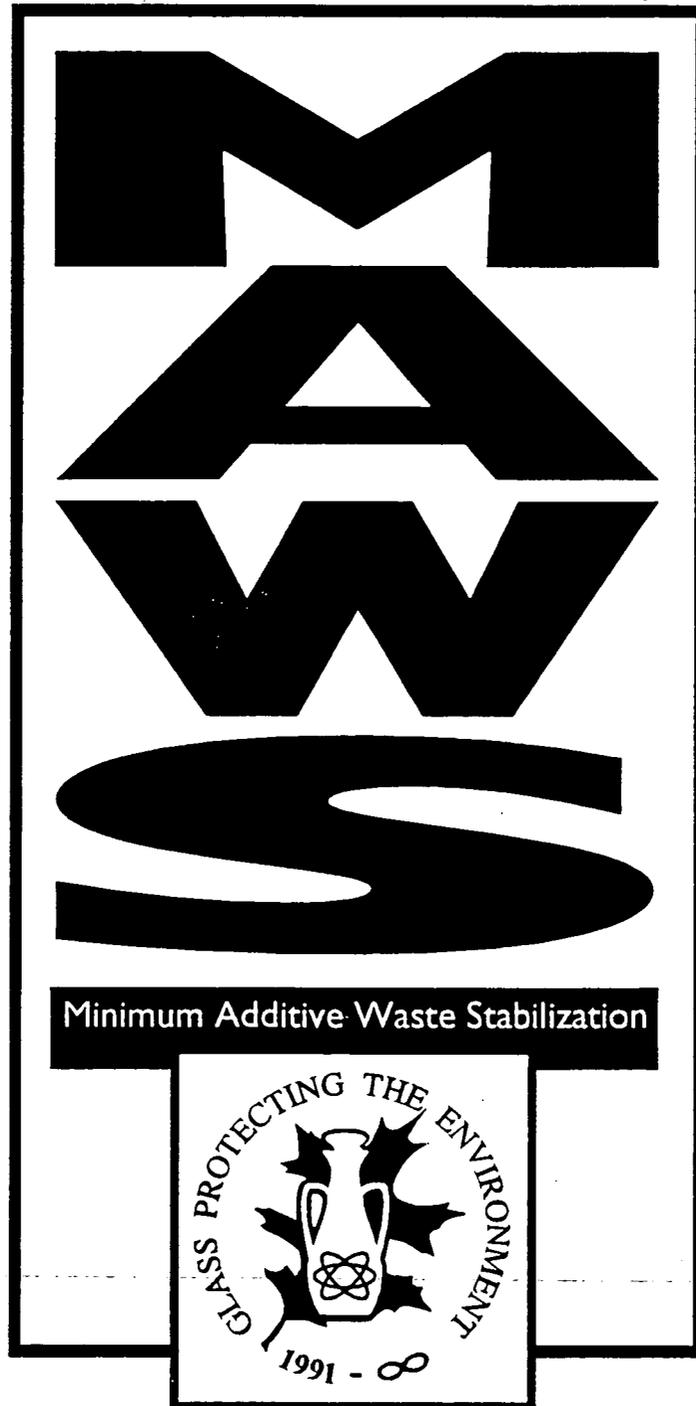


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**MISCELLANEOUS HANDOUTS FROM THE
COMMUNITY MEETING OF FEBRUARY 22, 1994**

02/22/94

**DOE-FN/PUBLIC
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HANDOUTS**



The minimum additive waste stabilization (MAWS) technology remediates multiple waste streams in one integrated treatment system that is cost-effective and produces an environmentally sound waste form for disposal. A treatment system that utilizes the MAWS concept is being demonstrated at the Department of Energy's Fernald Environmental Management Project (FEMP) in Fernald, Ohio near Cincinnati. At Fernald, approximately 350,000 cubic meters of residue from uranium ore processing was buried in waste pits. Pit sludge and the surrounding soil and groundwater are contaminated and require remediation. The MAWS concept integrates vitrification (turning wastes into glass) with soil washing and ion-exchange wastewater treatment and uses various wastes for resources as additives for vitrification, minimizing the use of costly additives. As a result, waste loading is increased, and the final waste volume, as well as the disposal cost, can be significantly reduced. The soil washing and wastewater treatment systems remediate contaminated soil and water, whereas the vitrification system incorporates the pit sludge and resulting contaminated soil concentrates and spent ion-exchange resins into a final, stabilized glass waste form. This systematic approach further maximizes waste loading while eliminating secondary waste streams. Use of the MAWS system at Fernald is expected to be competitive with traditional treatment methods such as cement stabilization.

INTRODUCTION

The minimum additive waste stabilization (MAWS) technology is being demonstrated at the FEMP. The MAWS system integrates into one single process three primary treatment technologies that are usually employed separately for site remediation: vitrification, soil washing, and ion-exchange wastewater treatment. The MAWS system is centered on vitrification and incorporates all primary and secondary waste streams into a final, stabilized glass waste form. The integrated system is innovative because the waste streams are viewed as material resources to vitrification (making glass), and a "portfolio" approach is adopted to maximize the economic benefit.

Vitrification has been previously used in the DOE Complex for treatment of low-volume, high-level radioactive wastes with low waste loading resulting in high treatment cost. However, the economic attractiveness for utilizing vitrification to treat large volumes of low-level waste/mixed waste (by maximizing waste loading) and the feasibility of production-scale processing have yet to be demonstrated. The MAWS program will demonstrate both the economics of total life cycle cost savings, through increased waste loading and final waste volume reduction, and the production-scale feasibility of vitrification of large volumes of low-level waste/mixed waste through a synergistic approach. In addition, it will demonstrate the capability of producing a leach-resistant, durable, waste form (glass), clean soil, and water for placement back into the environment, and an off-gas effluent that meets regulatory requirements.

BACKGROUND

The FEMP is a federal facility that previously produced pure uranium for DOE. Production ended in 1989, and the site's mission has since been dedicated to environmental restoration. Process wastes containing low concentrations of uranium and thorium were stored in six on-site waste pits, plus a burn pit and a clearwell, designated as Operable Unit 1 (OU-1); a significant portion of the FEMP wastes are listed as hazardous under the Resource Conservation and Recovery Act (RCRA) because they contain certain RCRA components. Studies have indicated that uranium contamination is present in the pit sludges and in the surrounding soils and groundwater.

The major factors affecting remediation cost are the large quantities and varieties of wastes needing remediation - e.g., OU-1 consists of approximately 350,000 cubic meters of pit wastes; up to 540,000 cubic meters of soil under the pits, in the caps over the pits, and in the berms; and about 8.7 million liters of contaminated surface water. MAWS technologies can be adapted to reduce OU-1 and other FEMP and DOE remedial costs.

In July 1992, a joint venture was established between the Office of Technology Development and the Office of Environmental Restoration within Environmental Restoration and Waste Management (EM) of DOE to demonstrate the MAWS process at the Fernald OU-1. The contractors participating in this demonstration include GTS Duratek Corporation (vitrification testing and wastewater treatment), Catholic University of America (vitrification testing), and Lockheed Environmental Systems Corporation (soil washing). On-site support will be provided by the DOE Fernald Office and its contractor, Fernald Environmental Restoration Management Corporation (FERMCO), management and their subcontractors. Contract management and glass durability testing will be provided by Argonne National Laboratory.

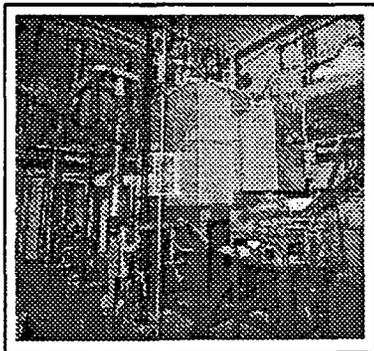
MAWS TECHNOLOGIES

LABORATORY STUDIES

The MAWS technology was adopted for demonstration at the FEMP because the site wastes (contaminated soils and sludges) contain both the glass former and the flux resources necessary for glassmaking. Waste characterization studies have been conducted to identify these glass-forming components. A glass composition variability study has been designed for combinations of soil-wash concentrates, waste pit sludges, spent ion-exchange media, and other identified wastes - with and without the addition of chemical additives. Extensive laboratory crucible melt studies have been conducted to determine the optimal blend of the wastes that will satisfy processing constraints (mainly melt viscosity, electrical conductivity, and liquidus temperature) and at the same time produce a leach-resistant, durable glass with high waste loading. Extensive glass property characterization and modeling is used in these studies to rapidly and efficiently determine target feed compositions. Characterization and laboratory development will also provide information about any components in the waste that may hinder the vitrification process and, thus, indicate when pretreatment of the waste may be necessary. Small-scale testing (10 kilogram/day and 100 kilogram/day glass output) in a continuous melter has also been conducted to obtain processing and off-gas performance data.

VITRIFICATION

The vitrification process uses high temperatures (typically between 1050 and 1600 degrees centigrade to chemically incorporate wastes into a glass matrix. At elevated temperatures, glass becomes electrically conductive, and the current passing between the electrodes in the vitrifier causes the conductive glass to heat and maintains the glass in a molten state. This process is known as joule heating. Most inorganics oxidize and dissolve in the molten glass because the great majority



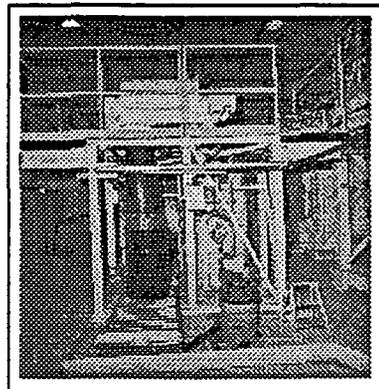
of oxides are soluble in silicate glasses; organics rapidly oxidize at the high temperatures and form simple gases (mostly carbon dioxide and water vapor) that are collected and treated in the off-gas system.

A vitrification system (GTS Duratek Duramelter) capable of producing at least 100 kg/day of glass from radioactive feed materials is located at the Vitreous State Laboratory of Catholic University of America. This system provides critical large-scale process data necessary for the development of process controls and operating protocols for the 300-kg/day system which is installed at the FEMP. Process data will include throughput rates, cold cap formation, and information on foaming events. Additionally, supporting data for scale-up to the larger pilot-scale and full-size units will continue to be collected from 10-kg/day and 100-kg/day units in conjunction with the 300-kg/day system to be used for the demonstration.

The vitrification system to be demonstrated at the FEMP will produce 300 kg/day of glass from radioactive waste. Presently, the 300 kg/day melter has produced glass gems which exceed the design capacity. On October 1, 1993, a continuous run using the fully integrated system, i.e. feed system, off-gas system and gem machine, was completed with non radioactive/ non hazardous surrogate material. On January 9, 1993, a continuous run was completed on a surrogate waste with high fluoride content. An extensive on-site testing program will be conducted to provide the essential system performance and operating data necessary for treatment technology selection at FEMP. These data will also provide the basis for scale-up to larger pilot-scale and full-scale treatment systems. Additional tests will be performed to support delisting of the vitrified waste, which would result in further cost savings for storage and monitoring. The FEMP vitrification system has been designed to handle a blend of pit sludges, spent resins, and soil concentrates. Site fly ash may also be tested as a source of silica. It is expected that the system may also be capable of vitrifying asbestos and Transite with little or no modification, which would be advantageous for application to other needs of the DOE Complex because such wastes are widespread. The MAWS system will be capable of dispensing the vitrified product into drums in the form of glass gems. The gems will be of various sizes to facilitate packing and enhance volume reduction while maintaining easy handling of the vitrified product.

The off-gas system will have an advanced two-stage scrubbing system designed to produce no secondary waste streams. The off gases will then be treated by high-efficiency particulate air filtration to meet regulatory requirements for release. Monitoring equipment will also be provided.

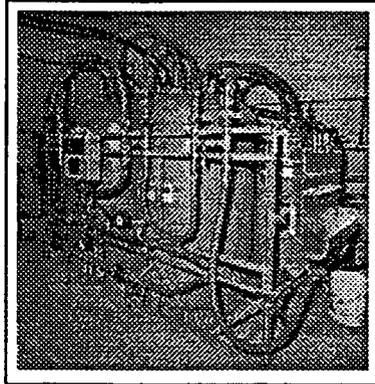
SOIL WASHING



Soils, primarily contaminated with uranium, will be washed with a special soil washing process (Lockhead TRUclean soil washer) to separate them into clean soils and soil concentrates. This will be accomplished by passing a slurry of the contaminated soils through a series of scrubbers, gravimetric separators, and hydrocyclone separators. Laboratory studies of FEMP soils have been performed to specify the demonstration unit, and a carbonate leach step has been added to achieve the target uranium cleanup level. The demonstration unit at FEMP will be able to process 0.4 cubic meters/hour of soil. The soil concentrates will be used as feed for the vitrification. All input and output streams will be analyzed for contaminants to determine the success of the soil washing for radionu-

clide removal and other RCRA contaminants, if appropriate. Mass balance calculations will verify final disposition of the contaminants. These studies are being conducted in close collaboration with the laboratory waste water treatment studies to ensure that the effluent from the process can be treated in the ion-exchange system and then recycled to the melter for ultimate stabilization of the contaminants in the vitrification system.

ION-EXCHANGE WATER TREATMENT



The water treatment system will treat contaminated wastewater from the vitrification and soil washing systems. Uranium and thorium contaminants will be stripped off by an organic ion-exchange resin and redeposited onto a glass resin that can be fed to the vitrifier, allowing for conventional disposal of the spent organic resin. The success and economics of this process will be evaluated and documented at the end of the FEMP demonstration. If necessary, the process can be modified to remove hazardous constituents, such as toxic metals, to ensure that all water quality standards are met for water discharged from the system. An acid-stripping process will be developed for regenerating the Dowex 21K organic ion-exchange resin used in the water treatment system. The stripped uranium will then be collected and used as feed for the melter.

A 10- to 100-gallon per minute water treatment system, capable of removing uranium from the influent to levels below 20 parts per billion, is installed at FEMP. Operating parameters for the system will be optimized by performing laboratory studies using soil wash waters as the influent.

INTEGRATION OF TECHNOLOGIES

Process feasibility evaluations will be performed for each technology as well as for the overall integrated system. The key objective of evaluating the capability and performance of each individual technology is to determine the system parameters necessary to optimize the performance of the overall integrated system. Optimum performance of a system involving multiple and interactive steps is generally not obtained by optimizing each step individually. Performance itself is a multi-attribute variable composed of factors including leach resistance of the final waste form, overall waste volume reduction, waste loading, system throughput rates, and capital, operating, and waste disposal costs. Economic feasibility studies will be conducted for the integrated system on the basis of cost estimates for the overall process over the life cycle of the program.

REMEDIAL INVESTIGATION/FEASIBILITY STUDIES AND ECONOMICS

A database on vitrification process parameters for FEMP wastes will be developed from the MAWS program, as well as from other vitrification studies being carried out as part of the Remedial Investigation/Feasibility Study (RI/FS) process at FEMP. This information will permit a detailed comparative analysis of processing and economic feasibility relative to alternative stabilization technologies and will provide the basis for vitrification process scale-up and design.

GLASS CHARACTERIZATION AND DURABILITY

Even if the MAWS concept proves to be technically feasible and economical, further testing may be needed to demonstrate that the vitrified waste product will endure with time and may be protective of the environment. The MAWS program includes extensive testing to provide a database of quality, consistency, homogeneity, leachability, and durability of the vitrified waste product. Expected long term performance of the glass will be determined and documented. These data may then be used to supplement the existing database on glass performance (mainly high-level waste glass) for use in studies to determine whether it is possible to place the treated waste in less expensive disposal facilities, thus further reducing site remediation costs.

A three-tiered leach testing approach for durability will be used: (1) standard toxicity characteristic leaching procedure (TCLP) and product consistency testing for inorganics, (2) service condition testing, and (3) accelerated testing. This tiered approach will identify and conduct practical testing methods that can be used to determine the performance of the vitrified product (including elemental and radionuclide release characteristics) under disposal conditions. A variety of other leach testing methods will also be used in conjunction with detailed surface analyses by analytical electron microscopy, scanning electron microscopy, secondary ion mass spectrometry, and optical microscopy. The objective of these tests will be establish a meaningful testing approach and database for demonstrating the durability of the glass product.

DELISTING OF THE GLASS WASTE FORM

Although the high temperatures of the vitrification process are expected to destroy the organic components responsible for RCRA listing and the final glass waste form is expected to be highly leach-resistant, the glass will remain a listed waste (mixed waste). This listing presents additional storage costs, as well as concerns for the FEMP during bench-scale and pilot-scale studies, and will ultimately affect the type of disposal facility selected. For these reasons, the MAWS program will collect a large number of samples of the glass waste form produced in this program for subsequent characterization by independent EPA-certified laboratories to support a delisting application.

This vitrification system demonstration will potentially provide a basis for the adoption of in-furnace vitrification as the EPA best demonstrated available technology (BDAT) for selected multiple waste streams, such as raffinate sludges and soils (similar to adoption of vitrification for high-level wastes). If adopted as BDAT, it could expedite remediation programs at many DOE sites that may otherwise be forced to deal with demonstrating leach-resistance to satisfy potential requirements for mixed waste forms (beyond passing the TCLP test), an area in which appropriate regulations, and even consensus test methods, are conspicuously lacking.

ACCOMPLISHMENTS

- Completed surrogate 300 kg/day glass run with gem maker.
- Completed fluoride run with the 300 kg/day melter.

FUTURE PLANS

- Demonstrate and develop the process for several waste forms.
- Complete radioactive soil washing run.
- Complete radioactive/mixed waste run with the 300 kg/day melter.
- Demonstrate the fully optimized process in 1994.
- Expand the MAWS program to other DOE sites, as applicable.

This fact sheet has been prepared as part of the effort to familiarize the public with the specific vocabulary used in discussions about environmental restoration and waste management at Fernald.

ALARA - As Low As Reasonably Achievable, or keeping radiation emissions and exposures to levels set as far below regulatory limits as is reasonably possible in order to protect public health and the environment.

alpha radiation - The most energetic but least penetrating form of radiation. It can be stopped by a sheet of paper and cannot penetrate human skin. However, if an alpha-emitting isotope is inhaled or ingested, it will cause highly concentrated local damage.

aquifer - A permeable body of rock capable of yielding quantities of groundwater to wells and springs.

AR - Administrative Record, a required, comprehensive file of documents that forms the basis of decisions made regarding cleanup at Fernald. It is available for public review and comment. (See PEIC).

ARARs - Applicable or relevant and appropriate requirements, a comprehensive set of laws and regulations that are relevant to guide the selection of cleanup activity at a particular site.

asbestos - A strong and incombustible fiber widely used in the past for fireproofing and insulation. The small, buoyant fibers are easily inhaled or swallowed, causing a number of serious diseases including: asbestosis, a chronic disease of the lungs that makes breathing more and more difficult; cancer; and mesothelioma, a cancer (specific to asbestos exposure) of the membranes that line the chest and abdomen.

atom - The smallest particle of an element having the chemical properties of that element; the fundamental building block of matter.

AWWT - Advanced waste water treatment

background radiation - The natural radioactivity in the environment. Natural radiation consists of cosmic rays, filtered through the atmosphere from outer space, and radiation from the naturally radioactive elements in the earth (primarily uranium, thorium, radium and potassium). Also known as natural radiation.

baseline risk assessment - (See BRA).

BDN - Biodenitrification, the process of breaking down nitrates into harmless elements through the use of living bacteria.

beta radiation - High-energy electrons (beta particles) emitted from certain radioactive material. Can pass through 1 to 2 centimeters of water or human flesh and can be shielded by a thin sheet of aluminum. Beta particles are more deeply penetrating than alpha particles but, because of their smaller size, cause less localized damage.

biological effects - The early or delayed results of biological damage caused by nuclear radiation (alpha, beta gamma).

biosphere - The part of the earth and its atmosphere in which living things exist.

BRA - Baseline risk assessment, the study and estimation of risk from taking no activity. Involves estimates of probability and consequence.

carcinogen - A cancer-causing agent.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund), the federal law that guides cleanup of hazardous waste sites.

CFR - Code of Federal Regulations

characterization - Facility or site sampling, monitoring and analysis activities to determine the extent and nature of a release. Characterization provides the basis for acquiring the necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

CIS - Characterization investigation study

cleanup - The general term for environmental restoration, the process designed to ensure that risks to the environment and to human health and safety from waste sites either are eliminated or reduced to prescribed, safe levels.

closure plan - Documentation prepared to guide the deactivation, stabilization and surveillance of a waste management unit or facility under the Resource Conservation and Recovery Act.

conservation - The preservation of resources through efficient and careful use.

contamination - The presence of foreign materials, chemicals or radioactive substances in the environment (soil, sediment, water or air) in significant concentrations.

CRARE - Comprehensive Response Action Risk Evaluation.

CRU - CERCLA/RCRA unit, another term for the operable units at Fernald.

cubic meters - A volume equal to the volume of a cube measuring one meter in each dimension.

comment period - Time provided for the public to review and comment formally on a proposed action or decision.

community relations - The effort to establish two-way communication with the public to ensure public input into the decision-making process related to Superfund.

curie - A unit of radioactivity that represents the amount of radioactivity associated with one gram of radium. To say that a sample of radioactive material exhibits one curie of radioactivity means that the element is emitting radiation at the rate of 3.7 million times a second. Named after Marie Curie, an early nuclear scientist.

consent decree - Signed agreement between DOE and OEPA that mandate specific environmental improvements at Fernald

daughter product - An element formed by the radioactive decay of another element; often daughter products are radioactive themselves

DEs - Drum equivalents

decay - The process whereby radioactive particles undergo a change from one form, or isotope, to another, releasing radioactive particles and/or energy.

decontamination - The removal of unwanted material (typically radioactive material) from facilities, soils, or equipment by washing, chemical action, mechanical cleansing or other techniques.

defense wastes - Radioactive wastes resulting from weapons research and development, the operation of naval reactors, the production of weapons materials, the reprocessing of defense spent fuel, and the decommissioning of nuclear-powered ships and submarines.

disposal - Waste emplacement designed to ensure isolation of waste from the biosphere, with no intention of retrieval for the foreseeable future.

dioxin - One of the most hazardous of all chemicals, can cause both acute and long-term effects ranging from chloracne, a skin disease, to cancer, reproductive failures, and reduced resistance to infectious disease.

DOE - U.S. Department of Energy

DOE-FN - U.S. Department of Energy Fernald Field Office

dose - Quantity of radiation or energy absorbed; measured in rads. (See rad).

dose equivalent - A term used to express the amount of effective radiation received by an individual. A dose equivalent considers the type of radiation, the amount of body exposed, and the risk of exposure. Measured in rems. (See rem).

dosimeter - An instrument that measures exposure to radiation.

EA - A written environmental analysis that is prepared under the National Environmental Policy Act to determine whether a federal action would significantly affect the environment and thus require preparation of a more detailed environmental impact statement.

effluent - A waste discharged as a liquid.

electron - An elementary particle with a unit negative charge and a mass 1/1837 that of the proton. Electrons surround the positively charged nucleus and determine the chemical properties of

the atom.

EE/CA - Engineering evaluation and cost analysis

EIS - Environmental impact statement, required by the National Environmental Policy Act. (See NEPA).

element - Any of the 109 substances that cannot be broken down further without changing its chemical properties. Singly or in combination, the elements constitute all matter.

EMR - Environmental monitoring report also called the Annual Site Environmental Report

environmental restoration - The process of environmental cleanup designed to ensure that risks to the environment and to human health and safety from waste sites either are eliminated or reduced to prescribed, safe levels.

ERMC - Environmental restoration and management contractor

erosion control - Methods to control land surface features to prevent erosion by surface water or precipitation runoff.

EWMF - An engineered waste management facility, designed to store low-level radioactive wastes.

exposure - A measurement of the displacement of electrons from atoms caused by x-rays or by gamma radiation. Acute exposure generally refers to a high level of exposure of short duration; chronic exposure is lower-level exposure of long duration.

FEMP - Fernald Environmental Management Project, the name given Fernald when its missions was transferred from weapons production to environmental restoration

FERMCO - Fernald Environmental Restoration Management Corporation, the contractor selected in August 1992 to clean up Fernald

FFCA - Federal Facility Compliance Agreement, an agreement signed in 1986 between DOE and U.S. EPA; predates the Consent Agreement and the Amended Consent Agreement.

final disposition - Methods for permanent disposal of waste or contaminated media residuals following excavation/treatment.

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fission - The splitting of a heavy nucleus into two or more radioactive nuclei, accompanied by the emission of gamma rays, neutrons and a significant amount of energy. Fission usually is initiated by the heavy nucleus absorbing a neutron, but it also can occur spontaneously.

FMPC - Feed Materials Production Center, the name of Fernald until 1991

FR - Federal Register

FRESH - Fernald Residents for Environment, Safety and Health

friable asbestos - Asbestos insulation that is loose and capable of becoming airborne.

FS - Feasibility study, the Superfund study following a remedial investigation which identifies, develops, evaluates and selects remedial action alternatives.

gamma rays - Penetrating electromagnetic waves or rays emitted from nuclei during radioactive decay, similar to x-rays. Dense materials such as concrete and lead are used to provide shielding against gamma radiation.

geohydrologic - Pertaining to groundwater and its movements through the geologic environment.

geohydrology - The science dealing with underground water, often referred to as hydrogeology.

groundwater - Waste beneath the earth's surface that fills pores between materials such as sand, soil or gravel. Groundwater is a major source of water for agricultural and industrial purposes and is an important source of drinking water for about half of all Americans.

half-life - The time required for a radioactive substance to lose 50 percent of its activity by decay. The half-life of the radioisotope plutonium-239, for example, is about 24,000 years. Starting with a pound of plutonium-239, in 24,000 years there will be one-half pound of plutonium-239, in another 24,000 years there will be one-fourth pound, and so on. (A pound of material remains, but it gradually becomes a stable element.)

hazardous waste - A solid waste or combination of solid wastes that, because of quantity, concentration or physical, chemical or infectious characteristics, may cause or significantly contribute to an increase

in mortality or an increase in serious, irreversible, or incapacitating-reversible-illness or pose a substantial hazard to human health or the environment when improperly treated, stored, transported, disposed or otherwise managed. About 290 million tons of hazardous wastes are generated in the United States each year. A small percentage (about 4 percent) is recycled. The rest is treated, stored or disposed. Of the hazardous wastes disposed, most are injected as a liquid into the ground in specially designed injection wells. A large quantity is placed in surface impoundments (pits, ponds and lagoons). A small portion is placed directly on the land or buried.

heavy metals - Metals that are dense. Examples include mercury, lead, silver, gold and uranium.

HEPA - High-efficiency particulate air

high-level radioactive wastes - Highly radioactive material, containing fission products, traces of uranium and plutonium, and other transuranic elements, that results from chemical reprocessing of spent fuel. Originally produced in liquid form, high-level waste must be solidified before disposal.

ion - Atomic particle, atom or chemical radical bearing an electric charge, either negative or positive.

ionization - Removal of electrons from an atom, for example, by means of radiation, so that the atom becomes charged.

ionizing radiation - Radiation that has enough energy to remove electrons from substances it pass through, forming ions.

isotopes - Atoms of the same element that have equal numbers of protons, but different numbers of neutrons. Isotopes of an element have the same atomic number by different atomic mass. For example, uranium-238 and uranium-235.

leachate - The solution formed when soluble components have been removed from a material.

leaching - To remove a soluble substance from a material by dissolving it in a liquid, and then removing the liquid from what is left.

LLW - Low-level waste, discarded radioactive material such as rags, construction rubble, glass, etc., that is only slightly or moderately contaminated. This waste usually is disposed of by land burial.

millirem - A unit of radiation dosage equal to one-thousandth of a rem. A member of the public can safely receive up to 500 millirems per year, according to federal standards, but the U.S. EPA ordinarily limits public exposure to 25 to 100 mrem/year.

mixed waste - Contains both radioactive and hazardous components.

mobility - The ability of radionuclides to move through food chains in the environment.

monitoring well - A hole drilled into the ground with a pipe inserted to allow for the collection of groundwater samples.

natural radiation - Radiation that is always present in the environment from such sources as cosmic rays and radioactive materials in rocks and soils. Also known as background radiation.

NCP - National Oil and Hazardous Substances Pollution Contingency Plan

NEPA - National Environmental Policy Act, requires a study of the impacts of activities at federal facilities.

neutron - A particle that appears in the nucleus of all atoms except hydrogen. Neutrons are one of three basic particles that make up the atom. Neutrons have no electrical charge.

NLO - National Lead of Ohio, Inc., the company that operated Fernald from 1951 until 1986

NOA - Notice of availability, published when a document on some aspect of Fernald cleanup is issued. Documents are available in the administrative record and public reading room.

NOV - Notice of violation

NPDES - National Pollutant Discharge Elimination System

NPL - National Priorities List, the list of the nation's worst Superfund sites. Fernald was added in 1989.

NRC - Nuclear Regulatory Commission

NTS - Nevada Test Site, a repository for radioactive wastes.

nuclear radiation - Ionizing radiation originating in the nuclei of atoms; alpha, beta, and gamma radiation.

nucleus - The central part of an atom that contains protons, neutrons and other particles.

OEPA - Ohio Environmental Protection Agency

OSHA - Occupational Health & Safety Act

OU - Operable unit, or area of study that contains similar characteristics or problems. There are five operable units at Fernald.

pathways - The means by which contaminants move. Possible pathways include air, surface water, groundwater, plants and animals.

PCB - Polychlorinated biphenyl, a synthetic, organic chemical once widely used in electrical equipment, specialized hydraulic systems, heat transfer systems, and other industrial products. Highly toxic and a potent carcinogen. Any hazardous wastes that contain more than 50 parts per million of PCBs are subject to regulation under the Toxic Substances Control Act.

PEIC - Public Environmental Information Center, 10845 Hamilton-Cleves Highway, Harrison, Ohio 45030, which houses the administrative record and the public reading room. The phone number is 513-738-0165.

PEIS - Programmatic environmental impact statement, being conducted nationally by DOE.

picocuries - Measurement of radioactivity. A picocurie is one million millionth, or a trillionth, of a curie, and represents about 2.2 radioactive particle disintegrations per minute.

plume - A defined area of groundwater containing contamination that originates from a particular source such as a waste unit.

plutonium - An artificially produced element that is fissile and radioactive. It is created when an atom of uranium-238 captures a slow neutron in its nucleus.

PP - Proposed plan, a CERCLA document on which the public comments that summarizes what cleanup remedy has been selected, and why.

RA - Risk assessment, the study and estimation of risk from a current or proposed activity. Involves

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estimates of the probability and consequence of an action.

rad - Radiation absorbed dose, a measurement of ionizing radiation absorbed by any material. A rad measures the absorption of a specific amount of work (100 ergs) in a gram of matter.

radiation - Fast particles and electromagnetic waves emitted from the nucleus of an atom during radioactive disintegration.

radioactive - Giving off, or capable of giving off, radiant energy in the form of particles (alpha or beta radiation) or rays (gamma radiation) by the spontaneous disintegration of the nuclei of atoms. Radioisotopes of elements lose particles and energy through the process of radioactive decay. Elements may decay into different atoms or a different state of the same atom.

radioactive waste - A solid, liquid or gaseous material of negligible economic value that contains radionuclides in excess of threshold quantities except for radioactive material from post-weapons-test activities.

radioisotope - An unstable isotope of an element that eventually will undergo radioactive decay (i.e., disintegration). Radioisotopes with special properties are produced routinely for use in medical treatment and diagnosis, industrial tracers, and for general research.

radionuclide - A radioactive species of an atom.

radon - A radioactive gas produced by the decay of one of the daughters of radium. Radon is hazardous in unventilated areas because it can build up to high concentrations and, if inhaled for long periods of time, may cause lung cancer.

RCRA - Resource Conservation and Recovery Act, the federal environmental law designed to account for and ensure proper management of hazardous wastes, from creation to disposition

rem - Roentgen equivalent man, a unit used in radiation protection to measure the amount of damage to human tissue from a dose of ionizing radiation. Incorporates the health risks from radiation.

remedial action - Long-term cleanup activities

remedial design - A phase of remedial action that follows that remedial investigation/feasibility study

and includes development of engineering drawings and specifications for a site cleanup.

remediation - Those activities performed to remove or treat hazardous waste sites or to relieve their effects.

removal action - Interim cleanup activities that are identified as needed to protect public health and the environment

restoration - (See environmental restoration)

RI - Remedial investigation, the CERCLA process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations.

RI/FS - Two distinct, but related studies, the remedial investigation and feasibility study. Together, they characterize environmental problems and outline remedial actions to solve those problems.

Risk assessment - (See RA)

risk communication - The exchange of information about health or environmental risks between risk assessors, risk managers, the general public, news media, interest groups, etc.

risk management - The process of evaluating alternative regulatory and non-regulatory responses to risk and selecting among them. The selection process necessarily requires the consideration of legal, economic and social factors.

ROD - Record of decision, a written decision that identifies the selected method for long-term cleanup of contamination at a site

SARA - Superfund Amendments and Reauthorization Act

scoping - In CERCLA, scoping is the initial planning phase of the cleanup process, when requirements are discussed and the projects defined. In the NEPA process, scoping relates to public involvement to help identify significant issues early so that efforts can be focused on those areas requiring resolution and to present a balanced environmental impact statement.

sludge - A semi-solid residue from any of a number of air or water treatment processes. Sludge can be a hazardous waste.

slurry - A watery mixture of insoluble matter that results from some pollution control techniques.

Superfund - The program operated under the legislative authority of CERCLA and SARA that funds and carries out the EPA solid waste emergency and long-term removal remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority level on the list, and conducting and/or supervising the ultimately determined cleanup and other remedial actions.

solidification - The conversion of either liquid or loose hazardous waste into a solid.

solubility - A measure of how much of a given substance will dissolve in a liquid. Usually measured in weight per unit volume.

somatic effects - Effects of radiation limited to the exposed individual, as distinguished from genetic effects, which also affect subsequent, unexposed generations.

stable isotope - An isotope of an element that is not radioactive.

SWCR - Site-wide characterization report

thorium - A naturally-occurring radioactive element

threshold dose - The minimum dose of radiation that will produce a detectable effect.

toxic - Relating to a harmful effect by a poisonous substance on the human body by physical contact, ingestion or inhalation.

toxicology - The science that deals with poisons and their effects on plant, animal and human life.

transuranic wastes - Waste materials contaminated with isotopes above uranium in the periodic table. Transuranic waste is long-lived, but only moderately radioactive.

treatment - Any activity that alters the chemical or physical nature of a waste to reduce its toxicity or prepare it for disposal.

uranium - The heaviest element found in nature. Approximately 997 out of every 1000 uranium atoms are uranium-238. The remaining 3 atoms are the fissile uranium-235. The uranium-235 atom

splits, or fissions, into lighter elements when its nucleus is struck by a neutron.

U.S. EPA - United States Environmental Protection Agency, sometimes referred to as EPA.

UST - Any underground storage tank or associated piping containing hazardous materials.

vitriification - A method of immobilizing waste that produces a glass-like solid that permanently captures the radioactive materials.

VOCs - Volatile organic compounds, chemicals that contain carbon and commonly also contain hydrogen, oxygen and other elements. The prefix "volatile" means that the compound evaporates rapidly. Most industrial solvents are volatile. Found in some liquid and air waste releases.

waste minimization - Employing new techniques to reduce the amount of hazardous and radioactive wastes generated to as low a level as possible.

WEMCO - Westinghouse Environmental Management Company of Ohio, the contractor who ran Fernald from 1986 until December 1, 1992. Formerly WMCO, for Westinghouse Materials Company of Ohio.

x-rays - Electromagnetic radiations used in medical diagnosis; a penetrating electromagnetic radiation, usually generated by accelerating atoms to high velocity and suddenly stopping them by collision with a solid body.

Concentration Comparisons

Parts per million:

- One automobile in bumper-to-bumper traffic from Cleveland to San Francisco
- One drop of gasoline in a full-size car's tankful of gas
- One facial tissue in a stack taller than the Empire State Building
- One pancake in a stack four miles high

Parts per billion:

- One silver dollar in a roll of silver dollars stretching from Detroit to Salt Lake City

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● One kernel of corn in enough corn to fill a 45-foot-silo, 16 feet in diameter

● One sheet in a roll of toilet paper stretching from New York to London

Parts per trillion:

- One square foot of floor tile on a kitchen floor the size of Indiana
- One drop of detergent in enough dishwasher to fill a train load of railroad tank cars 10 miles long
- One mile on a two-month journey at the speed of light

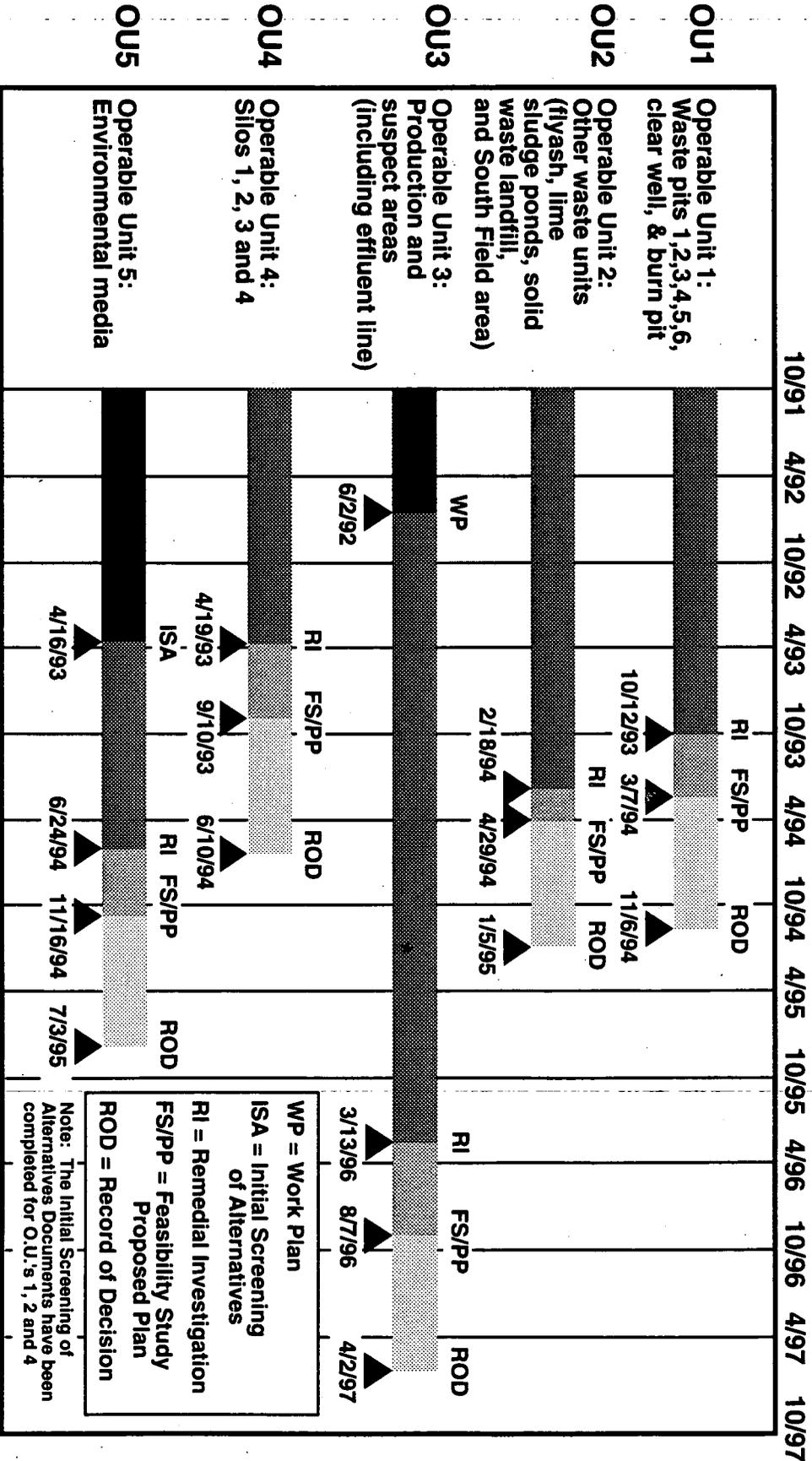
Parts per quadrillion:

- One postage stamp on a letter the size of California and Oregon combined
- The palm of one's hand resting on a table the size of the United States
- One human hair out of all the hair on all the heads of all the people in the world
- One mile in a journey of 170 light years

Sources:

- *Glossary of Environmental Restoration Terms and Acronym List* (EPA/OPA-87-017, August 1988)
- *Glossary of Environmental Restoration* (DOE, Office of Environmental Restorations and Waste Management, Oak Ridge Operations, October 1990 and October 1991)

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT SCHEDULE OF RI/F/S ACTIVITIES



* The OU3 ISA will be incorporated into the OU3 FS

UPCOMING PUBLIC PARTICIPATION ACTIVITIES

DATE/TIME	EVENT	PLACE	TOPIC
Second and fourth Monday each month 7:30 p.m.	Crosby Township Meeting	Crosby Township Civic Center	Fernald status report and updates given at each meeting.
First and third Thursday each month 7:00 p.m.	Ross Township Meeting	Ross Fire House	Fernald status report and updates given at each meeting.
First and third Monday each month 7:30 p.m.	Morgan Township Meeting	Morgan Township Civic Center	Fernald status report and updates given at each meeting.
Fourth Thursday each month 7:30 p.m.	FRESH Meeting	Venice Presbyterian Church	Fernald status report and updates given at each meeting.
February 22, 1994 6:00 - 9:30 p.m.	DOE Community Meeting	The Plantation Harrison, Ohio	Fernald Cleanup Status and Break-out Sessions
March 7 - April 20	Operable Unit 4 Public Comment Period on the Proposed Plan	Comments can be mailed to DOE at P.O. 398705, Cinti, Ohio 45239-9705	Public input on the preferred alternative for disposal of waste and structures of Silos 1, 2, 3, and 4.
March 12, 1994 April 9, 1994 8:30 a.m. - Noon	Fernald Citizens Task Force Monthly Meetings	AmeriSuites Forest Park	Open to public. Topics include waste disposal and future land use.
March 21, 1994 7:00 - 10:00 p.m.	Operable Unit 4 Public Meeting on Proposed Plan	The Plantation Harrison, Ohio	Discussion on the Proposed Plan. Public comments will be taken.
April 5, 1994 (tentative) 7:00 - 9:00 p.m.	Workshop on the Operable Unit 1 Feasibility Study/ Proposed Plan	TBD	Explanation of the alternatives selected as cleanup remedies for Operable Unit 1.