

EPA AND DOE COOPERATIVE EFFORTS ON MIXED WASTE TREATMENT

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ABSTRACT

Over the last several years, the U. S. Environmental Protection Agency (EPA) and the U. S. Department of Energy (DOE) have undertaken a wide range of cooperative activities related to the treatment of mixed waste. Under an interagency agreement, EPA and DOE formed the National Technical Workgroup on Mixed Waste (NTW) to cooperate on technical issues associated with the regulating, permitting, and research/development/demonstration of treatment technologies for mixed waste. Specific examples of EPA and DOE cooperation include permit roadmap for mixed waste treatment, cooperative research on continuous emissions monitors, technical assistance on sampling from mixed waste treatment effluents, mercury waste treatment and stabilization, and dioxin in secondary waste. EPA and DOE have decided to continue to work together and have recently executed a Memorandum of Understanding (MOU) on Coordinated Research. A key objective of this MOU is to encourage enhanced cooperation between DOE's Office of Science and Technology (OST) and the EPA's Office of Solid Waste (OSW) in research, development, and demonstration (RD&D) on cost-effective waste management technologies. This MOU is also designed to provide EPA technical data to develop more effective and appropriate standards for mixed waste management issues. This MOU will establish an enhanced level of cooperation on the development of technical solutions to address the problem of mixed waste treatment. Several initial activities are currently being initiated under the MOU. This paper will cover (1) EPA emerging regulations impacting mixed waste treatment, (2) the existing DOE and EPA joint efforts under the NTW charter, and (3) the future efforts between DOE and EPA under the new MOU.

INTRODUCTION

Mixed waste contains hazardous waste and radioactive material, and is subject to the requirements of Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). The regulatory requirements imposed by RCRA are implemented by EPA and the States. DOE sites that store, treat, or dispose of mixed waste must comply with the regulatory requirements of RCRA in addition to AEA regulations. In addition, remediation of mixed waste at DOE facilities must be consistent with guidance and regulations under section 120(a)(2) of CERCLA as amended.

Hazardous and radioactive waste sites pose difficult challenges to DOE as owner of these sites and to EPA as a regulator of these sites. DOE stores more than 165,000 cubic meters of mixed waste, which includes more than 2,300 different types of waste streams, at 36 DOE sites. In addition, DOE estimates that about 27,000 cubic meters of mixed low-level waste and

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transuranic waste will be generated over the next five years. These challenges exist in the management, treatment, and disposal of mixed wastes in environmentally sound and cost-effective ways.

EPA has developed comprehensive rules and regulations concerning the treatment of hazardous waste. The presence of radioactive constituents in mixed waste increases the complexity of waste management and treatment and therefore it is more critical to have effective communication between EPA and DOE on mixed waste issues. The two agencies recognize that the regulatory framework associated with complying with hazardous and radioactive waste treatment standards is complex and that a proactive approach of addressing the technical barriers is key to success. A number of regulatory activities are underway at the EPA that could impact DOE mixed waste treatment. Examples of regulatory activities that could impact mixed waste treatment over the next three to five years include the following:

- Hazardous Waste Combustion MACT Rule.
- Advanced Notice of Proposed Rule Making (ANPRM) on Mercury.
- Mercury Action Plan for Mercury.
- PCB “Mega-rule”.
- Land Disposal Restriction (LDR) IV and Corrections (Secondary Waste).
- Mixed waste Storage and Disposal Rules.

The following sections discuss the impacts of these rules on mixed waste treatment and the future cooperative activities that EPA and DOE will undertake to ensure development by EPA and compliance by DOE with these rules in a cost effective and environmentally protective manner.

EPA REGULATORY AND NON-REGULATORY ACTIVITIES AFFECTING MIXED WASTE

A number of EPA’s regulatory activities that are underway or have recently been completed will impact mixed waste storage, treatment, and disposal. Research and development are necessary to support the development of emerging rules and to cost-effectively comply with rules that have been finalized. Examples of regulatory activities that will likely drive research and development needs within the next three to five years include the following:

- Hazardous Waste Combustion Emission Standards. On July 30, 1999, EPA adopted a comprehensive set of emission standards for hazardous waste combustors, including DOE’s mixed waste incinerators. The standards cover dioxins and furans, mercury, five other heavy metals, total chlorine, and particulate matter (among others). This MACT rulemaking under the Clean Air Act will be implemented over the next three years. DOE Facility Compliance Date: July 2002.
- Mercury Hazardous Waste Treatment Standards. On May 28, 1999, EPA published an advance notice of proposed rulemaking (ANPRM) to initiate revisions to the hazardous waste treatment standards applicable to all mercury-bearing wastes, which includes any mixed waste containing mercury. One particular focus is on the effectiveness of non-

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combustion, alternative technologies that can treat organo-mercury wastes. Estimated final rule date: Summer 2001.

- **Mercury Action Plan.** This Action Plan consists of an assemblage of potential regulatory and voluntary actions, enforcement and compliance, research, and outreach to characterize and reduce risks associated with mercury. Its multimedia and cross-discipline focus and its emphasis on pollution prevention will impact mixed wastes containing mercury. Estimated completion: Now through an indeterminate future period.
- **PCB “Mega-Rule.”** On June 29, 1998, EPA promulgated amendments to 40 CFR part 761 significantly affecting the use, manufacture, processing, distribution in commerce, and disposal of PCBs. This Mega-Rule affects mixed wastes containing PCBs. Among other things, the amendments provide new alternatives for the cleanup and disposal of PCBs, establish standards and procedures for decontaminating materials contaminated with PCBs, and create a mechanism for recognizing, under TSCA, other Federal or State waste management permits or approvals for PCBs. DOE Facility Compliance Date: August 1998.
- **LDR Phase IV and Progeny.** On May 26, 1998, EPA promulgated treatment standards for characteristic metal-bearing wastes, including mixed wastes, under the RCRA Land Disposal Restrictions (LDR) program. The regulations also adopted alternative treatment standards for soil contaminated with hazardous waste. On May 11, 1999, this rule was corrected and clarified, particularly with respect to treatment residuals and point of generation – both of which directly affect DOE mixed waste facilities. DOE Facility Compliance Date: August 1998 for metal standards; authorized state program controls effective date of soil treatment standards.
- **Mixed Waste Storage, Treatment, and Disposal.** In November 1999, EPA published a notice of proposed rulemaking (NPRM) to make regulations more flexible for generators of mixed low-level radioactive waste (MLLW) who are storing wastes that EPA and the Nuclear Regulatory Commission (NRC) oversee. In this NPRM, EPA will seek comment on options for storing and managing mixed waste. EPA is also evaluating NRC storage and disposal regulations for their effectiveness in also properly managing chemical hazards. Estimated rule dates: Proposal in 2000 and promulgation in 2001.

NATIONAL TECHNICAL WORKGROUP ON MIXED WASTE TREATMENT

The EPA and DOE established an interagency agreement (IAG) in 1991, to address tasks of mutual interest to both agencies relative to mixed waste treatment facilities. The National Technical Workgroup (NTW) on Mixed Waste Treatment was established to

"Support the development of a coordinated, consistent, cost-effective and environmentally protective treatment of mixed waste through interagency cooperative efforts on compliance, regulatory development and implementation."

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The NTW is composed of representatives from important stakeholders involved with operating, regulating and permitting mixed waste treatment technologies including

- Environmental Protection Agency and State personnel including regional permit writers, researchers and regulation developers,
- Department of Energy and contractor personnel including facility operators, environmental management staff, and technology developers, and
- Personnel from privatized or commercial mixed waste treatment organizations

The drivers for the NTW relate to regulatory and/or permit actions that impact mixed waste treatment. Over the last few years the NTW has served as the national coordinating group to identify and resolve technical issues and barriers to regulating, permitting and compliance of mixed waste treatment facilities and to facilitate the exchange of technical information among various groups across the nation. NTW activities include coordination of research, development of technical resource documents, multi-agency technical assistance teams for site-specific issues, conducting of joint workshops on technical issues, and technology transfer of information. Some of the important current activities addressing these drivers include:

- MACT Rule Development, Implementation, Permitting and Compliance for Mixed Waste Treatment Facilities.
- Technical Assistance Teams (TATs) for Permitting Mixed Waste Treatment Facilities.
- The Mercury Compliance Strategy to develop the necessary information database on mercury control and compliance assurance in order to facilitate the rapid and environmentally protective compliance with the mercury provisions of the MACT standard.
- Mixed Waste Characterization for Generators and Treatment Operators.
- Human Health and Ecological Risk Assessment
- Alternative Technologies.

This workgroup provides a technical forum for a broad range of technical stakeholders to exchange information on lessons learned, technical solutions, permit roadblocks, streamlined permitting procedures, treatment technology and pollution control strategies, performance assurance techniques, and a wide variety of other technical issues related to the regulating, compliance and permitting of mixed waste treatment systems.

The annual meeting of the National Technical Workgroup is the major meeting for the full membership. It was held August 24-26, 1999 at the Hyatt Regency Crystal City near the Reagan National Airport in Arlington, Virginia. The NTW annual meeting is one of the best opportunities to review the outputs of the EPA/DOE interagency efforts and to provide input into the future directions of the technical activities. The objectives of this year's meeting was as follows:

- Technical interaction on special requirements of mixed waste treatment systems relative to implementation of MACT rules
- Develop consistent approach to implementation

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- Share lessons learned and ideas for compliance, monitoring and control technologies, compliance assurance, risk assessments and compliance testing

The meeting was scheduled just after the MACT rules had been promulgated and the Washington DC area was chosen to ensure that the MACT regulation writers would be well represented. Presentation materials from individual presenters and a summary of the workshop can be found on the NTW Web site (<http://www.ntw-mixedwaste.org>).

In the last year, EER has focussed on high priority technical issues identified as part of the continuing NTW dialogue among EPA, States and DOE. In the current fiscal year NTW is facilitating regulatory cooperation and address technical problems in areas such as

- **MACT Rule Permitting and Compliance for Mixed Waste Treatment Facilities.** The objectives of this task were to evaluate the impacts of and to support the implementation and compliance with the hazardous waste combustion Maximum Achievable Control Technology or (MACT) rules.
- **Technical Assistance Teams (TATs) for Permitting Mixed Waste Treatment Facilities.** The objective of this task was to provide a continuing mechanism by which owner/operators and permit writers can get rapid assistance on compliance and permitting technical issues for mixed waste treatment. The Technical Assistance Teams provide direct technical input to DOE and to permit writers by addressing specific technical issues arising from various case studies.
- **The Mercury Compliance Strategy.** The objective of this study was to develop the necessary information database on mercury control and compliance assurance in order to facilitate the rapid and environmentally protective compliance with the mercury provisions of the MACT standard.
- **Mixed Waste Characterization for Generators and Treatment Operators.** Under the sponsorship of the EPA/DOE Interagency Agreement, the EER has previously developed a Technical Resource Document on Waste Characterization. This task built upon this previous efforts and focused on the impacts of the new MACT rules, advanced waste characterization techniques such as nondestructive assays, continuous emissions monitors and generator requirements.
- **Risk Assessment.** In this task, EER investigated whether the various risk assessment methodologies can be combined and are defining approaches to resolve some of the inconsistencies among the different fate and transport models, air models, and the other numerous input parameters used within a risk assessment. A focus meeting was held to identify and resolve the various issues associated with risk assessment methodologies and results presentation formats.
- **Alternative Technologies.** The objective of this task was to examine the capabilities and the permitting (Subpart X) of emerging alternative technologies. The technologies include: all forms of thermal (combustion and oxidation) and non-thermal treatment

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technologies for mixed waste and associated air pollution control devices, continuous emissions monitors, waste characterization techniques and unique integration schemes for system components.

MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DOE OST AND EPA OSW

The U.S. Department of Energy Office of Science and Technology (OST) and the U.S. Environmental Protection Agency Office of Solid Waste (OSW) have recently signed a Memorandum of Understanding on Coordinated Research and Development for mixed waste treatment. The purpose of this Memorandum of Understanding (MOU) is to establish an enhanced level of cooperation on the development of technical solutions to address the problem of hazardous waste mixed with radioactive material (“mixed waste”). This MOU is expected to help the Environmental Protection Agency (EPA) promulgate and implement environmentally sound regulations addressing mixed waste and to facilitate the Department of Energy’s (DOE) expeditious and cost-effective compliance with the promulgated regulations. This MOU is also intended to maximize the benefits flowing to the nation’s citizens and taxpayers both from the development of environmentally protective mixed waste regulations but also from the coordinated approach to spending taxpayer funds on development of and compliance with these regulations.

One objective of this MOU is to encourage enhanced cooperation among DOE’s Office of Science and Technology (OST) and the EPA’s Office of Solid Waste (OSW) in research, development, and demonstration (RD&D) of cost-effective waste management technologies in support of regulation development process employed by the OSW to address mixed waste management issues. Cooperation will be in the form of, but not limited to, DOE providing performance, cost, and other data about the demonstration and field testing of mixed waste treatment and control technologies mutually identified by OSW and OST. This cooperation is expected to provide OSW technical data in a timely fashion for developing sound and cost-effective regulations and standards for mixed waste.

Another objective is interagency cooperation in budgetary planning of the scope of OST’s technical research and development effort and OSW’s mixed waste regulatory agenda and associated activities. Cooperation in such planning is expected to enable DOE and EPA to achieve maximum mutual benefit from complementary use of public funds, which will directly benefit the nation’s taxpayers. To that end, EPA and DOE will cooperate to the extent feasible in the project and budget planning phases ensuring the most cost-effective means of reaching the overall goal of developing environmentally sound regulations for mixed waste.

DOE and EPA fully recognize the important role of others in this process, particularly EPA’s Office of Research and Development (ORD) and Office of Radiation and Indoor Air (ORIA), EPA regional offices, DOE field offices, state regulatory agencies, and external stakeholders. OSW and OST will take the responsibility to consult with each of these stakeholders in any actions that may be contemplated and to involve these stakeholders as appropriate in any deliberations. EPA and DOE will also take into account public stakeholder input during the project planning and budgetary phases through their respective established frameworks.

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Effective information exchange is a key component of this cooperative venture. Information from a variety of sources covering a range of activities is needed for the successful implementation of this approach. In seeking the most efficient and effective means of information exchange, OST and OSW will involve DOE's operations, permit writers, Federal and State regulators, and appropriate stakeholders using OSW's and OST's existing frameworks. OST and OSW may also employ mechanisms such as workshops, technical resource documents, annual meetings, and web sites for information dissemination.

For purposes of implementing this MOU, a core management team (CMT) will be established. The CMT will consist of representatives of the signatories of this MOU (and other office representatives deemed appropriate by the signatories) and is responsible for coordination and management of activities under this MOU and for coordinating each Agency's efforts to seek funding for individual projects that would implement this MOU. The CMT will take into account current activities on mixed waste being undertaken by both DOE and EPA and future areas of potential coordination, as outlined below.

The CMT will work directly with the steering committee of the National Technical Workgroup (NTW) with respect to the activities under this MOU. The NTW is an existing group of DOE, EPA, state, and facility personnel that focuses on issues of interagency concern, such as development of regulations, compliance assistance, and implementation strategies. Both DOE and EPA recognize the NTW as an important and critical element in facilitating interagency cooperation and coordination in general and also in implementing this MOU.

EPA RESEARCH PRIORITIES AFFECTING MIXED WASTE

EPA's Waste Research Strategy provides the framework for hazardous waste research within EPA's Office of Research and Development (ORD). Four (4) research topic areas are identified as having the highest priority:

- Contaminated ground water: The focus is on improved risk assessment, characterization and remediation of non-aqueous phase liquids (NAPLs), the application and management of natural and accelerated process for subsurface remediation, and the demonstration and verification of innovative characterization and remediation technologies.
- Contaminated soil/vadose zone: The focus is on improved exposure and risk assessment of soils, the application and management of natural and accelerated process for remediation, and the demonstration and verification of innovative characterization and remediation technologies in soils and the vadose zone.
- Active waste management facilities: The focus is on multimedia, multipathway modeling and the development or estimation of toxicity values. Activities underway include an assessment of alternative treatment technologies for mercury and other hard-to-treat wastes.

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- Hazardous air pollutant emissions from combustion facilities: The focus is on the control and monitoring of emissions, emissions fate process and transport modeling, and indirect exposure and risk assessment methods and models.

DOE RESEARCH PRIORITIES AND ACTIVITIES AFFECTING MIXED WASTE

The DOE Mixed Waste Focus Area (MWFA) is conducting research and development to address the most important mixed low-level and transuranic waste problems. The MWFA has identified and prioritized eight major problem areas, including characterization, mercury contamination, material handling, and salt and ash stabilization. A number of ongoing research activities pertain directly to these priorities for mixed low-level and transuranic wastes, including:

- Alternatives to Incineration to Reduce Emission Hazards. This includes alternative oxidation, organic separation, and organic destruction technologies.
- Treatment and Stabilization Alternatives for Mercury Bearing Mixed Waste. This includes development of new technologies to stabilize Hg wastes, use of Hg sorbents to remove Hg from liquids and solids, etc.
- Handling Mixed Waste Contaminated Materials. This includes improving the methods and means of characterization, treatment, and packaging and disposal for radioactive wastes.
- Nondestructive Characterization. This includes the development of technologies to characterize waste without exposing samplers to radiological or chemical hazards.
- Payload Enhancement for Transporting TRU Waste within Restrictive Regulatory Limits. This includes efforts to improve systems for packaging, transport, and disposal of TRU waste.
- Monitoring and Removing Hazardous and Radioactive Contaminants from Thermal Treatment Gas Streams. This includes research on preventing the generation of dioxins and furans and on monitoring and controlling emissions of dioxins and furans, mercury, and heavy metals.
- Approaches to Comply with MACT Standards. This includes research efforts to prepare DOE mixed waste treatment facilities to comply with the changing regulatory framework, especially EPA's recent MACT rule for hazardous waste combustors. Efforts to sample and analyze emissions in flue gas with high concentrations of acid gases at the Idaho Nuclear Technology Engineering Center (INTEC) is an example.
- Individual Site Testing: Savannah River Site (SRS) CIF testing of dioxin and mercury in mixed waste incinerators; Oak Ridge TSCA testing of particulate matter and mercury continuous emissions monitors; and Waste Engineering Research Facility (WERF) evaluations of mercury and dioxin control alternatives are examples of site-specific control efforts and of sources of information for other facilities.

POTENTIAL AREAS OF FUTURE RESEARCH COORDINATION

The key focus of the activity arising from this MOU is the coordination of activities leading to information needed by both agencies related to mixed waste treatment, storage, and disposal. In some areas it is appropriate for DOE and EPA researchers to work closely together in a coordinated fashion to better leverage resources and capabilities towards common problems and to provide the information needed to support EPA regulatory development and DOE compliance efforts. As discussed in the MOU, the Core Management Team (CMT) will define the specific areas of coordinated technology development and demonstration-related activities, taking into account current activities and future programmatic directions. Simply for purposes of illustration, potential research topics on which DOE and EPA could cooperate include:

- **Mercury Waste Treatment and Compliance with MACT Standards:** DOE waste includes a wide range of sources of mercury ubiquitous throughout the DOE mixed waste inventory. EPA has promulgated stringent new emissions standards on existing and new incinerators burning hazardous waste including mixed waste. The new HWC MACT standards will impact DOE's four existing incinerators, which will need to investigate additional types of emission control strategies for mercury. Areas for further inquiry related to mercury emission control at DOE incinerators include: (1) reliable and non-intrusive waste characterization techniques for mercury levels to ppm levels; (2) characterization of mercury speciation in stack gases and related control techniques (e.g., increasing oxidation of mercury) to allow more effective mercury scrubbing; (3) evaluation of techniques for removal of mercury from scrub solutions; (4) high reactive, high capacity carbons for beds and injection; (5) iodine capture in carbon; and (6) impacts of real flue gas constituents and temporal variations on sorbent performance.
- **Alternative Treatment Technologies for Mercury Waste:** EPA's comprehensive reevaluation of the treatment standards for mercury impacts DOE's handling of its wide range of mercury bearing wastes. Research is needed to identify mercury waste treatment options for DOE mixed wastes to address the viability and parameters of alternative technologies for long-term land disposal. Among the key research areas are: (1) the need to examine stabilization alternatives for soils with high mercury; (2) advantages of modifications to the current EPA leachability test; (3) removal and recovery technologies; and (4) other immobilization technologies.
- **Alternative Compliance Assurance Options for MACT:** Given ALARA safety restrictions for sampling of mixed waste for compliance purposes, it is not feasible to reliably sample heterogeneous waste streams for trace species particularly when concentration levels of interest are low (e.g., for compliance with the mercury emission standard the of the HWC MACT). Alternative strategies need to be investigated and tested jointly so that they are acceptable to DOE, EPA, and the States. Among these are use of continuous emissions monitors (CEMs), nondestructive remote detection, and robust control technologies.
- **Prevention of and Treatment for Dioxin in Ash:** EPA regulations control the levels of dioxins and furans that can be disposed in a landfill. EPA has recently signaled its intention to investigate the nature of combustion ash as part of its Land Disposal Restrictions (LDR) Reinvention ANPRM. Dioxin may be found in bottom ash and fly

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ash generated in the thermal treatment of mixed waste. In light of EPA's investigation, there is a need to define the best prevention or control technologies to avoid production of dioxins and furans in bottom ash and fly ash from DOE incinerators and other thermal treatment units.

- **Tests for Deregulation of Low-Risk Hazardous Waste:** EPA is proposing to provide administrative and economic relief by developing a multimedia, multipathway risk-based approach that could exclude low-risk wastes from regulatory control under Subtitle C of RCRA. Of the 400 waste constituents that require the development of "exit levels," approximately 210 are without adequate or reliable analytical methods at the proposed exit levels. These analytical barriers may be further complicated by presence of radioactive component in mixed waste. If DOE wastes are to qualify for deregulation under this EPA initiative, further research is needed on sampling methods and techniques with the necessary specificity and sensitivity.
- **Pollution Prevention:** EPA and DOE both want to control multimedia pollution through pollution prevention, particularly with respect to key compounds that are persistent, bioaccumulative, and toxic (PBT). To overcome some barriers associated with the lack of facility expertise and a lack of capital funds to invest in process improvements, DOE ORNL and EPA are developing concepts for a performance contracting approach. This approach involves the waste generator paying a lower bill for waste management (thereby preserving capital) due to savings from pollution prevention process changes. The type of work needed involves the development of a technical framework for P2 paying for process improvements, building communications networks among EPA, DOE, state regulators, technologists, industry and financial sector, and disseminating case studies to illustrate implementation steps, costs and benefits.
- **Life Cycle Analysis of Toxic Metals:** As noted above, EPA and DOE both want to control multimedia pollution through pollution prevention, particularly with respect to key compounds that are persistent, bioaccumulative, and toxic (PBT). Of particular interest for mixed waste are metals such as mercury, lead, and cadmium. Life Cycle Analysis addresses the cradle-to-grave fate of each metal including production, uses, alternatives, exposure, recycle/reuse, and disposal. Research is needed to better understand and depict the life cycle of metals in DOE operations. This will lead to a greater ability to pursue strategic waste reduction opportunities as well as risk reduction opportunities. Further work is also needed to determine those aspects of a toxic metal Life Cycle Analysis that are unique to DOE and those that have application to a broader range of industrial operations.
- **Waste Form Research:** A National Academy of Science panel conducted a study to assess the appropriateness of final disposal of various forms of mixed waste. The report entitled "The State of Development of Waste Forms for Mixed Wastes: U.S. Department of Energy's Office of Environmental Management" was released in 1999. This report specifically defined areas of research and development necessary to develop and test suitable waste forms. Pursuit of research and development in these areas should be coordinated between EPA and DOE.