

**ACTION PLAN
FOR
EMERGING TECHNOLOGICAL
ALTERNATIVES TO INCINERATION**

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**U.S. DEPARTMENT OF ENERGY
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ACTION PLAN FOR EMERGING TECHNOLOGICAL ALTERNATIVES TO INCINERATION

Executive Summary

In January 2001, the Secretary of Energy accepted the recommendations of the Panel on Emerging Technological Alternatives to Incineration (the Panel), a task force of the Secretary of Energy Advisory Board (the Board). To address the Panel's recommendations, the Secretary directed the Office of the Assistant Secretary for Environmental Management (EM) to develop this Action Plan.

The Panel was created in response to public concern and following litigation regarding the proposed incineration of radioactive mixed waste at the Idaho National Engineering and Environmental Laboratory (INEEL). The Board asked the Panel to "evaluate and recommend emerging non-incineration technologies for treatment and disposal of mixed waste," including "waste that the DOE had planned to incinerate in the Advanced Mixed Waste Treatment Facility at INEEL."

In its final report, issued December 2000¹, the Panel summarized its findings in 17 statements. Protection of the environment and assuring public and worker safety and health underlie each of the Panel's points and also drive DOE's response to these findings. The Panel's findings focus on four key themes:

- Categorizing the wastes that need to be treated and matching the wastes to the treatment alternatives
- Funding and implementing a systems approach to develop and test promising technologies
- Addressing the next generation of technologies through a program of basic and applied research, including improved understanding of the off-gas chemistry of the more advanced alternatives
- Engaging stakeholders of various expertise in the efforts leading to the deployment of waste treatment technologies

The Action Plan describes the EM Program's broad strategy for responding to the Panel's recommendations. An element of the strategy is to better understand the need for treatment technology solutions. The Panel acknowledged, and DOE agrees, that any technology solution developed for INEEL to treat waste targeted for incineration should be considered for application at other DOE sites. Consequently, a component of EM's strategy includes an improved assessment of the amount of mixed low-level and transuranic waste across the DOE complex that may need treatment. The strategy also includes seeking the U. S. Environmental Protection Agency authorization to dispose of PCB bulk and non-liquid remediation-contaminated transuranic waste at the Waste Isolation Pilot Plant (WIPP). Subsequent modification of the

¹ Available at www.hr.doe.gov/SEAB

WIPP Hazardous Waste Facility Permit issued by the Secretary of the New Mexico Environment Department would also be required.

As the Panel recognized, waste disposal regulations can evolve and will influence any long-term strategy for research, development, demonstration, and deployment of treatment technologies. The potential expansion of WIPP's certification to allow disposal of certain types of PCB-contaminated transuranic waste at WIPP would reduce the amount of waste currently requiring treatment. Another change could be approval by the Nuclear Regulatory Commission to use chemical additives that minimize the concentration of gases during transportation of TRU waste. This approval would also reduce the amount of waste needing treatment and improve DOE's ability to screen and evaluate treatment technologies.

Technological alternatives to incineration have been under investigation by the EM Office of Science and Technology (OST) Transuranic and Mixed Waste Focus Area (TMFA) for several years. As recommended by the Panel, work on developing technological alternatives will remain under the purview of the TMFA. The TMFA's plan for developing alternatives includes:

- Identifying the types and classes of waste that may be treated by an alternative to incineration
- Identifying specific alternatives to be developed and demonstrated
- Establishing key decision points and criteria for selection of technologies for demonstration and deployment, and specifying the development and demonstration data to collect
- Specifying performance requirements that support the Panel's criteria for each alternative
- Identifying locations for test beds for both surrogate and actual wastes

This plan is based on a systems approach that considers the overall risks and costs associated with handling and disposing of all effluents, including but not limited to front-end handling, aqueous waste treatment, primary treatment, and off-gas treatment. Fundamental to the systems approach is integrating public and worker safety and health, and environmental protection into the research and development of alternative treatment technologies to incineration. To enhance the TMFA's efforts in this area, DOE has increased the TMFA's FY 2001 funding from \$6 million to \$11 million for work on alternatives to incineration. Decisions on future funding will consider the progress made in the WIPP disposal and transportation activities for transuranic waste results of the on-going technical review and prioritization process, and appropriations. This consideration ensures that future funding decisions will reflect developing and changing needs.

While initially each of these tactics (i.e., regulatory and technology approaches) will be followed in parallel, the EM Program will take an integrated approach to solving the problem, ensuring resources are effectively applied.

The Department also recognizes the need and importance of engaging stakeholders in the technology evaluation process, as recommended by the Panel. Two specific actions will enhance participation. First, a committee of community and public representatives has been established under the Environmental Management Advisory Board. Members of this committee, called the Alternative Technologies to Incineration Committee (ATIC), will examine candidate

technologies and provide advice and recommendations to the EM Assistant Secretary. They also will facilitate stakeholder comment and communication on the issue of emerging alternative technologies to incineration for treatment of mixed transuranic and low-level radioactive wastes. As recommended by the Panel, this committee will be a source of on-going public participation in periodically assessing the progress of the technology developments on alternatives, essentially providing a type of peer review.

Second, the DOE EM Program will host a national stakeholder forum on alternatives to incineration. As recommended by the Panel, the forum agenda will include input from the ATIC, the TMFA, and other stakeholders.

During its investigations and deliberations, the Panel expressed concerns over the DOE's approach to managing buried waste, although acknowledging that such wastes were beyond the scope of its mandate. In response, EM has drafted this plan to include a brief description of the activities in this area. The Subsurface Contaminants Focus Area (managed under the EM OST) is addressing some relevant short-term and long-term activities in response to the Panel's concerns. In the near-term, technologies are being investigated to mitigate further spread of contaminants and limit associated risks and cleanup costs. These technologies include deep barrier placement; improved longer-life surface caps; landfill stabilization; advanced verification and monitoring technologies; chemical stabilization methods to reduce mobility of metal species; and underground destruction of dense non-aqueous organics. Vadose zone and groundwater contamination are being addressed through a roadmapping effort (to be completed in 2002) among DOE sites to define viable research and development paths for addressing concerns.

For the longer term, the OST's EM Science Program is addressing basic understanding of the interactions of contaminants and the subsurface environment through its projects. To further define the longer-term research needs and opportunities, the OST has requested a study by the National Academy of Sciences/National Research Council. The study will define gaps and areas of research, and will evaluate the next generation of treatment technologies and cleanup approaches for the specific categories of DOE transuranic and mixed waste for which current treatment technologies are not adequate. This work will be complete in 2002.

Table ES-1 summarizes the schedule for activities that implement the Panel's recommendations. The DOE plans two years in advance to submit a budget to Congress, so planning is underway for the FY 2003 budget. Progress on these activities can be monitored by reviewing information on the websites listed in Table ES-2. The EM Office of Integration and Disposition is also developing a web site to serve as a single source for information on these activities. The site will be accessible on the EM home page, also listed on Table ES-2.

Table ES-1. Schedule for Completing Key Actions to Implement Recommendations

Activity	Estimated Completion
Submit DOE FY 2002 Budget to Congress	April 2001 (Completed)
Initiate FY 2003 Budget Planning	April 2001
Formation of EM Advisory Board's Alternatives to Incineration Committee	April 2001
Submit National PCB Disposal Permit Application for WIPP	Calendar year 2001
Transuranic and Mixed Waste Focus Area (TMFA) Conducts Technical Review on Robust and Partial Technologies	August 2001
Results of Transuranic Waste Transportation Studies	October 2001 and September 2002
TMFA Selection of Priority Technologies for Testing	November 2001
EM Advisory Board's Alternatives to Incineration Committee Review of TMFA's Alternative Technologies Plans	November 2001
Host National Stakeholder Forum	To Be Determined Based on Stakeholder Input
Submit DOE FY 2003 Budget to Congress	February 2002
Initiate FY 2004 Budget Planning	April 2002
Update Inventory of Mixed Low-Level Waste and Mixed Transuranic Waste Needing Treatment	April 2002
TMFA and National Research Council Identify Basic and Applied Research Needs	May 2002
Conduct Alternative Technologies Comparison Testing	September 2002
Conduct Integrated Systems Testing and Demonstrations including Pollution Control Subsystems	2003-2006

Table ES-2. EM Websites

EM Office	EM Web Address
Office of Intergovernmental and Public Accountability (EM-11)	http://www.em.doe.gov/public/index.html
Office of Integration and Disposition (EM-20)	http://www.em.doe.gov/integrat/
Office of Science and Technology (EM-50)	http://www.em.doe.gov/ost
Environmental Management Advisory Board	http://www.em.doe.gov/emab/
Transuranic & Mixed Waste Focus Area	http://tmfa.inel.gov
Transuranic & Mixed Waste Focus Area -Alternatives to Incineration Work Package	http://tmfa.inel.gov/newpages/Technical.asp?list=all&from=

1.0 BACKGROUND

Consistent with environmental regulations, the Department of Energy (DOE) has successfully treated, using incineration, a variety of organic-based mixed wastes that resulted from its past and present nuclear energy, waste remediation, and weapons missions. However, public concern over incinerator emissions, the recently mandated U.S. Environmental Protection Agency (EPA) requirements to enhance monitoring and treatment of these emissions, the costs of operations and the Secretary of Energy's Advisory Board's Report on Alternatives to Incineration have led DOE to expand its evaluation of alternatives to incineration.

In 1999 a lawsuit was filed against DOE to contest plans to construct an incinerator for treatment of radioactive mixed waste at the Idaho National Engineering and Environmental Laboratory (INEEL) as part of its Advanced Mixed Waste Treatment Project (AMWTP). In April 2000, the Department agreed to a settlement that included two key actions. First, the DOE contractor would proceed with the construction of the AMWTP without an incinerator. Second, the Secretary of Energy would appoint a Blue Ribbon Panel (the Panel) to evaluate and recommend new technological initiatives that the Department should pursue to establish alternatives to radioactive mixed waste incineration.

The Panel's charter was to evaluate alternative technologies to treat low-level and transuranic (TRU) wastes containing polychlorinated biphenyls (PCBs) and hazardous constituents, including such wastes that the DOE had planned to incinerate in the AMWTP. The Panel was also to evaluate whether these technologies could be implemented in a manner that would allow the Department to comply with all the legal requirements, including those contained in the October 1995 Settlement Agreement and Consent Order signed by the state of Idaho, DOE, and the Navy. That agreement requires the Department to remove from Idaho 65,000 cubic meters of waste stored at INEEL by the end of 2018.

As a sub-panel of the Secretary of Energy Advisory Board, the Panel's proceedings were conducted in public forums, and public comments were incorporated in the final report. The Panel submitted its findings and recommendations to the Secretary of Energy on December 15, 2000, in *Report of the Secretary of Energy Advisory Board's Panel on Emerging Technological Alternatives to Incineration*, available on the web site www.hr.doe.gov/seab.

2.0 APPROACH

The DOE Environmental Management (EM) Program has a broad strategy for developing solutions for management of mixed low-level waste (MLLW) and mixed TRU waste. The strategy includes seeking regulatory changes at the Waste Isolation Pilot Plant (WIPP), continuing development efforts to improve the ability to meet TRU waste transportation safety requirements, and evaluating treatment technology solutions.

2.1 Potential Regulatory Changes at WIPP

The WIPP, near Carlsbad, New Mexico has been designated as the disposal site for DOE's TRU and TRU-mixed waste. For TRU waste to be disposed of at WIPP, it must meet the requirements for transportation in a shipping container designated as the TRUPACT-II and meet the WIPP waste acceptance criteria. Under present regulations, TRU waste containing hazardous constituents can be disposed of at WIPP without additional treatment provided the waste meets transportation requirements and WIPP Waste Acceptance Criteria. Presently, WIPP can also dispose of TRU waste contaminated with less than 50 parts per million of PCB. Some of the waste that had been planned for treatment in the proposed AMWTP incinerator is PCB-contaminated TRU waste. The Department is working with the EPA to review a proposal under which EPA would grant national regulatory authorization to allow disposal of certain PCB-contaminated TRU waste at WIPP without pretreatment. This authorization could significantly reduce the volume of TRU waste requiring treatment prior to disposal.

The performance assessment conducted in support of WIPP's permit to dispose of and contain TRU waste indicates the facility's ability to prevent the migration of PCBs, and much of the analysis necessary for the review of PCB disposal options has already been done through the hazardous waste permitting process. The DOE Carlsbad Field Office (CBFO) is organizing the data according to the formats required by the Amendment to TSCA regulations. If all disposal applications are approved, WIPP will be permitted to receive PCB remediation waste and bulk product waste. If this disposal authority is granted, at least some of the INEEL wastes with PCBs and those at other sites across the DOE complex could be disposed of at WIPP without further treatment.

DOE will continue to work with the EPA regional and national regulators and with the New Mexico Environment Department (NMED) to develop a regulatory path forward for PCB-contaminated TRU waste and ultimate disposal authority for the WIPP. The PCB approval process will begin with submittal of the TSCA application to EPA Region 6 pursuant to 40 CFR §761.75(c), planned to occur before the end of calendar year 2001. If the EPA approves the TSCA application, the CBFO would then submit a RCRA permit modification to the NMED to delete the current prohibition on PCB concentrations > 50 ppm. This entire process is expected to take from 12 to 24 months. Stakeholder input will be ensured through the routine processes followed by EPA and NMED as part of their permit review activities.

2.2 TRU Waste Transportation

Gas generation, particularly hydrogen, is an area of concern for the transportation of DOE's radioactive wastes. Incineration was the proposed treatment for some wastes at INEEL to eliminate the gas generation concern. Hydrogen is a flammable gas that can be generated by radiolysis of organic materials, such as oily sludges and plastics, or from chemical interactions. If hydrogen is generated in sufficient quantity, it can create a combustion risk during transportation. Under NRC transportation and cask requirements, hydrogen is restricted to less than five percent by volume of the total gas inventory within any confined volume of materials to be shipped in NRC-certified containers. The amount of other flammable gases, such as volatile

organic compounds (VOCs), is also limited. Gas generation is a concern during transportation because the transportation container does not allow the gas to vent, as is the case during normal storage. Incineration or alternative treatments can eliminate the source of the hydrogen and/or VOCs and so avoid the combustion risk.

To manage this risk, methods to predict gas generation during the transportation of TRU waste to WIPP have been developed for most of the waste destined for WIPP. For the remaining waste, various activities are ongoing, including the following:

Reduce confinement layers within drums. Some TRU waste is currently stored in drums. The drums often contain smaller containers of waste. These multiple packages represent multiple levels of containment, each of which must meet the five percent limit. Efforts are continuing to demonstrate technology to remove the confinement layers, after which the waste would meet shipping requirements. Demonstration of these technologies is targeted for completion in September 2001.

Use of hydrogen getters. Hydrogen getters have been in use since the 1970s. These getters are chemical compounds that scavenge or absorb the hydrogen that may be present or generated in the waste and reduces the risk of combustion. Hydrogen getters have been identified as a potential solution to help reduce the buildup of hydrogen in TRU waste transportation containers. Efforts are ongoing to test and determine an optimal getters packaging configuration for TRU waste applications. A report on the hydrogen getters packing configuration testing is expected in September 2002.

Gas generation tests for organic sludges. Some of the waste targeted for incineration is TRU contaminated organic sludge. The development of a model to adequately predict the amount of gas these sludges may generate is ongoing. Once an effective predictive methodology is developed and approved, the waste may meet the shipping requirements and could be shipped to WIPP for disposal without treatment. A report on the gas generation tests is due October 2001.

2.3 Evaluating Treatment Technologies

Although the Panel acknowledged regulatory changes and other developments in the management of mixed TRU waste that could affect the need for technology alternatives to incineration, the focus of its review was technology solutions for both TRU and mixed waste. Consequently, evaluation of alternative treatment technologies to incineration is the primary response to the Panel's Report. The technologies must be reviewed and decisions made on which technologies should be researched, developed, demonstrated, and deployed. To achieve this objective, both partial treatments and robust treatments will be evaluated considering two potential disposal endpoints: WIPP for TRU waste or surface disposal sites for MLLW.

3.0 ALTERNATIVE TECHNOLOGY STRATEGY

This portion of the Action Plan describes the activities in the OST's TRU and Mixed Waste Focus Area (TMFA) that are ongoing or are being undertaken in response to the Panel's Report. As necessary, the TMFA will modify the Alternatives to Incineration Work Package (MW-07) described in its Multi-year Program Plan to incorporate the Panel's recommendations.

Since 1994, the TMFA has engaged in a development program for alternatives to incineration. This program was based on DOE sites' needs to treat waste streams not amenable to incineration. The Alternatives to Incineration portion of the Multi-year Program Plan will be updated to describe an accelerated and supplemented effort to develop alternatives in response to the Panel's recommendations. Under this plan, the "Alternatives to Incineration Work Package" will focus on the most promising technologies for near-term application. It will cover two types of treatment. One option is robust treatments capable of treating a wide variety of waste compositions, such as the DC-arc melter. The other option is simple partial treatments, such as steam reforming and thermal/vacuum desorption, capable of removing and/or destroying VOCs and hazardous organic compounds (e.g., PCBs) in sufficient amounts to allow shipment of the waste to WIPP or to other sites. The Work Package considers five general categories of technologies reviewed by the BRP:

- Thermal treatment without incineration
- Aqueous-based chemical oxidation
- Dehalogenation
- Separation (soil washing, solvent extraction, and thermal desorption)
- Biological treatment

The EM Program will investigate the highest priority alternatives as recommended by the Panel. These include steam reforming, thermal/vacuum desorption and DC-arc melter. The Department expects that at least one alternative technology system will be developed, demonstrated, and made readily available for deployment at one or more DOE or commercial sites. Actual site needs, once better defined, may require more than one option.

Related activities will specifically include the following:

- Identification of the types and classes of waste that may be treated by an alternative to incineration
- Identification of specific alternatives to be developed and demonstrated
- Key decision points and criteria for selection of technologies for demonstration and deployment, including specifying the development and demonstration data to be collected
- Specification of performance requirements for each alternative
- Identification of locations for test beds involving both surrogate and actual wastes (including industrial solicitations)

Depending on the outcome of the waste characterization and evaluation activity described below, the “Alternatives to Incineration Work Package” may require a broad range of efforts from basic science research to full-scale integrated demonstrations. Stakeholder input will be incorporated into decisions on what technologies will be tested and what data must be collected.

The alternative technologies to be evaluated are likely to be new to the existing regulatory environment. The TMFA will address such potential regulatory issues by working directly with the EPA under an existing Memorandum of Understanding and with state regulatory agencies throughout the alternatives development process. Communication with these agencies will inform technology developers of the data needed to ensure permitting of their alternative technologies. The developers also will be informed of pending regulatory changes that may alter the potential market and/or future performance requirements for their proposed alternatives.

For the purpose of this Action Plan, the “Alternatives to Incineration Work Package” activities are described through the following three basic elements: overall test strategy, technology selection criteria, and evaluation and decision points.

3.1 Overall Test Strategy

The test strategy will consist of the following five dependent and overlapping sub-elements, as recommended by the Panel.

3.1.1 Waste Characterization and Evaluation

Prior to extensively developing alternatives to incineration, as recommended by the Panel, comprehensive waste evaluation and characterization is required to define the market for alternatives now and in the future. The types and quantities of both MLLW and TRU waste in present inventories and to be generated will determine the various surrogate and actual wastes to be tested, the types of alternatives to be developed, and their capacity and performance requirements. In particular, a more accurate assessment is needed on the quantities and characteristics of the waste to be generated as a result of environmental restoration and decontamination and decommissioning activities. The outcome of this assessment will determine the magnitude of the overall alternatives development program, especially if a majority of these future wastes do not require an alternative to incineration to meet treatment requirements for land disposal (e.g., MLLW) or transportation (e.g., TRU waste). Information will be factored into this assessment as it becomes available.

DOE waste generators are finding alternatives to incineration as several commercial mixed waste treatment facilities become operational or near operational. Therefore, the market for to-be-developed alternatives to address present inventories-- especially for MLLW – may be limited. Still, limited and targeted development and demonstration activities will lessen DOE’s exclusive reliance on these commercial options, reduce programmatic risk, and increase confidence in the potential alternatives.

Less commercial treatment capability exists for TRU waste. Unlike MLLW, mixed TRU waste does not require treatment to meet RCRA land disposal requirements. Treatment of some portion of the TRU waste inventory may be required to ensure the waste meets WIPP transportation requirements and TSCA-regulated disposal requirements. Some of the TRU waste transportation and disposal issues may be resolved with non-treatment strategies (e.g., regulatory changes [2.1], hydrogen getter technology [2.2]) depending on the waste characteristics and media. These strategies can affect the extent of treatment required for transportation of TRU waste. A comprehensive TRU waste inventory, together with knowledge of advancing technology and changing regulations are extremely important in identifying the need and performance requirements for future treatment capability.

The TMFA will look to the EM Office of Integration and Disposition and the National TRU Waste Program to develop the inventory information while the TMFA concentrates on assessing the technology gaps.

3.1.2 Comparison Testing

Technical issues will be addressed through comparative demonstrations of emerging alternative incineration methods. Alternatives selected for the demonstrations will be based on the waste evaluation and characterization effort described above and will include near-ready or relatively mature technologies, as identified in the Panel's report (Appendix 1, #7). The study will collect the necessary performance, design, scale-up, and permitting data for each selected technology. These data must be collected to determine:

- (1) technology performance, secondary waste quantity and content
- (2) emissions and contaminants associated with the emissions
- (3) potential for accidents and process upsets that could cause excess emissions
- (4) system and component reliability and maintainability, and energy and mass balance data to be subsequently used for scale-up

Starting in FY 2001, the TMFA will assess locations and facilities for the comparison tests. Pending technical reviews and identified needs, funding levels for the testing program will be determined for FY 2002 and beyond.

3.1.2.1 Surrogate and Actual Waste Testing

Testing with identical waste surrogates and actual wastes will ensure that the alternative treatment methods produce comparable data. In response to the Panel's recommendation, the Alternatives to Incineration Work Package will define the methods and extent of actual waste testing. Types of surrogate and actual waste to be tested will be prioritized based on the waste characterization and evaluation effort. As indicated by the Panel recommendations, the expected high inventories of debris waste and challenging TRU organic sludges are likely candidates for both surrogate and actual waste testing.

3.1.2.2 Comparison Testing Data Requirements

A treatment system often comprises a collection of technologies. Consequently, performance data must be collected to compare all the technologies used in the treatment system since no single technology may be adequate by itself to meet environmental, safety, and health standards. Performance data will be based on tests with surrogate and actual waste. Although tests will vary with the type of waste, important performance measures of reliable and safe operation include:

- Efficiencies for all treatment system components intended to provide destruction or removal of volatile and hazardous organic materials
- Extent of contaminant retention in the residuals requiring disposal
- Amount of radionuclides and volatile and hazardous materials that exist in any secondary effluents requiring disposal
- Volume and weight of final disposal product, secondary effluents, and the subsequent treatments that may be required to dispose
- Amount and rate of exhaust gases released from the treatment system and the efficiency of the removal system to reduce or eliminate the amounts of radioactivity and hazardous materials contained in those gases
- Measurements of final air emissions to assure the presence of hazardous products are below regulatory limits
- Measurements of the heat/energy required to operate versus the rate at which the treatment system generates heat/energy to assure adequate control

Measurements are required to compare component and system performance and associated emissions. Data are required to evaluate the cause and effect of upset conditions and the ability of an alternative system to recover quickly to minimize or prevent emission of hazardous materials. Such tests would include measurements of emissions subsequent to spike increases in waste throughput, energy content, and contaminant or radionuclide content. Data will be available to evaluate overall risks and costs associated with handling and disposing of all effluents and the specific safe containment of plutonium during normal and abnormal conditions.

3.1.2.3 Integrated System Testing and Demonstrations

The TMFA will select the higher performing alternative(s) for integrated prototype testing. These tests will involve systems that incorporate auxiliary components, and applicable scientific results, as discussed below.

3.1.3 Deployments and Demonstrations to Address Specific Site Needs

In addition to the primary alternative test units, tests of other alternative treatment methods to incineration, presently planned or being conducted at other locations, will be leveraged and altered consistent with the comparative studies. A number of these leveraged alternative methods will involve on-going TMFA-funded projects addressing specific DOE issues and needs for both MLLW and TRU waste.

3.1.4 Auxiliary Component and System Development

Auxiliary system testing will include sufficient testing to assure the performance of any pretreatment, waste-feed pre-sizing, off-gas monitoring and analysis, and all primary and secondary residue production. Each auxiliary technology, individually or in combination with other technologies, must meet environmental, safety, and health standards and performance requirements for reliable, safe, and cost-efficient operation.

3.1.5 Basic Science Research

Basic research efforts will supplement the testing of near-ready or mature alternatives, and development activities will optimize the auxiliary systems required for completely integrated alternative methods. Basic research, spanning at least three years, will study material research, off-gas pollutant formation, and long-term waste form stability. The EM Science Program will solicit for and select projects to provide basic science research on incineration alternatives. The TMFA will provide areas for solicitation based on technical, regulatory, and stakeholder considerations.

3.2 Technology Selection Criteria

As recommended by the Panel, the criteria to select technologies for advancement from demonstration to deployment will include:

- Environmental, safety, and health risk considerations
- Stakeholder and regulatory interests
- Functional and technical performance
- Operational reliability
- Pre- and post-treatment requirements
- Economic viability
- Technical maturity

The TMFA will establish specific parameters and weights for each criterion.

3.3 Evaluation and Decision Points

The “Alternatives to Incineration Work Package” described in the TMFA Multi-year Plan will identify technical milestones, key decision points, and activities that establish the bases for decisions (e.g., defining and weighting criteria). As a result, decisions will be consistent with agreements, regulations, and the broader public interest considerations applicable to mixed waste throughout the nation. Independent peer reviews will also provide input prior to key decisions. The reviews will involve experts selected through the American Society of Mechanical Engineers in compliance with the Society’s procedures and EM’s OST guidance. Examples of activities and program transitions that include peer reviews are:

- Establishment of performance data requirements for various test classes
- Preparation and review of test plans
- Review of test plan reports of the comparative studies and of basic science research
- Transition to comparative tests involving actual wastes
- Transition to large-scale integrated demonstrations

Although the schedule of actions and decisions will be affected by actual research and development results, the initial target schedule includes the following:

Action	Estimated Completion
1. TMFA starts demonstration work on a robust technology and a partial technology through technical review	August 2001
2. Technical review and selection of priority technologies for testing	November 2001
3. EMAB Alternative Technologies to Incineration Committee reviews TMFA plans for alternatives	November 2001
4. Inventory of MLLW and mixed TRU waste needing treatment	April 2002
5. Host National Stakeholder Forum	TBD Based on Stakeholder Input
6. Identify basic and applied research needs	April 2002
7. Evaluate state of development of air pollution control subsystems and identify specific testing and demonstration needs to assure containment	December 2002

The TMFA Multi-year Program Plan FY 2001 is available on the web at: <http://tmfa.inel.gov>

4.0 STAKEHOLDER STRATEGY

The Department is committed to meaningful stakeholder involvement in developing and evaluating alternative technologies to incineration and in site-specific decisions to deploy technologies. In addition to continuing ongoing processes for stakeholder involvement in technology development and deployment, two key actions will be implemented as a result of the recommendations of the Panel:

- Establish an Alternative Technologies to Incineration Committee (ATIC) under the Environmental Management Advisory Board (EMAB)
- Hold a national stakeholder forum on alternative technologies

The EMAB, operational since 1992, is federally chartered under the Federal Advisory Committee Act (FACA). The EMAB provides independent advice and recommendations to the EM Assistant Secretary regarding environmental restoration and waste management issues. The

EMAB provides an open channel for stakeholder groups and affected communities to provide advice and comment to the EM decision-making process.

4.1 Alternative Technologies to Incineration Committee

The EM Program agrees with the Panel that stakeholder involvement is essential for successful deployment of waste treatment technologies. To provide opportunities for ongoing public involvement in the process of developing alternatives to incineration, the EMAB has established an ATIC committee.

ATIC members will examine DOE's candidate technologies for treatment of DOE mixed TRU and MLLW, including waste proposed for incineration at INEEL's AMWTP. ATIC will provide advice and recommendations to the EM Assistant Secretary through the full EMAB regarding development and demonstration of such technologies. The ATIC Charter, approved by the EM Assistant Secretary, is provided in Appendix 2. ATIC will have direct access to managers in the technology development programs.

FACA and EMAB requirements guided the ATIC member selection process. Current ATIC members are listed in Appendix 2, Exhibit 1. The EM Assistant Secretary appointed the two ATIC co-chairs and the two ATIC members affiliated with stakeholder groups that were party to the lawsuit challenging the plan to construct and operate a new incinerator at the INEEL. The governors of Idaho and Wyoming each were invited to nominate a representative who will be appointed by the EM Assistant Secretary. The remaining members were drawn from the general public based on FACA diversity guidelines and technical considerations contained in Appendix 2, Exhibit 2. The EM Assistant Secretary approved and appointed the ATIC membership.

ATIC was formally established at the April 17, 2001 meeting of the full EMAB.

4.2 National Stakeholder Forum on Alternative Technologies

As yet another channel to communicate the technology development plan for incineration alternatives and to solicit stakeholder views, EM will sponsor a national stakeholder meeting; its exact timing and agenda will be determined based on stakeholder input. This National Stakeholder Forum on Alternative Technologies will bring together technical experts and concerned parties to exchange information and discuss:

- The TMFA Plan for developing alternatives to incineration
- The current state of technology development
- Factors to be considered in determining the acceptability of new technologies
- The positives and negatives of various alternative technologies
- Opportunities for stakeholder involvement

This Forum will provide input to the Department and ATIC on the technology development plan. ATIC, in turn, will provide comments to EMAB for deliberations and approval consistent with

Federal Advisory Committee Act guidelines. The EM OST has allocated funds to hold the Forum.

Interested stakeholders and ATIC members will help the Department plan this Forum. The EM Program will use already planned activities to gather stakeholder input for the Forum agenda. One example was the April 23-26, 2001, National Forum and Technology Exhibit on Developing Strategies to Accelerate Federal Agency Environmental Cleanup, in Salt Lake City, Utah. There, EM representatives met with stakeholders to gather input. Other opportunities include the regular meetings of the Citizens Advisory Boards and meetings of other EM stakeholder groups, like the National Governors Association Federal Facilities Task Force and the State and Tribal Government Working Group.

The EM Office of Intergovernmental and Public Accountability will plan and conduct this Forum in partnership with EM OST, other EM program and field offices, and interested stakeholders. Information on this Forum will be available on the EM web site (Table 5-1).

5.0 FOR MORE INFORMATION

Progress on these activities can be monitored by reviewing information on the websites listed in Table 5-1. The EM program is also developing a web site to serve as a single source for information on this Action Plan.

Table 5-1. EM Websites

EM Office	EM Web Address
Office of Intergovernmental and Public Accountability (EM-11)	http://www.em.doe.gov/public/index.html
Office of Integration and Disposition (EM-20)	http://www.em.doe.gov/integrat/
Office of Science and Technology (EM-50)	http://www.em.doe.gov/ost
Environmental Management Advisory Board	http://www.em.doe.gov/emab/
TRU & Mixed Waste Focus Area	http://tmfa.inel.gov
TRU & Mixed Waste Focus Area - Alternatives to Incineration Work Package	http://tmfa.inel.gov/newpages/Technical.asp?list=alt&from=

Appendices

- Appendix 1: Executive Summary of the “Report of the Secretary of Energy Advisory Board’s Panel on Emerging Technological Alternatives to Incineration”
- Appendix 2: EMAB Charter, ATIC Charter, Guidelines for Establishing Committee

References

1. Secretary of Energy Advisory Board. *Report of the Secretary of Energy Advisory Board’s Panel on Emerging Technological Alternatives to Incineration*. December 2000.

Appendix 1

“Report of the Secretary of Energy Advisory Board’s Panel on Emerging Technological Alternatives to Incineration” Executive Summary

Report of the Secretary of Energy Advisory Board's Panel on Emerging Technological Alternatives to Incineration

Executive Summary

The Panel on Emerging Technological Alternatives to Incineration, a task force of the Secretary of Energy Advisory Board, was created following a dispute over the proposed incineration of radioactive mixed waste at the Idaho National Engineering and Environmental Laboratory (INEEL). The Board asked the Panel to “evaluate and recommend emerging non-incineration technologies for treatment and disposal of mixed waste,” including the “waste that the DOE had planned to incinerate in the Advanced Mixed Waste Treatment Facility (AMWTF) at INEEL.” The Panel’s principal conclusions and recommendations, based on six months of inquiry and much very instructive public comment, include the following:

1. The disposal of mixed transuranic (TRU) waste – containing radioactive material, PCBs and other hazardous constituents – poses a unique problem, and existing regulations were not designed specifically to address such wastes. The principal public concern regarding the treatment of such wastes by incineration and alternative technologies involves the potential release of plutonium. An assessment of technologies for waste treatment should take into account, among others, the overall risks and costs associated with handling and disposing of all the effluents, including but not limited to, front-end handling, aqueous waste treatment, primary treatment, and off-gas treatment.
2. In addition to the wastes defined in the Panel’s mandate, which are located at the Transuranic Storage Area at INEEL, volumes of waste of the same general kind and at least equal magnitude are buried in pits and trenches on an 88-acre disposal site. The Panel notes that the problem is serious, and urges the Department of Energy to put increased emphasis on adequately defining the subsurface phenomena involved, and as quickly as possible to put in place comprehensive plans to deal with the issue before significant crises can develop.
3. While the Panel recognizes that waste disposal regulations can evolve and will influence any long-term strategy for research, development, demonstration, and deployment (RDD&D), the Panel’s recommendations do not assume changes in the current state and federal requirements.
4. The Panel adopted seven criteria for evaluating alternatives to incineration: Environmental, Safety and Health Risk Considerations; Stakeholder and Regulatory Interests; Functional and Technical Performance; Operational Reliability; Pre- and Post-Treatment Requirements; Economic Viability; and Maturity.
5. The Panel evaluated technologies that may be grouped in five general categories: thermal treatment without incineration, aqueous-based chemical oxidation, dehalogenation, separation (soil washing, solvent extraction and thermal desorption), and biological treatment.
6. The Panel finds that there are promising technological alternatives to incineration. None of the alternatives is ready for immediate implementation; all need to be further developed, adapted and tested with actual mixed waste.
7. The Panel’s intent was not to endorse or reject specific commercial applications, but rather to focus on technology categories, identifying those that appear most promising for near-term application and for long-term developmental funding. The Panel classified the technological alternatives to incineration in three groups: (1) those that clearly appear promising and should have highest priority for funding [steam reforming, thermal/vacuum desorption, DC-arc melter, plasma torch]; (2) potentially promising technologies for which important unresolved issues remain [mediated electrochemical oxidation, microwave decomposition, supercritical water oxidation, solvated electron dehalogenation]; and, (3) technologies to which the Panel accords lowest priority [iron chloride catalyzed oxidation, molten aluminum, solvent extraction, high temperature hyperbaric chamber, silent discharge plasma, soil washing

with a chelating agent, treatment with sodium in mineral oil followed by chemical oxidation with peroxydisulfate, and biological treatment].

8. The result of this evaluation is a varied and robust set of technologies that deserve a place in DOE's RDD&D program. The nation should emerge with improved and feasible solutions to a costly dilemma. DOE should seriously consider technologies identified in the most promising category as alternatives for an incinerator at the AMWTP. Tests of these technologies should be conducted on both surrogates and actual wastes to prove their applicability.
9. No single technology may by itself be adequate to meet the desired environmental health and safety standards and achieve the desired destruction of hazardous and PCB waste. Robust solutions are likely to require combinations of several technologies.
10. DOE should consider technologies that are presently deemed less mature for further development and testing with the aim of either advancing them to readiness for deployment or eliminating them from further consideration. Also, a program of basic and applied research should be pursued to identify and nurture the next generation of technologies that are sure to be needed.
11. In the period following creation of the Panel, DOE has been preparing an RDD&D plan for developing and deploying safe, cost-effective and timely technological alternatives to incineration. The Panel appreciates and generally supports DOE's substantial ongoing efforts to devise this strategy, and believes that if its recommendations are followed, DOE should be able to achieve results consistent with the deadline of the Idaho agreement, other regulatory requirements, and broader public interest considerations applicable to mixed waste throughout the nation.
12. The Panel expects that the DOE will change its proposed Plan for Developing Technological Alternatives to Incineration in response to the Panel's recommendations. DOE should first categorize in detail the wastes that need to be treated, and then link the actual wastes to processes in proposed work scopes.
13. The Transuranic and Mixed Waste Focus Area (TMFA) is not now funded adequately to underwrite the testing of the technological alternatives to incineration. As an essential first step, the Panel supports a budget for this purpose that would provide approximately \$91 million over the four fiscal years beginning in 2001. Urgent needs start with proof testing of the candidate technologies, using the actual materials involved. The TMFA is the logical home for this testing work. The testing program should be cognizant of and responsive to the needs of the entire DOE complex. The Panel is concerned that mechanisms may not yet be in place to ensure that the results of such testing form the basis for the actual treatment.
14. Also in this regard, the Panel strongly supports increased and continuing basic scientific and developmental work over the longer term on processes to deal with mixed waste. DOE's emphasis on 'near ready' or 'mature' technologies should not preclude further evaluation of innovative alternatives, and the proposed RDD&D schedule almost certainly will have to be extended to allow full assessment of such technologies.
15. In evaluating the most promising alternatives to incineration, DOE should take a systems approach, and should consider the alternative technologies (especially the air effluent containment technologies) as a system under both normal and upset conditions.
16. Citizen stakeholder involvement is essential for successful deployment of waste treatment technologies. Citizen stakeholders should involve people of various expertise from around the country and region. DOE should follow the example of the Army's chemical weapons disposal program by broadening stakeholder outreach beyond the agency's site-based Citizen Advisory Boards (CABs) and making sufficient, specific budgetary provision for technical assistance to committees of citizen advisors. The Panel endorses a 2001 national conference on alternative technologies to incineration, and encourages DOE to involve, in both the Steering Committee and the conference itself, not only the local CABs but also other persons and groups with regional and national perspectives and expertise. Opportunities should be provided for ongoing public

participation in periodically assessing the progress of the technology developments on alternatives, e.g., the peer review process.

17. DOE's initial technology selections should be made on the basis of the Panel recommendations. Given the likelihood that the DOE plan itself will change in light of this report, the Panel asks the full SEAB to review progress and continue to advise the Secretary on these matters after DOE has had the opportunity to recast its initial proposal to reflect the Panel's findings and recommendations. DOE should assume full responsibility for whether or not the waste treatment processes are satisfactory for the task at hand. Nothing must be allowed to get in the way of selection, testing, implementation and deployment of a technology or technologies that, in this sensitive situation, will get the job done, while also demonstrating good faith to all parties with an interest in seeing the job is getting done well.

Appendix 2

Environmental Management Advisory Board Charter

Alternative Technologies to Incineration Committee Charter

Alternative Technologies to Incineration Committee Roster (Exhibit 1)

Federal Advisory Committee Act Diversity Guidelines and Technical Considerations for
Establishing Committee (Exhibit 2)

EMAB Charter

Department of Energy

Charter for the Environmental Management Advisory Board

1. Official Designation:

Environmental Management Advisory Board

2. Objective, Scope of Activity, and Duties:

The Environmental Management Advisory Board will provide the Assistant Secretary for Environmental Management with information, advice and recommendations on issues confronting the Environmental Management program. The Board will advise the Assistant Secretary from the perspective of affected groups and state and local governments. The Board will be advised of the progress on the Environmental Management projects at regular intervals to be determined by the Assistant Secretary.

The Board will perform the following duties:

- a. Advise the Department of Energy on Environmental Management projects;
- b. Issue reports and recommendations;
- c. Recommend options to resolve difficult issues faced in the Environmental Management program, including clean-up criteria and risk assessment, land use, priority setting, management effectiveness, cost-versus-benefit analyses, the future national configuration of waste management and disposal facilities, privatization, science and technology, strategic planning, long-term stewardship, and solutions to barriers to deploying market-driven technologies.

3. Time Period Necessary for the Board to Carry Out Its Purpose:

Since the task of the Board is to advise agency officials on a series of Environmental Management projects and issues, the time period required to carry out its purpose is continuing in nature.

4. Official to Whom this Board Reports:

This Board will report to the Assistant Secretary for Environmental Management.

5. Agency Responsible for Providing Necessary Support for the Board:

United States Department of Energy

6. Description of Duties for Which the Board is Responsible:

The duties of the Board are solely advisory and are stated in paragraph 2, above.

7. Estimated Annual Operating in Dollars and Person-Years:

The Department of Energy will provide resources sufficient to conduct its business as well as travel and subsistence (per diem) expenses for eligible members. The estimated costs are \$850,000 and approximately 6 permanent staff members.

8. Estimated Number and Frequency of Board Meetings:

The Board will meet semi-annually or as deemed appropriate by the Assistant Secretary for Environmental Management. Specialized committees of the Board will meet as deemed appropriate by the Assistant Secretary for Environmental Management.

9. Termination Date (if less than 2 years from the date of establishment or renewal):

Not applicable.

10. Members:

Members of the Board shall be appointed by the Secretary of Energy for 2 years to achieve continuity in membership and to make use of the acquired knowledge and experience with Environmental Management projects. Members may be reappointed for additional terms of 1 or 2 years.

11. Organization and Subcommittees:

The Board shall report to the Assistant Secretary for Environmental Management or other officers of the Department designated by the Secretary of Energy.

The Board is authorized to constitute such specialized committees as the Assistant Secretary for Environmental Management and the Board find necessary to carry out its responsibilities. Each committee will be chaired by an individual appointed by the Assistant Secretary or the Board's Executive Director. The Assistant Secretary will review the need for such specialized committees at least once a year to decide which should be continued. Committees will report through the Board.

Experts who are not members of the Board may be consulted by the Board or specialized committees, as appropriate.

12. Chair:

The Assistant Secretary for Environmental Management appoints a Chair or co-Chairs of the Board from the Board membership.

Date: January 18, 2000

/S/ James N. Solit

James N. Solit

Advisory Committee Management Officer

Date Filed: January 18, 2000

Charter

Environmental Management Advisory Board's Alternative Technologies to Incineration Committee (ATIC)

Background

The Secretary of Energy Advisory Board's Panel on Emerging Technological Alternatives to Incineration submitted a final report in December 2000. The Panel was chartered to evaluate and recommend technology initiatives the Department should pursue at Idaho as an alternative to incinerating mixed, transuranic (TRU) and low-level wastes. The Panel identified a range of "promising technologies" for further evaluation and suggested changes to DOE's developing Research, Development, Demonstration, and Deployment (RDD&D) plan for selecting alternative technologies.

Among other recommendations, the Panel recognized "...the need to develop and maintain full and meaningful public involvement throughout the RDD&D process, particularly in the evaluation and implementation of any technology for the Department's Idaho National Engineering and Environmental Laboratory (INEEL) TRU and mixed waste" (p. 22).

On January 8th, 2001, Secretary Richardson announced that as part of the Department's process to further evaluate and select alternative technologies to incineration and implement the evolving RDD&D plan, he would broaden opportunities for public involvement, including creation of a citizens' working group to monitor progress and provide direct input into the Department's technology-development efforts. Subsequently, it was determined that this citizens' working group would be organized as a Committee under the existing Environmental Management Advisory Board (EMAB), a Federal Advisory Committee Act (FACA) entity, external to and independent of the Department, which advises the Assistant Secretary for Environmental Management on issues relating to the treatment and remediation of cold war "legacy" nuclear waste.

Mission

The ATIC will examine emerging candidate technologies identified by the Department for treatment for disposal of mixed TRU and low-level wastes previously scheduled for incineration at INEEL. The Department is identifying these technologies through implementation of its technology RDD&D plan. The ATIC will facilitate stakeholder comment and communications on issues related to emerging alternative technologies to incineration for the treatment of mixed TRU and low-level wastes.

Reporting

The ATIC will report to the Environmental Management Advisory Board. The members of the Environmental Management Advisory Board, after discussion in an open meeting, will formulate advice and recommendations for transmittal to the Assistant Secretary for Environmental Management (EM-1). Transcripts and minutes of EMAB meetings will be made available to the public through direct and electronic mail as requested, postings on the EMAB web site (<http://www.em.doe.gov/emab>), and in DOE reading rooms. (The EMAB normally meets semi-annually. In accordance with FACA guidelines, all meetings of the EMAB are announced in the *Federal Register* approximately 30 days prior to a scheduled meeting.)

Estimated Number and Frequency of Meetings

The ATIC will meet 2-4 times annually as prescribed by the Committee Co-Chairs. ATIC meetings will be scheduled by the Committee Co-Chairs and will be announced in the EMAB Bi-Monthly Report available on the EMAB website (<http://www.em.doe.gov/emab>). Minutes of ATIC meetings also will be posted on the EMAB web site and will be made available to the public through direct and electronic mail as requested.

Membership Appointment Process

The ATIC will be composed of not more than sixteen (16) members. The Assistant Secretary for Environmental Management will appoint:

- The Committee Co-Chairs.
- Two representatives from public policy organizations that were parties to a Settlement Agreement resolving issues related to the treatment of waste at the Department's Idaho National Engineering and Environmental Laboratory (INEEL).
- One representative nominated by the Governor of Idaho and one representative nominated by the Governor of Wyoming.
- Ten representatives selected from candidates nominated by organizations and individuals based on announced selection criteria.

A selection panel composed of the EMAB Co-Chairs, the ATIC Chair or Co-chairs, and the EMAB Executive Director will evaluate the nominations and submit membership recommendations based on announced criteria. The Assistant Secretary for Environmental Management will make the final selection from those candidates recommended by the selection panel.

Terms of Appointment

Members will be appointed for an initial term of one year.

The Assistant Secretary for Environmental Management may reappoint members to additional one-year terms.

The Assistant Secretary for Environmental Management may fill vacancies on the ATIC based on recommendations made by the candidate selection panel.

Termination of the Committee

The Committee's Charter will be reviewed annually by the EMAB Co-Chairs and the EMAB Executive Director. Decisions to extend or terminate the Committee's existence will be discussed at public meetings but shall be subject to the approval of the Assistant Secretary for Environmental Management. The Committee may recommend its own dissolution to the EMAB Co-Chairs and the Assistant Secretary for Environmental Management.

Exhibit 1

**ALTERNATIVE TECHNOLOGIES TO INCINERATION
COMMITTEE ROSTER**

Mr. Richard Begley, Co-Chair Aiken, South Carolina	Mr. George W. Hinman Pullman, Washington
Ms Victoria Tschinkel, Co-Chair Tallahassee, Florida	Mr. Robert D. Kaestner Idaho Falls, Idaho
Dr. Carl Anderson Cheyenne, Wyoming	Mrs. Karen K. Patterson Aiken, South Carolina
Dr. John S. Bennion Pocatello, Idaho	Mr. William Lee Poe, Jr. Aiken, South Carolina
Dr. Norman Cutshall Boys, Maryland	Mr. Gary E. Richardson Boise, Idaho
Dr. Maxine Dakins Rigby, Idaho	Dr. Erik Ringelberg Jackson, Wyoming
Mr. Luther V. Gibson, Jr. Oak Ridge, Tennessee	Mr. James R. Wilkinson Pendleton, Oregon
Dr. Perry Holcomb North Augusta, South Carolina	Ms Kathleen Trevor Boise, Idaho

Exhibit 2

Criteria For Selection of Members for the Alternative Technologies to Incineration Committee (ATIC)

1. General: ATIC members shall be selected to representation of balanced points of view and balanced geographic representation is attained. ATIC members may include representatives of state and local governments, regulators, public policy groups, and concerned citizens.
2. Nomination/Appointment process. All appointments will be made by the Assistant Secretary for Environmental Management (EM-1).
 - The Assistant Secretary of Energy for Environmental Management (EM-1) shall appoint:
 - ' The Committee Co-Chairs.
 - ' One candidate each nominated by the Governors of the states of Idaho and Wyoming.
 - ' Two representatives from public policy organizations that were parties to a Settlement Agreement resolving issues related to the treatment of waste at the Department's Idaho National Engineering and Environmental Laboratory (INEEL).
 - Other ATIC members will be selected from candidates nominated by organizations and individuals based on announced selection criteria. The Assistant Secretary for Environmental Management will make the final selection from those candidates recommended by a Panel composed of the ATIC Co-Chairs, the EMAB Board Co-Chairs, and the Executive Director of EMAB.
3. General Criteria:
 - Agreement to Serve in a Volunteer Status: ATIC members serve as unpaid volunteers although members are reimbursed for travel and per diem. ATIC members are expected to attend 2-4 meetings a year. While it is anticipated that most meetings will be held in the Washington DC area, ATIC members may be asked to travel to field sites.
 - ' If a potential conflict of interest regarding a nomination is perceived to exist (for example, as a result of employment by an affected company party to issues under study of the nominee or a member of the nominee's family), the Office of the General Counsel will be consulted.

- **General Knowledge of EM Programs and Operations.** The mission of ATIC is to make recommendations to the Environmental Management Advisory Board regarding identification, testing, demonstration, selection, and deployment of technologies for treating mixed TRU and low-level wastes that are alternatives to incineration, and secondarily, to ensure that EMAB deliberations regarding this effort are open to public participation and comment. Candidates should be broadly familiar with the EM mission and scope of operations and have some current practical and policy experience or expertise in dealing with the “legacy” waste issues.
- **Technical Knowledge:** ATIC members will be asked to provide advice on the development, testing, selection and possible deployment of remediation technologies. Individuals should have broad understanding or familiarity with one or more of the following areas: risk management, waste treatment technologies, waste transportation, waste storage, radiation protection, basic and applied science methodologies, the technology development processes, safety management and broad Project Management and public policy experience.
- **Geographic and Organizational Diversity:** Self-explanatory.

Exhibit 2 - continued

**Candidate Evaluation Sheet
Alternative Technologies to Incineration Committee (ATIC)**

Name:

Specialty:

Education:

Current (or applicable employment):

Nominated by:

Ranking: (0 no experience; 5 high experience)

- Risk Management _____
- Waste Treatment Technologies _____
- Waste Transportation _____
- Waste Storage _____
- Radiation Protection _____
- EM Basic and Applied Science Programs _____
- EM Technology Development Processes _____
- Safety Management _____
- Broad Project Management and Public Policy Experience _____

Score (0-20) for status of knowledge of EM programs _____

Score (0-20) for required Geographic Diversity _____

Other Considerations: