

nuclear waste

ENTERED

January 12, 2001

Secretary Peter Maggiore
New Mexico Environment Department
Harold Runnels Bldg
100 St. Francis Drive, P.O. Box 26110
Santa Fe, NM 87502-6110



Dear Secretary Maggiore:

I am enclosing with this letter two reports that I mentioned in our meeting about WIPP on December 8, 2000. These are reports produced by the Secretary of Energy Advisory Board. At the meeting I had mentioned the Openness Committee Pilot Review on Relations between DOE Facilities and their Host when we spoke about DOE's outreach responsibilities to the New Mexico Environment Department. The second report on alternatives to incineration technologies I mentioned in relation to the potential for PCB disposal at WIPP. I hope you find the reports informative.

I am also writing to ask about your progress in formulating a policy for how NMED will give meaningful consideration to informal comments from citizen representatives or opinion leaders as a regular part of its decision making processes. I know that you have taken our concerns seriously. In particular your recent withdrawal of the temporary authorization for the class 2 drum age criteria modification for Idaho, based in part on informal citizen comments, was encouraging. However, I am interested in receiving any written policies or guidance that you have approved. At the meeting you indicated that Greg Lewis would get back to us prior to this year's legislative session.

As we stated in the December 8, 2000 meeting, we would be happy to meet with you and Governor Johnson on nuclear issues at some future date. Please let us know if you would find this informative.

Thank you for your attention and cooperation.

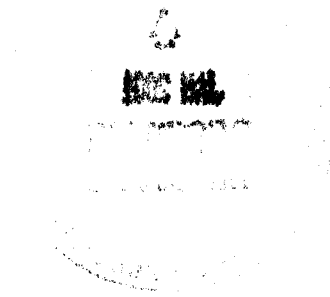
Sincerely,

Margret Carde

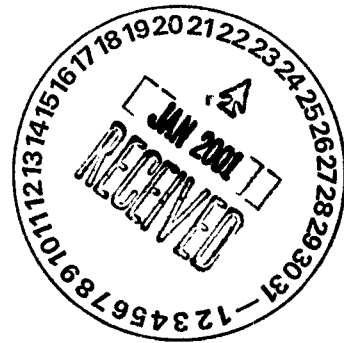
cc: Greg Lewis
Susan McMichael
Paul Ritzma
Steve Zappe

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Relations between DOE Facilities and their Host Communities: A Pilot Review



**Openness Advisory Panel
Secretary of Energy Advisory Board
U.S. Department of Energy
Washington, D.C. 20585**

November 17, 2000

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Relations between DOE Facilities and their Host Communities: A Pilot Review

Executive Summary

This report is about how the Department of Energy (DOE) can improve its relationships with the communities in which its facilities are located. In March 2000, Secretary Richardson asked the Openness Advisory Panel (OAP) of the Secretary of Energy Advisory Board to review and assess DOE's relationships with the communities surrounding its laboratories and facilities and to provide an independent assessment of how DOE is perceived as a neighbor, what it is doing well, and what it could do better. As a first step, the OAP conducted a pilot review at several sites representative of DOE's varied missions and provide a basis for developing a more extensive review process. The selected sites were Lawrence Berkeley National Laboratory, a multi-purpose science laboratory; Lawrence Livermore National Laboratory, an active defense laboratory; and the Fernald Plant, a former defense site now being cleaned up and shut down, and a widely recognized example of good community relations.

The review consisted of two-day visits and meetings with individuals or small groups representing a cross section of interests and views. These included state and local regulatory authorities, elected officials, public service providers (e.g. police and fire officials), business leaders, union leaders, educators, public interest groups, DOE or site advisory boards, contractors, and DOE site and operations office personnel. The visits were conducted by a site review team consisting of four OAP members. A total of more than 100 individuals at the three sites were interviewed during the course of the pilot review. The following conclusions and recommendations are based on the observations of the OAP site review team that visited the three sites and subsequent discussions with other OAP members.

Summary Of Findings

1. *Good community relations are essential for DOE facilities to achieve their missions.* Neglecting constructive relations and dialog with the communities in which DOE facilities are located can lead to conflicts that divert management attention and resources from achieving DOE's missions and can place DOE at a disadvantage in the competition for skilled employees and community support.
2. *Each site must tailor community relations programs to its own circumstances, consistent with Departmental policy.* Rather than prescribing specific practices, it is preferable to set performance goals for community relations and let each site determine how best to achieve them. Lessons from past community relations failures at some DOE facilities, sometimes leading to acrimonious litigation, must be understood and applied elsewhere so that other facilities do not repeat the same mistakes.
3. *DOE must recognize and address its legacy of public distrust.* Trust in the DOE and its predecessor agencies has been eroded by past actions and community experiences with DOE facilities. This legacy of distrust places extra burdens on DOE and contractor personnel who bear no responsibility for past actions, but who must nonetheless deal with the legacy.

4. *Communication must be full, open, timely, and two-way.* Each site must provide complete and timely information to the community. Failure to provide full and complete information causes distrust. Information concerning public health, safety, and the environment must be made readily available. Good community relations involves listening to the concerns of the community, not simply “getting the message out.”
5. *Person-to-person contacts are crucial for good community relations.* Successful community relations requires building positive personal relationships with key individuals and groups in the community. An important contributor to success is relationships with stakeholders developed by employees at all levels of the organization, not just at the top.
6. *A constructive attitude towards community relations is critical to success.* DOE and the contractor must approach community relations with the understanding that the site is part of the local community, not a federal enclave on foreign territory. Facility management must be willing to consider the impacts of their choices on the state of relations with the surrounding community, and to take those impacts into account in making decisions. New approaches conducive to good community relations will likely require changes in some traditional and firmly held views within facilities.
7. *Management at all levels must be accountable for good community relations.* Management at all levels of DOE and site contractor organizations must be actively and visibly engaged with the community and must strongly support community relations efforts throughout the organization. Incentives for good community relations should be established for senior DOE managers and for site contractors. The best approach for assessing performance is for DOE to listen directly to the community’s views, rather than to rely solely on self-evaluations.
8. *Community relations requires a clear and unambiguous organizational focus.* Community relations should have a clearly identified focal point at the site, operations office, and headquarters levels, separate in reality and appearance from any activities aimed primarily at one-way communication, often referred to as “public relations.” Community relations efforts will appear insincere, and thus be ineffective, if they are seen as means of persuasion or manipulation.
9. *Community relations must be an integral part of DOE’s operations.* Community relations should be treated as a normal cost of doing business, and should not be a low priority when budgets are tight. Community relations activities also require time, which should be provided for in program planning.
10. *DOE facilities should seek ways to make their resources useful to the surrounding community.* A proven way for DOE facilities to improve relationships is to use their resources to help host communities. Mutual fire protection and emergency response agreements, as well as education support activities at all levels and in all sectors of the community, are highly valued by host communities. However, education programs must not promote a point of view or seek to convey a message. Sites should also consider other ways in which their physical resources and employee skills might benefit their neighbors.

Recommendations to the Secretary

1. The Secretary should establish a policy emphasizing effective, progressive community relations as a priority throughout the complex of DOE facilities. This policy should be included in the Department's Strategic Plan. It should, in turn, be embraced and promulgated by each of the facilities as an integral programmatic objective.
2. The Secretary should require community relations reports from field managers at the monthly field managers meeting in Washington in order to ensure continuing high level attention to this issue.
3. Incentives for good community relations should be established. Senior DOE managers should have measurable performance standards included in their job descriptions and performance evaluations. DOE should tie experience in community relations to site management contract awards, and contracts should include meaningful criteria and incentives for performance in community relations. A process for independent assessments of the community's views of the adequacy of a site's performance in this area should be developed.
4. DOE Headquarters should have an institutional focal point for community relations, to assist Program Secretarial Officers carry out their responsibilities in this area, to monitor the Department's performance across the complex, and to identify and disseminate community relations "best practices" from both departmental and private sector experience.
5. Each site should develop an organized approach to enable members of the community to express concerns and an organized approach for the site to respond. The community should have a clear understanding of how, and to whom, to communicate concerns. The mechanism for communication should include an appeal process to assure objective review.
6. DOE should periodically conduct independent community relations reviews at DOE sites. Continuing the process tested in this pilot review is desirable as a way to evaluate DOE's relations with its host communities. It is also a potentially powerful tool to assist facilities strengthen the ties with their communities.

Background

In March 2000, Secretary Richardson asked the Openness Advisory Panel (OAP) of the Secretary of Energy Advisory Board to review and assess DOE's relationships with the communities surrounding its laboratories and facilities and to provide an independent assessment of how DOE is perceived as a neighbor, what it is doing well, and what it could do better.

As a first step, the OAP decided to conduct a pilot review at several sites and provide a basis for developing a more extensive review process. Three sites were selected for this pilot review. The sites were selected as representative of DOE's varied missions:

- Lawrence Berkeley National Laboratory, a multi-purpose science laboratory
- Lawrence Livermore National Laboratory, an active defense laboratory
- The Fernald Plant, a former defense site now being cleaned up and shut down, and a widely recognized an example of good community relations.

The review consisted of two-day visits and meetings with individuals or small groups representing a cross section of interests and views. A site review team consisting of four OAP members conducted the visits.¹ The team met with:

- state and local regulatory authorities
- elected officials
- public service providers (e.g. police and fire officials)
- business leaders and union leaders
- educators
- public interest groups
- DOE or site advisory boards
- contractors
- DOE site and operations office personnel

A total of more than 100 individuals at the three sites were interviewed during the course of the pilot review.

¹ Herbert Brown (Chairman), Margret Carde, Thomas Cotton (Vice Chairman), and Eric Willis

Findings

The following conclusions are based on the observations of the OAP site review team that visited the three sites and subsequent discussions with other OAP members.

These findings also draw on other reports by SEAB panels that address different aspects of DOE's relations with outside parties. The first is the report of the SEAB Task Force on Radioactive Waste Management. Established in 1991 at the request of Secretary James D. Watkins, this intensive 27-month study examined the critical issues of ensuring public trust and confidence in the Department's radioactive waste management programs, and developed recommendations intended to be more broadly applicable within the Department.² Its report, *Earning Public Trust and Confidence: Requisites for Managing Radioactive Waste*, was issued in November 1993.³ (The task force will be referred to as the Trust and Confidence Task Force herein to ensure clear association with this report.) Since radioactive waste management activities affect many if not most of the communities that are neighbors to DOE facilities, they have particular relevance to this review of community relations activities and issues.

The second report is *Responsible Openness: An Imperative for the Department of Energy*, issued by the Openness Advisory Panel of the SEAB in August 1997.⁴ In this report, the Openness Advisory Panel took an expansive view of openness:

"We see 'openness' as a broad concept that covers much more than declassification. Providing the public with access to information is equally important. And beyond accessibility of information, openness involves a way of doing business in which stakeholders and other interested parties are invited to participate, rather than be kept at arm's length."⁵

This report addressed the broader aspects of openness: improving the classifications system, achieving greater accessibility to documents and information, and changing the culture of the Department. Since the Department's relations with its neighboring communities is a crucial aspect of this broad concept of openness, a number of the findings and recommendations of this earlier report are applicable to the specific issue of improving community relations.

² The panel undertook an extensive effort extending over a period of 27 months. In a series of eight meetings throughout the country, the panel heard formal presentations from nearly 100 representatives of state and local governments, non-governmental organizations, and senior DOE Headquarters and Field Office managers. The group also commissioned a variety of studies from independent experts, contracted with the National Academy of Sciences and the National Academy of Public Administration to hold workshops on designing and leading trust-evoking organizations, and carried out one survey of parties affected by the Department's radioactive waste management activities and a second one of DOE employees and contractors.

³ *Earning Public Trust and Confidence: Requisites for Managing Radioactive Waste*, Final Report of the Secretary of Energy Advisory Board Task Force on Radioactive Waste Management, U.S. Department of Energy, Washington, D.C., November 1993. The report is available on the SEAB Web page at <http://www.hr.doe.gov/seab/>

⁴ *Responsible Openness: An Imperative for the Department of Energy*, Openness Advisory Panel, Secretary of Energy Advisory Board, U.S. Department of Energy, Washington, D.C., August 25, 1997. The report is available on the SEAB Web page at <http://www.hr.doe.gov/seab/>

⁵ *Responsible Openness*, p. 5.

1. Good community relations are essential for DOE facilities to achieve their missions

The crucial first step in improving community relations is for DOE and contractor personnel to understand that the state of their facility's relations with its neighbors can affect their ability to carry out their missions.⁶ **Public trust, above all else, is essential.**⁷

What kind of involvement DOE should have with its neighbors begs the question: who are the neighbors? The old definition of neighbor as someone who lives and works near the DOE site may no longer be adequate. Today, "neighbors" may be described as those interested in or affected by DOE's presence, whether by traffic congestion, health and safety concerns, as a potential employer, through interaction with employees that work at DOE sites, the impact of the site on land use questions, and a variety of other issues.

Old definitions of "neighbor" are rapidly changing. For example, **DOE facilities find themselves in an increasingly dynamic environment.** Change has many dimensions: local development and growth patterns, economic changes both residential and industrial, social and political shifts of opinion, and demographic changes both within the facilities themselves and in the surrounding communities. **No longer can a DOE facility assume that it is the only attractive "high tech" business in town.** The influx of other companies means growing competition for both technical and support personnel, as well as for the interest and support of the local community. It is not practical to take the community's appreciation for the existence of the facility for granted.

Changing residential and demographic patterns are complicating the task of relating to the surrounding community. The review team observed at every site that employees are the first line, and the most effective, ambassadors in a community. However, **the concept of a site's "community" is expanding as workers, for economic reasons, must live farther and farther away.**⁸ While the relationship to the local host community remains of central importance, a declining percentage of site workers residing in that community can lessen the beneficial influence of workers as "ambassadors." At the same time, there may be a need to extend the geographic scope of a site's community relations efforts to encompass new dormitory communities in which more and more workers reside. Interviews with representatives of some of these more remote communities indicated genuine interest in having a closer relationship with the neighboring DOE facility.

Another important change is the demographic "graying" that is occurring at some DOE facilities. As the average age of the employees increases, there are fewer families with school age children, and therefore lesser incentives to the older DOE employees for community involvement, particularly in schools. Facilities need to encourage the older generation of workers to make their skills available as valuable resources for the community and to support and recognize

⁶ One DOE official pointed out that the first step is to convince DOE and contractor personnel that community relations is a problem that affects them; then show them what they can do about it.

⁷ Earlier studies arrived at the same conclusion as this study. "Public trust and confidence is not a luxury. DOE not only has an obligation to earn it, but it also has a compelling need to do so." *Earning Public Trust and Confidence*, p. 20. "DOE needs to have the public trust if it is to accomplish its missions...." *Responsible Openness*, pp. 2-3.

⁸ We were informed by a realtor that the average price of a 1000 square foot two bedroom, one bath house in Berkeley, host to the Lawrence Berkeley Laboratory, is about \$500,000.

community efforts.

Good relations with surrounding communities are desirable for the simple reason that public facilities conducting the public's business should be good neighbors. At a more pragmatic level **poor community relations limit a facility's ability to carry out its missions.** At the simplest level, **a state of friction caused by the surrounding community's dissatisfaction can divert management attention and resources away from program missions.** If the relationship is characterized by deep distrust, it can lead to, or exacerbate, active opposition to those missions. As the Trust and Confidence Task Force observed, "The lack of public trust and confidence is not only being recognized by stakeholders as an obstacle to programmatic progress, but it is also being used increasingly as a reason for opposing initiatives that are important to programmatic progress."⁹

Cases of activities causing conflict with the community should be carefully scrutinized and not allowed to fester, since problems in one area can adversely affect the overall relationship. As one environmental activist observed with respect to the relations of the nearby DOE facility with his community, "There have been good points, but the bad ones stick in your mind."

Where there is continuing and vocal political opposition to a particular activity at a site, it is important to determine whether the benefits of retaining the activity outweigh those of terminating it in the interests of eliminating the disproportionate amount of management time and resources devoted to it. In cases in which the activity is part of the site's mandated mission, the site might have little discretion to eliminate the activity. However, it might have some ability to modify it in ways that address local concerns while still achieving fundamental objectives. As one DOE manager observed, it may be necessary to modify the mission in order to achieve enough consensus to allow progress.

Furthermore, as DOE facilities increasingly seek to expand activities beyond core missions, by providing services to other government agencies and even the private sector, the acceptability of particularly discretionary activities to host communities deserves careful consideration. In one instance of a controversial activity observed during the pilot study, members of the community suggested that simply placing the option of terminating the activity on the table for discussion might reduce the conflict and improve the level of trust. **It must not be expected, however, that improving community relations practices can make conflicts go away entirely.** Some level of disagreement about the activities of the government are to be expected in a democratic society. **What can be accomplished is to lower the level of emotion associated with those disagreements and to keep it from poisoning the relationship between the site and the community.**

DOE should develop procedures for assessing community concerns about an activity, determining the extent to which they can be addressed at the site level, and deciding how to include the concerned public in the review process. The procedures should encourage interactions with the community that assure early attention to community concerns, even if raised by only a few members of the public.

⁹ *Earning Public Trust and Confidence*, p.37

2. *Each site must tailor community relations programs to its own circumstances, consistent with Departmental policy*

Every site has unique features that must be taken into account in developing an appropriate community relations program. Every community has its own character, and the history of the relationship between the site and the community has created current realities that must be taken into account when addressing future site plans.

A particularly important difference concerns the nature of the activities at the site. For example, **Fernald, which is engaged solely in cleaning up and shutting down, faces very different challenges from Livermore, which is still actively engaged in defense nuclear activities.** At Fernald, there is widespread agreement about the mission of the site. Various parties said that the key point in the turnaround of relations with the community was the decision to shut down the activities that were the source of radioactive and hazardous emissions. From that point on, a cooperative relationship to achieve the shared objective of environmental health and safety was possible. At sites where there are ongoing activities that have potentially adverse impacts on the community, or that are associated with controversial policy issues, the scope of shared interests is smaller and the potential for conflicts greater.

Despite these differences, there are common denominators of principle and practice that should apply across all sites.¹⁰ However, the means and styles of implementation may be different to suit particular circumstances. Local DOE community relations officials with considerable successful experience cautioned against pushing specific techniques onto all the sites from the top. Instead, **it is better to set a performance goal (improve relations with the community) and let each site figure out how best to achieve it.** DOE officials at several sites pointed to the Department's successful Integrated Safety Management (ISM) initiative, aimed at making safety management an integral part of work, as a good example of a non-prescriptive approach.

In seeking methods to improve community relations in their particular circumstances, sites should seek to learn from the successful experiences of other DOE sites and the private sector. Lessons from past community relations failures at some DOE facilities, sometimes leading to acrimonious litigation, must be understood and applied elsewhere so that other facilities do not repeat the same mistakes. **DOE Headquarters should promote a systematic effort to identify and assess the causes of both successes and failures in community relations and to disseminate the lessons throughout the complex.¹¹**

¹⁰ One businessman with considerable success at community relations warned, "'We're different' is an excuse for not doing anything."

¹¹ The Trust and Confidence task force recommended that DOE "Support and develop mechanisms to learn from innovations by Field Offices that have increased public trust and confidence." *Earning Public Trust and Confidence*, p. 54

3. DOE must recognize and address its legacy of public distrust

DOE and the site contractor must understand that they are operating in a climate of public distrust created by behavior over many years. This point was made in a variety of ways by many people in each of the communities that were visited. As one senior site manager put it, “The problem we face is that people don’t believe anything DOE says.” On the same point, a local emergency response person said, “Once you’ve lied to me, it’s hard to trust you. It took a long time for me to believe anything from DOE.” **This legacy of distrust places extra burdens on DOE and contractor personnel who bear no responsibility for past actions, but who must nonetheless deal with the legacy.** As the Trust and Confidence Task Force observed, this legacy of distrust could require the adoption of measures that would not otherwise be necessary.¹²

“The many decades of secrecy that have surrounded the activities of the Department of Energy have served to create suspicion of the Department and its activities. These suspicions, reinforced by ongoing lapses in providing complete and timely information, damage relations between the Department and its contractors and the communities in which they must operate. These suspicions also erode confidence in the Department by the public and its elected representatives, undermining the Department’s capacity to accomplish its missions. As a result, the Secretary should place a high priority on enhancing and institutionalizing openness throughout DOE and its contractor community. The public trust that openness can nurture is an essential precondition for success in the Department’s activities.” *Responsible Openness*, p. ix.

“The legacy of distrust created by the Department’s history and culture will continue for a long time to color public reaction to its radioactive waste management efforts. Only a sustained commitment by successive Secretaries of Energy can overcome it.” *Earning Public Trust and Confidence*, p. 36.

One measure that has proved to be helpful is the use of independent expert review and analysis to help defuse controversial technical issues. At several sites, various parties (including regulators) said that the independent technical work produced by consultants for stakeholder groups was of excellent quality and very useful. The Department should encourage the use of such independent technical reviews, and should ensure that the independent reviewers, who can be difficult to find, are provided the timely, comprehensive information they need to conduct an effective review.¹³

It is also important to be responsive to all elements in the community, and not to marginalize those who are critical and distrustful. Critics and opponents should be brought to the table as part of the community and not be isolated from contact with DOE and contractor

¹² “If DOE is to restore public trust and confidence, it will have to take steps that might be considered unnecessary for an organization that has maintained public trust and confidence over long periods of time.” *Earning Public Trust and Confidence*, p. 36.

¹³ At one site a candidate independent technical reviewer withdrew from consideration in part because DOE appeared to be uncooperative in providing timely data. At another site, independent reviewers were refused requests to tour the site or meet with key personnel.

decisionmakers. People who feel cut off from constructive communication may seek other, perhaps less constructive, means of expressing their views. The site review team learned that members of the community look to the activists to raise issues, and expect the site to respond to the issues seriously and respectfully. When an activist group proposes to hire its own technical expert, DOE should cooperate appropriately.

Establishment of advisory groups should be considered as a means of enhancing regular two-way communication. The Trust and Confidence Task Force recommended that DOE commit itself to "Early and continuous involvement of state and/or local advisory groups ... on which a broad range of stakeholders ... are represented. That involvement would be characterized by frequent contact, complete candor, rapid and full response to questions, implementation of at least some suggestions, and assistance in increasing the technical and oversight skills of the community."¹⁴ **It is important, however, that community advisory groups not be seen as creatures of the DOE or facility management.** The need to include minority opinions in the dialogue is essential. The danger of developing an insider group of advisors cuts off DOE's ability to respond to the dynamic quality of community change. Advisory groups need flexibility to address various situations as they arise. The scope of an advisory group's review should not be arbitrarily limited.

In seeking the trust of the community, DOE and contractor management must learn to trust the community in return. As one DOE community relations official observed, two-way trust is needed. While this might appear risky to those accustomed to a less open way of conducting business, it can lead to remarkably helpful results. In Fernald, DOE along with its regulators (the U.S. Environmental Protection Agency and the Ohio Environmental Protection Agency) created a citizen's task force to make recommendations on central issues posed by the remediation of the Fernald Environmental Management Project, including the target cleanup levels and the final disposition of the radioactive wastes from the site. Instead of recommending a "not in my backyard" approach involving cleanup to background levels and removal of all waste from the site, the task force took a broad view, considering a wide range of issues including feasibility, cost, and safety and equity issues raised by moving waste from their site for disposal somewhere else. As a result, the task force accepted cleanup to the EPA maximum contaminant levels, and permanent disposition of all but the most radioactive portion of the waste onsite.¹⁵ Because the task force members were seen by the community as representative of and responsible to the community, their recommendation was accepted by the community as a whole.

4. Communication must be full, open, timely, and two-way

Good community relations requires good communications in both directions. The site must provide information to the community, and must be willing to receive and consider information from the community.

¹⁴ *Earning Public Trust and Confidence*, Executive Summary.

¹⁵ Fernald Citizens Task Force, *Recommendations on Remediation Levels, Waste Disposition, Priorities, and Future Use*, July 1995.

In *Responsible Openness*, the OAP pointed out that providing the public with access to information is a central part of openness. The validity of this conclusion was verified by discussions with members of the communities surrounding all three sites visited during this pilot study.

DOE and contractor personnel should actively provide information to the community about what the site does -- not only about the activities that might be of concern to the public but also about the benefits its activities provide to the community and the broader society. Members of the public stressed that **lack of knowledge and familiarity causes mistrust and fear**.

Providing access to the facility can go a long way toward reducing the air of mystery that has surrounded DOE facilities in the past. Community Open Houses appear to be an effective and appreciated way to increase public familiarity with the activities of the facility.

It is also important to take the initiative in making information available, rather than to provide it only when there is an obvious need or legal requirement. One local business leader observed: "It's what they don't say that stirs the pot. Lay it out there in terms laymen can understand."

The need to make information understandable to the intended recipients was a common theme raised by a variety of community members during the site visits. **Two levels of information are necessary: details and hard data for opinion-setters, and clear, readable, concise information for the general public.**¹⁶

It is particularly important to be as forthcoming as possible in providing information in cases in which it might be damaging or where the situation is changing rapidly. One senior manager put it this way: "If you have bad news, it doesn't get better with time." In the case of rapidly changing news, frequent updates and interaction with community members are essential, first, to show that DOE is addressing the problems of concern and second, to utilize public questions as a way to help identify areas that DOE may need to address more fully. A local emergency response provider said that the willingness of the site contractor to share information was key to establishing trust. "Just tell us the truth; people can handle it."

Information concerning public health, safety, and the environment must be made readily available. In general such information is not classified. However, substantial effort might be required to find the documents containing the information. Furthermore, in some cases those documents will have to be reviewed and redacted because they also contain information that is classified.¹⁷ Emphasizing the importance of making information publicly available, the Trust and Confidence Task Force recommended that DOE should "disseminate without exception information about past practices that may raise questions about potential health, safety, and

¹⁶ Individuals dealing with site cleanup issues often want direct access to original records and raw data, without any additional interpretation or explanation.

¹⁷ "Virtually all information bearing on environment, health, and safety is now unclassified. But, the simple fact that the information is unclassified does not necessarily mean that it is accessible. Unclassified information that is buried in a file is effectively unavailable to the public (or the Department)." *Responsible Openness*, pp. 5-6.

environmental risks.” (See box)

To provide information fully and rapidly, the Department should:

- Identify and employ the information channels actually used by stakeholders.
- Disseminate without exception information about past practices that may raise questions about potential health, safety, and environmental risks.
- Invoke the pre-decisional exemption in the Freedom of Information Act only under exceptional circumstances, which are candidly explained.
- Release, on request, any DOE-generated material that has been shared, even informally, with any other non-governmental organization. Precautions should, of course, be taken to protect legitimate proprietary information.

Earning Public Trust and Confidence, p. 50

Failure to provide full and complete information breeds distrust. The site review team heard of several cases in which requests for data and answers to specific questions from particular groups in a community were not provided in a timely way. These occurrences were pointed out not only by the requesters, but also by other members of the community who clearly thought that the failure to respond indicated arrogance, the desire to cover up damaging information, or just plain incompetence.

Communication needs to be timely and ongoing, not simply responsive to problems. Officials should not wait for a final evaluation of a crisis or final decision on a proposal before communicating with the community. At one site, a businessman said that when he told a colleague he was coming to discuss community relations at the DOE facility, the colleague responded “They must have a problem.” A local official dealing with hazardous materials called for a free and ongoing exchange of information that is not reactive and that is not necessarily solicited. “I am a public official in charge of assuring community health and safety. If I’m in the dark,” he said, “the community has a real problem.”

The minimum legal requirements concerning the amount and timing of information to be provided should be exceeded whenever necessary to meet community needs. Information should be routinely accessible, so members of the community do not have to resort to measures such as Freedom of Information Act requests to obtain it. In addition, there should be communication about problems and issues from the beginning. One DOE community relations official pointed out that the involvement processes required by law come too late to allow meaningful public/DOE dialogue. A variety of communication methods is desirable to reach all segments of the community population. In one instance, DOE and contractors used e-mail to provide timely and appreciated “heads-up” notices to members of the community to alert them to developing issues.

Communication should also be two-way. Good community relations involves listening to the concerns of the community, not simply “getting the message out.” One DOE manager

told us: "The most important thing we can do is listen to the public and be honest with them. We must give them the good and the bad news, and follow through on commitments."

The idea of two-way communications applies in particular to the way in which the facility approaches the community with respect to plans for future activities. At several sites, various members of the community suggested that the facility management should not go out to public meetings with proposals to sell, but rather with a blank sheet of paper and a willingness to talk about issues and solutions.

To ensure clear and timely two-way communication, there should be an established and visible mechanism through which the public has direct access to top contractor and DOE officials at the site. A standing advisory panel can serve this function, but more informal practices (such as regular one-on-one meetings) can also work.

Special care is needed so that the culture of secrecy historically present at defense-related sites is not an obstacle to openness in communications and in community relations in general. At one site, a businessman noted that relationships had improved in past years, but that recent security issues have slowed the progress that had been made.

Preservation and enhancement of security for critical nuclear secrets is essential. Consistent with this necessity, the Department should strive to preserve openness in its relations with the communities surrounding its sites and with the public more broadly. In its previous report, the Openness Advisory Panel observed that greater openness is required for the success of the Department's missions not only for the credibility and trust that it engenders, but also because the ability to recruit and retain a staff of the highly skilled scientific and technical professions needed to implement its defense missions, especially the Science Based Stockpile Stewardship program, might depend upon it. As the report observed, "a life 'behind the fence' may not seem as desirable to new recruits as it may have been during the Cold War."¹⁸ In addition, the productivity of the laboratories will probably entail a greater mix of classified and unclassified research than in the past. The more openness there is, consistent with rigorously protecting classified information, the greater likelihood of productive advances in both areas.¹⁹

5. Person-to-person contacts are crucial for good community relations

Successful community relations require building positive personal relationships with key individuals and organizations.²⁰ It was clear at all of the sites visited that members of the community trusted specific individuals associated with the site rather than the organizations to which they belonged. One DOE public affairs official observed that there is so much competition

¹⁸ *Responsible Openness*, p.2.

¹⁹ *Responsible Openness*, p. 3

²⁰ The importance of building relationships in the host community is recognized in the private sector. "At the heart of the neighbor of choice strategy is relationship building. The intention is to position the company favorably into the community by developing positive and sustainable relationships with key individuals and organizations.....The company has to be viewed as an asset, not a liability, in the community. And it has to use relationship building as a means for developing a legacy of trust in the community. When a crisis occurs, consequently, the company's explanations will be heard fairly." Burke, Edmund M., "Becoming a Neighbor of Choice...A Strategy for Community Relations," the Center for Community Relations at Boston College, March 26, 1996, p. 3.

for public attention in the proliferation of mass media that mass communications is an ineffective way to persuade the public. Instead, he stated, building personal relationships with opinion leaders is “the only way I know of to build trust.”

Both DOE and the site contractor must have the right people in the community relations jobs; the public must be comfortable with them and have access to them. These people must also have respect within DOE and hold high enough positions to have direct access to top management. Continuity of personnel appears to be particularly important in building trusting personal relationships.

In addition to a formal community relations or public affairs staff, **each site visited by the site review team has employees at various levels throughout the organization who engage in outreach and involvement and are seen as effective ambassadors by the community.** At each site the site review team heard praise for the work of such individuals.²¹ **The community needs to see that senior management gives such individuals and their activities visible institutional support and recognition.**²²

A particularly successful model is the “Fernald Envoy Program,” established in 1994 to promote one-on-one communication between Fernald personnel and representatives of local community groups interested in site activities. Envoys, who are both DOE and site contractor employees, build close relationships with community groups by providing them with detailed information, listening to their questions, concerns, and suggestions, and providing this feedback to those involved in making decisions concerning Fernald cleanup activities. Envoys have direct access to top management. They are empowered to give information to the public – without having to go up and down the chains of command in the site contractor and DOE organizations; if they cannot answer a question from their own knowledge, they can get the needed information from experts at the site. **A DOE community relations official stated that the key to success at Fernald was relinquishing control of stakeholder relations, so that it took place all levels – not just the top of the organization.**

At some sites the site and community have set up citizen advisory boards which meet to discuss areas of concern in the community and to make recommendations to DOE and its contractor. These boards are effective if they are perceived as independent from DOE and when they have flexibility in defining the scope of their investigation.

6. A constructive attitude towards community relations is critical to success

DOE and the contractor must approach community relations with the understanding that the site is part of the local community, not a federal enclave on foreign territory. This is obviously the case at those sites where the primary or sole focus of activities now is management and mitigation of the health, safety, and environmental impacts of past activities on the surrounding

²¹ At one site, the individual who was mentioned most frequently as being an outstanding representative of the site to the community was not a member of the community relations or public affairs organizations.

²² At the same site, discussing the same person, a community member noted that if this person could not help and had to refer an issue to another part of the lab having the appropriate expertise, the result was that “things fall apart – there is no interest or understanding.” The perception was that the help came from the individual, not from the facility.

community. But it is also true at the sites with a continuing active defense mission. **With the end of the Cold War, and the growth of non-classified research activities even at defense sites, there is no reason to believe that the degree of isolation that prevailed in the past will serve a site well in the future.**

Both DOE and contractor management must understand clearly that they are engaged in the public's business and therefore are accountable to the public, including in particular that part of the public in whose neighborhood they work. **Facility management must be willing to consider the impacts of choices on the state of relations with the surrounding community, and to take those impacts into account in making decisions.**²³

Building good community relations requires people with the right attitude and mindset; they must not have a "fortress mentality" and must scrupulously avoid "demonizing" any opposition or being perceived as arrogant. It is important to treat all groups with respect. All members of the public, no matter what their views, have a right to know how the site affects their interests, and have the right to define those interests. Moreover, minority opinions could be harbingers of mainstream opinion to come. DOE should listen when these issues first arise so that DOE can deal with dynamic changes in matters that could well affect its community relationships.

New approaches conducive to good community relations will likely require changes in some traditional and firmly held views within facilities (see box).²⁴

Changing the Culture. ...[T]he 50 years of secrecy inherent in protecting the development of nuclear weapons inevitably produced a 'culture' – a system of beliefs and ways of doing business—that persists among the Department's employees and its contractors. Orders and regulations, however well intended to rectify defects in the system, will fall short of their intended purpose if they are counter to the prevailing mindset of this entrenched culture. It might be expected that this concern would apply only to the nuclear weapons complex, but in fact the non-defense activities of the Department were influenced by the Department's practices in the defense arena and have assumed many of its characteristics.

Until cultural change is seen by all to be in the self interest of the Department's and its contractors' employees, lasting and fundamental changes in the way DOE does business will be difficult to achieve, and the advances of the last few years will be transitory achievements."

Responsible Openness, p. 6.

²³ On this point, the Trust and Confidence Task Force recommended a series of measures "To ensure that the public trust and confidence implications of critical Departmental activities have been properly identified and weighed.." *Earning Public Trust and Confidence*, p. 54. The same point is recognized in the private sector "The only way that the neighbor of choice strategy will become corporate wide is to make it part of the company culture. Before a business decision is made managers need to consider: *What are the community implications of this decision?*" Burke, op. cit., p. 7.

²⁴ The first independent review of the Department's openness efforts called for steps to change the culture of secrecy that inhibited openness. National Research Council, *A Review of the Department of Energy Classification Policy and Practice*, National Academy Press: Washington, D.C., 1995, p. 83.

7. *Management at all levels must be accountable for good community relations*

Management at all levels of DOE and site contractor organizations must be committed to successful community relations. They must strongly support community relations efforts throughout their organizations. Furthermore, those efforts cannot be left to community relations personnel alone; **top level management, beginning with the facility director and the DOE operations office manager, must themselves be actively and visibly engaged with the community.**²⁵ This includes participation in a range of community organizations, and accessibility for one-on-one meetings with key members of the community.²⁶ Senior managers should have measurable performance standards for community relations included in their job descriptions and performance evaluations (see box).²⁷

“Senior managers would be required to establish performance standards in the area of sustaining public trust and confidence. That activity would become part of their job descriptions, and they would be evaluated accordingly.”

Earning Public Trust and Confidence, p. 59.

“Individuals and organizations often respond better to the promise of rewards than to the threat of penalties, and they tend to produce the things for which they are being rewarded. DOE should include explicit measures of openness in performance measures for agency personnel and contractors. Provision of explicit performance measures of openness could be a useful step in establishing concrete positive incentives for openness.”

National Research Council, *A Review of the Department of Energy Classification Policy and Practice*, p. 83.

A related issue that was raised at all sites as a concern is the need for clear lines of accountability so that the community knows who is responsible and accountable for what goes on at the site. Sometimes it is not clear whether to turn to site managers, contractor management, the DOE Field Office, or DOE Headquarters. Confusion in the lines of authority and responsibility does not build trust and may allow staff to abdicate responsibility—a sure-fire way to engender public distrust.

²⁵ The importance of broad management involvement in community relations is recognized in the private sector: “The neighbor of choice strategy needs to be a corporate-wide strategy, not a community relations strategy. While the community relations staff is instrumental and critical in planing and helping to carry out the strategy, positioning the company positively in the community is a corporate-wide responsibility.” Burke, op. cit., p. 7

²⁶ One senior site manager reported that when he joined the Chamber of Commerce, the other members from the community were very surprised, and pleased, to see someone from the facility.

²⁷ The importance of evaluating managers in terms of community relations performance was heard from both DOE officials and businessmen. As one businessman put it, “In my company, when we tried to get into a community, we found individuals and made it part of their performance appraisals. “ He also said it is important for facility management to get involved personally, say that community relations is important to them, and recognize people who do well in that area.

Authority and responsibility for community relations should be delegated to the Field Office level to the extent possible. Some community members interviewed by the site review team expressed dissatisfaction at the perception that information about important news has to be cleared with DOE Headquarters first. This situation engenders public impatience and perhaps distrust, depending on how long the delay is. The suspicion is that local staff members are not being candid or may be passing the buck to avoid admitting their own mistakes.

Concomitantly, DOE Field Office management must have the knowledge and skills needed to take a direct role in community relations and to administer the community relations aspect of the site management contract. This might require special training.²⁸

Contractor personnel also play a key role in community relations, since they are usually the largest and most visible presence on the site.²⁹ **DOE should establish performance-based criteria for community relations, and should tie experience in community relations to site management contract awards and success in community relations to bonuses.**³⁰ In addition, the DOE's contract with the site contractor must set meaningful standards of performance for community relations.

The best approach for assessing performance is for DOE to listen directly to the community's views of relations with the site, rather than to rely solely on self-evaluations. Success should be measured by results – the actual state of community relations. One DOE community relations manager suggested evaluating the site's performance by measuring "the temperature of the site's relations with the community," which might be accomplished by having a senior official from Headquarters meet with stakeholders.³¹ **This pilot review has shown that members of the community are willing and able to provide candid assessments to independent evaluators.**³²

²⁸ "Most general managers are unprepared for taking on a community relations activity....." Some companies provide training programs, others send them to executive education programs in community relations. Burke, op. cit. pp. 9-10.

²⁹ "Because of the Department's extensive use of contractors in carrying out its radioactive waste management activities, any attempt to strengthen public trust and confidence will have to include those individuals in order to be successful." *Earning Public Trust and Confidence*, p. 40

³⁰ The most recent RFP for the Fernald site contract included a factor for "Stakeholder Involvement Experience" – "the offeror's experience in effectively working with community groups, such as local citizens groups, local Government organizations and other interest groups." This was given 5 percent of the weight – the same as given to "Corporate Past Performance." DE-RP-00OH20115, p. 176, 179.

³¹ The Trust and Confidence Task Force recommended consideration of "the deployment of 'trust and confidence' teams that would independently evaluate how different units performed." *Earning Public Trust and Confidence*, p. 53

³² The Trust and Confidence Task Force concluded: "The actions [to enhance trust and confidence] endorsed by the Secretary would be incorporated into each program's strategic planning process and into its Total Quality Management regime. Appropriate metrics for evaluating performance would have to be developed in consultation with the affected stakeholders. Those 'publics' would also have to participate in the assessment process." *Earning Public Trust and Confidence*, p. 59.

The Trust and Confidence Task Force's recommendations to the Department concerning ways to improve the quality of its interactions with all public stakeholders included :

- "Make training in public involvement principles and processes a requirement for managers, supervisors, and technical personnel who might interact with stakeholders.
- Make bonus awards, career advancements, and promotions dependent on successful demonstration of the capability to interact positively with a wide range of sectors in the public.
- Require DOE contractors to conduct equivalent training for their employees. Their performance evaluations and awards should be structured to include contributions to the overall public involvement effort."

Earning Public Trust and Confidence, p. 50.

8. *Community relations requires a clear and unambiguous organizational focus*

Community relations should have a clearly identified focal point at the site, operations office, and headquarters levels. This focal point should be separate in reality and appearance from any activities aimed primarily at one-way communication, often referred to as "public relations."³³ Community relations involves working with the community on subjects of mutual interest and concern. While communications are important, they involve listening as well as providing information. The emphasis is on getting the community's messages in, rather than getting the site's message out. Community relations also involves public participation, to bring the public into the decision process at an early date concerning matters that affect their interests. (A good statement of the two-way focus of public participation is shown in the following box.) It could be difficult for the same individuals to function effectively in both one-way and two-way activities. Furthermore, **community relations efforts will appear insincere, and thus be ineffective, if they are seen as means of persuasion or manipulation.**³⁴

Community relations should not be viewed as solely a function of the environmental management part of a site's organization. DOE's environmental management program has devoted considerable efforts to a wide range of activities to engage its stakeholders, so its mechanisms for interactions with neighboring communities are generally well established and accepted. **The sites should seek to provide community relations points of contact for all activities, not just those conducted by the environmental management program.** This is particularly important for activities that are viewed as controversial.

³³ One-way communication is sometimes viewed as the function of "public relations." The need to consider community relations as something quite distinct from traditional public relations is hardly unique to DOE. "Government relations and public relations continues to dominate the thinking behind many companies' external affairs strategies. Community relations continues to be viewed as a marginal operation." Burke, op. cit., p. 9

³⁴ An individual involved in cleanup issues at one site said that the site had a large public relations group, in relation to its community outreach, and described the situation as "a volunteer mouse vs. a professional paid elephant."

DOE PUBLIC PARTICIPATION POLICY

Public participation is a open, ongoing, two-way communication, both formal and informal, between the Department of Energy and its Stakeholders. This steady, interactive communication enables each party to learn about and better understand the views and positions of the other. The Department recognizes the many benefits to be derived from public participation, for both stakeholders and DOE. Public participation provides a means for the Department to gather the most diverse collection of opinions, perspectives, and values from the broadest spectrum of the public, enabling the Department to make better, more informed decisions. Public participation benefits stakeholders by creating an opportunity to provide input and influence decisions.

POLICY

Public participation is a fundamental component in program operations, planning activities, and decision-making within the Department. The public is entitled to play a role in Departmental decision-making.

PURPOSE

This policy is intended to ensure that public participation is an integral and effective part of Departmental activities and that decisions are made with the benefit of important public perspectives. This policy provides a mechanism for bringing a broad range of diverse stakeholder viewpoints and values early into the Department's decision-making processes. This early involvement enables the Department to make more informed decisions, improve quality through collaborative efforts, and build mutual understanding and trust between the Department and the public it serves.

Excerpts from Department of Energy Public Participation Policy, DOE P 1210.1, 1994

A potentially complicating factor is the realignment of DOE lines of authority so that each site reports to the Headquarters office with the most direct interest in its activities. For example, Lawrence Livermore National Laboratory reports to the Office of Defense Programs, Fernald to the Office of Environmental Management, and Lawrence Berkeley Laboratory to the Office of Science. The different Program Secretarial Offices can have different attitudes toward, and experience with, community relations. **Secretarial attention may be required to ensure that a uniform level of attention is paid to community relations across the range of responsible Program Secretarial Offices.**³⁵ Including the state of each facility's community relations as a

³⁵ "[T]he social vision [the philosophical underpinning for community relations activities] needs to be widely communicated throughout the company, particularly by the CEO. Only the CEO has the authority – clout, if you will—to insist upon the importance of a social vision for the success of the company. It is explaining the *need* for a social vision that is most important. If the CEO does not explain the relationship of the vision to the future of the company, and if he or she is not personally involved in community affairs, then the vision becomes a platitude." Burke, op. cit., p. 8

standard agenda item for the Secretary's monthly meetings with the field managers could help achieve this objective.

DOE Headquarters should have an institutional focal point for community relations.

Although responsibility and authority for community relations should be decentralized to the extent possible, a headquarters office would assist Program Secretarial Officers carry out responsibilities in this area and would monitor the Department's performance across the complex. It could also help improve the quality and reduce the total costs of community relations throughout the DOE complex by taking the lead in identifying and disseminating community relations "best practices" from both departmental and private sector experience.³⁶ Because of the great overlap between community relations and public participation objectives, principles, and practices, a single organizational focal point for both may be appropriate.³⁷

9. Community relations must be an integral part of DOE operations

Community relations must be an integral part of all programs and activities, not simply an add-on.³⁸ As discussed earlier, it must be a responsibility of senior DOE and contractor management, not just the community relations organizations.

Adequate funding must be provided; community relations should be treated as a normal cost of doing business, and should not be viewed as a low priority when budgets are tight. Admittedly, this can be difficult in an environment of restricted and even declining funding for mandated missions. Nonetheless, the importance of good community relations to the achievement of DOE missions should be recognized in the allocation of resources. Past reports have emphasized the need for resources to address the closely related issues of trust and confidence, and openness.³⁹

Community relations activities also take time, which should be provided for in program planning. If sufficient time for early communication with the community is not planned at the beginning of an activity, more time may be required later to deal with public reactions to what might be perceived as unilateral actions by the site.

Community relations expertise should be treated with the same seriousness as technical and managerial expertise. Training in community relations "best practices" should be provided to staff, and when appropriate, outside expertise and experience should be brought in.

³⁶ On this point, the Trust and Confidence Task Force recommended that to promote a new culture, the Department should "Disseminate on a systematic basis throughout DOE experientially derived "best practices" for building, sustaining, or recovering public trust and confidence. *Earning Public Trust and Confidence*, p. 53

³⁷ See the Department of Energy Public Participation Policy, DOE P 1210.1.

³⁸ The Trust and Confidence Task Force reached the same conclusions: "Efforts to restore and sustain public trust and confidence cannot simply be appended to on-going activities. There must be a recognition among senior policy-makers and managers that most choices have consequences for institutional trustworthiness." *Earning Public Trust and Confidence*, p. 36.

³⁹ "Personnel and resources targeted toward the strengthening of public trust and confidence would be identified as part of the program's internal budget review." *Earning Public Trust and Confidence*, p. 59.

"Budgetary adjustments should be made in order to ensure the availability of resources for openness." *Responsible Openness*, p. 31.

10. DOE facilities should seek ways to make their resources useful to the surrounding community.

A proven way for DOE facilities to improve relationships with host communities is to use resources to help those communities. For example, **mutual fire protection and emergency response agreements are much appreciated by surrounding communities and appear beneficial to the DOE facility as well as its neighbors.** At one site, a local emergency response official said that emergency response cooperation “has helped turn around feelings against the site.” He recognized that such cooperation is mutually beneficial: “They needed our manpower as much as we needed their expertise.”

Education support activities at all levels are also highly valued by host communities. At all three sites visited in this pilot study, the site review team heard enthusiastic reports from local educators and others about a wide range of outreach efforts supporting local education programs. This was particularly true with respect to programs directed towards minority students. **These education efforts can benefit the DOE by increasing the scientifically and technically literate pool and introducing them to the possibility of working with the facility as a possible career** (see box).⁴⁰

While education outreach activities are popular, **an effort must be made to ensure that education programs do not stray into being public relations efforts to promote a point of view or convey a message.** When education outreach is done by staff volunteers, even in their private capacity as parents in their own children’s schools, training should be provided to clarify the distinction between public relations and education.⁴¹ While private businesses regularly advertise their successes through educational outreach, DOE as a government agency must use more restraint so that DOE is not perceived as using educational outreach as a tool for gaining public approval of its missions. **DOE’s emphasis should be a contribution to and partnership with education institutions and should assist such institutions in achieving their own goals.** DOE will benefit from these education activities by promoting a general interest in scientific careers.

Sites should also consider other ways in which physical resources and employee skills could benefit the local community. One businessman suggested, for example, that the site should make it possible for local businesses to purchase test and analytical services that they could not afford to do themselves. In his view, this would both benefit local businesses and provide income to the facility. Providing public meeting areas could be another contribution.

⁴⁰ It may be as important to increase the supply of trained technicians as the supply of scientists. These trained technicians make the labs work – and they are attractive employees for other high-tech companies. Cooperative programs – especially ones that give students an opportunity to work at the site in some capacity – can increase the likelihood that they will look to the site as a possible employer when they enter the job market.

⁴¹ One parent complained that a Lab volunteer in the schools used a Geiger counter to show radiation coming from a covered box. When the box was opened, a banana was inside. The parent said her child was afraid to eat bananas after viewing the demonstration.

“Strengthening the quality and practice of science, math, and engineering education in the United States is an essential priority for the nation Such investment in education is a benefit not only to the nation but also to the Department itself. Given its goals, it is a significant priority for the Department to ensure that the best talent is available to sustain its ongoing mission..... The Task Force believes the Department can make an invaluable contribution to the country and ensure its own skill support by harnessing its cadre of technical people and research base to enhance science, math and technology education at the K-12 level.”

SEAB Task Force on Education Final Letter Report (December 2, 1998)

Site management should work with the community in defining the types of assistance to be provided. It is important to involve opinion leaders from the community in the early planning stages, rather than simply presenting the community with fully developed proposals. One approach, used by some private sector companies, would be to conduct periodic community needs assessments – interviews with key community leaders to learn their opinions about the needs of the community that might be addressed by community programs supported by the site. This demonstrates the site’s commitment to the community, and helps ensure that its programs can be defended as responding to what the community itself identifies as critical needs. In addition, it can help avoid unreasonable expectations on the part of the community, since the site management can clearly identify the limitations on its ability to provide community support.⁴²

⁴² Burke, op. cit., p. 6.

Summary of Findings

1. Good community relations are essential for DOE facilities to achieve their missions

DOE facilities find themselves in an increasingly dynamic environment to which they must adapt. This brings the facilities into head-on competition for employees and community support with other, growing sectors of the economy. Neglecting constructive relations and dialogue with the communities in which DOE facilities are located can place DOE at a disadvantage in this competition and can lead to conflicts that divert management attention and resources from achieving DOE's missions.

2. Each site must tailor community relations programs to its own circumstances, consistent with Departmental policy

Every site has unique features that must be taken into account in developing an appropriate community relations program. While there are common denominators of principle and practice that should apply across all sites, the means and styles of implementation may be different to suit particular circumstances. Rather than prescribing specific practices, it is preferable to set performance goals for community relations and let each site determine how best to achieve them. DOE Headquarters should promote a systematic effort to identify and assess the causes of both successes and failures in community relations and to disseminate the lessons throughout the complex. Lessons from community relations failures at some DOE facilities, sometimes leading to acrimonious litigation, must be understood and applied elsewhere so that other facilities do not repeat the same mistakes.

3. DOE must recognize and address its legacy of public distrust

Trust in the DOE and its predecessor agencies has been eroded by past actions and community experiences with the DOE facilities. This legacy of distrust places extra burdens on DOE and contractor personnel who bear no responsibility for past actions, but who must nonetheless deal with the legacy. They must not marginalize those who are critical and distrustful. Furthermore, in seeking the trust of the community, DOE and contractor management must learn to trust the community in return. While this might appear risky to those accustomed to a less open way of conducting business, it can lead to remarkably helpful results.

4. Communication must be full, open, timely, and two-way

Good community relations requires good communications in both directions. The site must provide complete and timely information to the community, and must be willing to receive and consider information from the community in return. Lack of knowledge and familiarity causes mistrust and fear. Failure to provide full and complete information causes distrust. It is particularly important to provide information in cases in which the information might be damaging or where the situation is changing rapidly. Information concerning public health, safety, and the environment must be made readily available. The minimum legal requirements concerning the amount and timing of information to be provided should be

exceeded whenever necessary to meet community needs. Consistent with the necessity to protect critical nuclear secrets, the Department should strive to preserve openness in its relations with the communities surrounding its sites and with the public more broadly.

Good community relations involves listening to the concerns of the community, not simply “getting the message out.” There should be an established and visible mechanism through which the public has direct access to top contractor and DOE officials at the site.

5. *Person-to-person contact is crucial for good community relations*

Successful community relations requires building positive personal relationships with key individuals and organizations in the community. The review team found at all of the sites visited that members of the community trusted specific individuals associated with the site rather than the organizations to which they belonged. Both DOE and the site contractor community relations personnel must be respected by and accessible to the community, and must also be respected within DOE and have direct access to top management. An important contributor to success is relationships with stakeholders developed by employees at all levels of the organization, not just at the top. In addition to a formal community relations or public affairs staff, each site visited by the site review team has employees at various levels throughout the organization who engage in outreach and involvement and are seen as effective ambassadors by the community. The community needs to see that senior management gives such individuals and their activities visible institutional support and recognition.

6. *A constructive attitude towards community relations is critical to success*

DOE and the contractor must approach community relations with the understanding that the site is part of the local community, not a federal enclave on foreign territory. With the end of the Cold War, and the growth of non-classified research activities even at defense sites, there is no reason to believe that the degree of isolation that prevailed in the past will serve a site well in the future. Facility management must be willing to consider the impacts of choices on the state of relations with the surrounding community, and to take those impacts into account in making decisions. Building good community relations requires people with the right attitude and mindset; they must not have a “fortress mentality” and must scrupulously avoid “demonizing” any opposition or being perceived as arrogant. New approaches conducive to good community relations will likely require changes in some traditional and firmly held views within facilities.

7. *Management at all levels must be accountable for good community relations*

Management at all levels of DOE and site contractor organizations must strongly support community relations efforts throughout their organizations, and must themselves be actively and visibly engaged with the community. Senior managers should have measurable performance standards for community relations included in their job descriptions and performance evaluations. Authority and responsibility for community relations should be delegated to the Field Office level to the extent possible. Concomitantly, DOE Field Office

management must have the knowledge and skills needed to take a direct role in community relations and to administer the community relations aspect of the site management contract. Site contractor personnel also play a key role in community relations. DOE should tie experience in community relations to site management contract awards, and contracts should include meaningful criteria for performance in community relations. The best approach for assessing performance is for DOE to listen directly to the community's views of relations with the site, rather than to rely solely on self-evaluations. Success should be measured by results – the actual state of community relations. This pilot review has shown that members of the community are willing and able to provide candid assessments to independent evaluators.

8. *Community relations requires a clear and unambiguous organizational focus*

Community relations should have a clearly identified focal point at the site, operations office, and headquarters levels. This focal point should be separate in reality and appearance from any activities aimed primarily at one-way communication, often referred to as “public relations.” Community relations requires two-way communication and involves working with the community on subjects of mutual interest and concern. Community relations efforts will appear insincere, and thus be ineffective, if they are seen as means of persuasion or manipulation. Community relations should not be viewed as solely a function of the environmental management part of a site's organization. The sites should seek to provide community relations points of contact for all activities, not just those conducted by the environmental management program. Secretarial attention may be required to ensure that a uniform level of attention is paid to community relations across the range of Program Secretarial Offices having responsibility for the various sites. DOE Headquarters should have an institutional focal point for community relations. This could assist the various responsible Program Secretarial Officers carry out their responsibilities in this area, monitor the Department's performance across the complex, and identify and disseminate community relations “best practices” from both departmental and private sector experience.

9. *Community relations must be an integral part of DOE operations*

Community relations must be an integral part of all programs and activities, not simply an add-on. Adequate funding must be provided. Community relations should be treated as a normal cost of doing business, and should not be a low priority when budgets are tight. Community relations activities also require time, which should be provided for in program planning.

10. *DOE facilities should seek ways to make their resources useful to the surrounding community.*

A proven way for DOE facilities to improve relationships is to use resources to help host communities. Mutual fire protection and emergency response agreements are much appreciated by surrounding communities and appear beneficial to the DOE facility as well as its neighbors. Education support activities at all levels are also highly valued by host communities. This is particularly true of those directed towards minority students. These

education efforts can benefit the DOE by increasing the scientifically and technically literate pool and introducing them to the possibility of working with the facility as a possible career. An effort must be made to ensure that education programs do not stray into being public relations efforts to promote a point of view or convey a message. DOE's emphasis should be a contribution to and partnership with educational institutions and should assist such institutions in achieving their own goals. Sites should also consider other ways in which their physical resources and employee skills might benefit their neighbors. Site management should work with the community in defining the types of assistance to be provided.

Recommendations to the Secretary

1. The Secretary should establish a policy emphasizing effective, progressive community relations as a priority throughout the complex of DOE facilities. This policy should be included in the Department's Strategic Plan. It should, in turn, be embraced and promulgated by each of the facilities as an integral programmatic objective.
2. The Secretary should require community relations reports from field managers at the monthly field managers meeting in Washington in order to ensure continuing high-level attention to this issue.
3. Incentives for good community relations should be established. Senior DOE managers should have measurable performance standards for community relations included in their job descriptions and performance evaluations. DOE should tie experience in community relations to site management contract awards, and contracts should include meaningful criteria and incentives for performance in community relations. A process for independent assessments of the community's views of the adequacy of a site's performance in this area should be developed.
4. DOE Headquarters should have an institutional focal point for community relations, to assist Program Secretarial Officers carry out responsibilities in this area, to monitor the Department's performance across the complex, and to identify and disseminate community relations "best practices" from both departmental and private sector experience.
5. Each site should develop an organized approach to enable members of the community to express concerns and an organized approach for the site to respond. The community should have a clear understanding of how, and to whom, to communicate concerns. The mechanism for communication should include an appeal process to assure objective review.
6. The DOE should periodically conduct independent community relations reviews at DOE sites. Continuing the process tested in this pilot review is desirable as a way to evaluate DOE's relations with its host communities. It is also a potentially powerful tool to assist facilities strengthen the ties with their communities.

The format used in this pilot review, which relied heavily on independent observers rather than DOE employees listening to the views of representatives of community organizations, produced candid and helpful discussions. In the future, more planning and communication with the communities and site personnel should precede the site visits. More time should be allowed to identify people with whom to meet who are independent of DOE or its contractors, to allocate time for interviews, and to provide an opportunity for those interviewed to request changes in the format of the interviews or subjects to be discussed. Each review should include private feedback to the site personnel.

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**REPORT OF THE
SECRETARY OF ENERGY ADVISORY BOARD'S
PANEL ON EMERGING TECHNOLOGICAL
ALTERNATIVES TO INCINERATION**



December 2000

Secretary of Energy Advisory Board
U.S. Department of Energy

**Secretary of Energy Advisory Board
Panel on Emerging Technological Alternatives to Incineration**

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Acknowledgement to: Professional Reporter ~ Dorothy Bunn

TABLE OF CONTENTS

Executive Summary	vii
I. Statement of the Problem	1
A. The Panel's Charge and Approach	1
1. Secretary of Energy Advisory Board's Terms of Reference	1
2. The Panel's History and Procedures	2
B. Overview of the Issues	3
C. Characteristics of the 'Mixed Waste' at Issue in this Report	4
1. Origin, Forms, and Status of the Stored Mixed Wastes at INEEL	4
2. Other Mixed Wastes at INEEL	6
D. Why do Mixed Wastes Require Treatment?	6
II. Criteria for Evaluating Technological Alternatives to Incineration	9
III. Overview of the Technological Alternatives	10
A. Description of the Alternatives	10
1. Thermal Treatment without Incineration	10
2. Aqueous-Based Chemical Oxidation	11
3. Dehalogenation	11
4. Separation	11
5. Biological Treatment	12
B. Evaluation of the Alternatives	12
1. Most Promising Technologies	13
a. Steam Reforming	13
b. Thermal/Vacuum Desorption	14
c. DC-Arc Melter	14
d. Plasma Torch	14
2. Potentially Promising Technologies with Unresolved Issues	14
a. Mediated Electrochemical Oxidation	15
b. Microwave Decomposition	15
c. Supercritical Water Oxidation	15
d. Solvated Electron Dehalogenation	16
3. Lowest Priority Technologies	16
4. Conclusions and Recommendations	16
IV. DOE's Current Plan for Developing Technological Alternatives to Incineration	17
A. Overview of the Evolving DOE Plan	17
B. The Panel's Conclusions and Recommendations Regarding the DOE Plan	19

LIST OF TABLES

Table 1.	Blue Ribbon Panel Meetings	2
Table 2.	Panel Conference Calls	3
Table 3.	Comparison of Disposal and Transportation Requirements	8
Table 4.	Preliminary Analysis of Budget Impact of Draft RDD&D Plan for Alternatives to Incineration	20

LIST OF APPENDICES

- I.** Terms of Reference
- II.** Biographical Summaries of Panel Members
- III.** Request for Information (RFI), Commerce Business Daily (CBD) Announcement and List of Responders
- IV.** Waste Streams Potentially Requiring Treatment at AMWTP, by Charles Till
- V.** Executive Summary, Transuranic and Mixed Waste Focus Area, Alternatives to Incineration: Preliminary Research, Development, Demonstration and Deployment (RDD&D) Plan (October 2000)

LIST OF ACRONYMS

AEA	Atomic Energy Act
AMWTF	Advanced Mixed Waste Treatment Facility
AMWTP	Advanced Mixed Waste Treatment Project
CBD	Commerce Business Daily
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	United States Department of Energy
DOT	United States Department of Transportation
EM	United States Department of Energy's Environmental Management
EPA	United States Environmental Protection Agency
ES&H	Environmental, Safety and Health
FACA	Federal Advisory Committee Act
HEPA	High-Efficiency Particulate Air
HWFP	Hazardous Waste Facility Permit
IDC	Item Description Code
INEEL	Idaho National Engineering and Environmental Laboratory
LDR	Land Disposal Restrictions
MOU	Memorandum of Understanding
PCB	Polychlorinated biphenyl
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RDD&D	Research, Development, Demonstration and Deployment
RFI	Request For Information
RWMC	Radioactive Waste Management Complex
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
SDA	Subsurface Disposal Area
SEAB	Secretary of Energy Advisory Board
SWB	Standard Waste Box
TDOP	Ten Drum Overpack
TMFA	Transuranic and Mixed Waste Focus Area
TRU	Transuranic
TRUPACT II	Transuranic Package Transporter, Model II
TSA	Transuranic Storage Area
TSA-RE	Transuranic Storage Area Retrieval Enclosure
TSCA	Toxic Substances Control Act
USNRC	United States Nuclear Regulatory Commission
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WETO	DOE's Western Environmental Technology Office
WIPP	Waste Isolation Pilot Plant

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.

REPORT OF THE SECRETARY OF ENERGY ADVISORY BOARD'S PANEL ON EMERGING TECHNOLOGICAL ALTERNATIVES TO INCINERATION

I. Statement of the Problem

A. The Panel's Charge and Approach

The Blue Ribbon Panel on Emerging Technological Alternatives to Incineration is a task force of the Secretary of Energy Advisory Board (SEAB). The Panel was created following a dispute over the proposed construction of an incinerator for treatment of radioactive mixed waste at the Idaho National Engineering and Environmental Laboratory (INEEL), which resulted in the Department of Energy's (DOE) April 2000 commitment to appoint a 'blue ribbon' panel of independent experts to explore technological alternatives to incineration that might become available for use at DOE facilities nationwide.¹

1. Secretary of Energy Advisory Board's Terms of Reference

More details on the Panel's mission appear in the Terms of Reference subsequently established by the SEAB, based on the Settlement Agreement:

The SEAB Panel . . . will evaluate and recommend emerging nonincineration technologies for treatment and disposal of mixed waste on which the Assistant Secretary of Environmental Management's Office of Science and Technology should focus efforts for development, testing, permitting and deployment. The Panel will evaluate technologies to treat low-level, alpha low-level and transuranic wastes containing polychlorinated biphenyls (PCBs) and hazardous constituents, including the up to 14,000 cubic meters of such wastes that the DOE had planned to incinerate in the Advanced Mixed Waste Treatment Facility (AMWTF) at INEEL. The Panel will also 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 Settlement Agreement and Consent Order signed by the State of Idaho, DOE and the Navy, in October 1995. That agreement requires the Department to remove 65,000 cubic meters of waste at the INEEL from Idaho by the end of 2018.^{2,3}

¹ Settlement Agreement: *Keep Yellowstone Nuclear Free v. Richardson, et al.*; No 99 CV 1042J (D. WY).

² Terms of Reference are in Appendix I.

³ While the Panel's charge is to address non-incineration technologies for treating the 65,000 cubic meters of aboveground waste at INEEL, we also acknowledge that other DOE facilities have unique waste forms that must be treated. For example, TRU and fission-product contaminated kerosene from the PUREX process at the Savannah River Site and wastes at Hanford must also be treated.

2. The Panel's History and Procedures

The Panel consisted of nine members, appointed by the Secretary of Energy (five members), the Governors of Idaho and Wyoming (one member each), and public interest groups (two members). Biographical summaries appear in Appendix II.

The Panel held five formal meetings (Table 1). As required by the Federal Advisory Committee Act (FACA) all meetings were open to the public and the Panel sought public comments at each meeting. Briefings to the Panel at these meetings covered applicable regulations, inventory and characteristics of the waste, technology state-of-the-art, and DOE plans for research and development (R&D) on alternatives to incineration. In addition, the Panel issued a Request for Information (RFI) through the Commerce Business Daily (CBD) to solicit a broad range of industry and other views on mixed waste treatment options.⁴ A Subpanel, consisting of five Panel members⁵, initially reviewed the responses to the RFI and reported their findings to the full Panel. The Subpanel received technical assistance from three independent reviewers and a DOE review team.

Table 1. Blue Ribbon Panel Meetings

Meeting Number	Location	Date	Purpose
I.	Washington, DC	June 22, 2000	1. Task Definition 2. Planning and Procedures 3. Public Comment
II.	Idaho Falls, ID Jackson, WY	August 22-24, 2000	1. Regulatory briefing & discussion 2. Waste inventory /characterization 3. Technology options 4. Public Comment
III.	Washington, DC	September 27, 2000	1. Discuss DOE R&D Plans 2. Discuss Final Report Structure 3. Public Comment
IV.	Denver, CO	October 11, 2000	1. Further review DOE R&D Plans 2. Discuss responses to RFI 3. Review drafts of Final Report 4. Public Comment
V.	Jackson, WY	December 5-6, 2000	1. Complete Final Report 2. Public Comment

⁴ CBD announcement of RFI and list of responders appear in Appendix III.

⁵ Subpanel members: Dr. Carl Anderson, Dr. Robert J. Budnitz, Dr. Mario Molina, Dr. Marvin Resnikoff, and Dr. Charles Till.

In addition to the Panel meetings, five full-Panel conference calls and four Subpanel conference calls were held to prepare, discuss and organize materials for the formal meetings (Table 2).

Table 2. Panel Conference Calls

Conference Call Date	Participants
August 2, 2000	Full Panel
August 18, 2000	Full Panel
September 22, 2000	Subpanel
October 2, 2000	Subpanel
October 10, 2000	Subpanel
November 1, 2000	Subpanel
November 6, 2000	Full Panel w/ Independent Reviewers & Public
November 20, 2000	Full Panel & Public
November 27, 2000	Full Panel & Public

B. Overview of the Issues

As early as the 1970's, the scientific community recognized that the release to the environment of waste streams containing persistent organic compounds, such as polychlorinated biphenyls (PCBs) poses unacceptable hazards to humans and to ecological systems. One approach for treating PCB contaminated wastes has been incineration. However, this can lead to the formation of compounds such as dioxins and furans that are even more toxic. These emissions can be minimized by proper design and control of the incineration facilities. On the other hand, no such solution exists for radioactive wastes, and the principal public concern regarding incineration involves the potential release of plutonium. The U. S. Government's choice for disposal of this waste has been deep underground at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

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. For example, the removal of PCBs from mixed TRU waste requires some sort of treatment that might involve an overall risk to society higher than the risk of sending the untreated waste to a facility such as WIPP. In any event, treatment of mixed TRU waste, such as removal or immobilization of liquid, might be required for several reasons related either to long-term stability or to safe transportation to the disposal site. It might also be necessary to remove flammable volatile organic compounds and to minimize the radiolytic generation of hydrogen (from the interaction of alpha particles emitted by the radionuclides with organic compounds) in order to eliminate the potential for explosion of gases emanating from the waste.

The nature of the technologies to be utilized for the waste treatment depends on the purpose of treatment. For example, volatile and semi-volatile organic compounds can be separated from the mixed waste relatively easily – e.g., by evaporation at moderate temperatures, or by extraction under vacuum – and these compounds can be destroyed subsequently by oxidation to yield mostly carbon dioxide and water. PCBs are chemically very stable and are not volatile under ambient temperature conditions, so that their destruction is more difficult, requiring strong

chemical or thermal treatment before or after separation from the waste stream; no suitable 'mild' treatment exists. At the same time, it is necessary to ensure that the radioactive material eventually remains in the solid waste stream, so that it can be safely disposed of. An assessment of technologies for mixed waste treatment should take into account the overall risks and costs involved 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.

Incineration involves high temperatures, an open flame, and a large volume of gaseous effluents. Although a wide array of technological alternatives to incineration exists, no single one may be suitable for treatment of all types of mixed waste: a combination of steps or a set of several technologies might be required to treat the multiplicity of mixed waste. Some of these alternative technologies might also require high temperatures, but are nevertheless clearly distinct from incineration. For example, they might operate under reducing conditions without an open flame, rather than under oxidizing conditions in an open flame, thereby minimizing the generation of dioxins and furans from PCBs. Many alternative technologies also generate small amounts of gaseous effluents consisting of volatile organic compounds. Once separated from the waste, these effluents can be oxidized, for example, by contact with a ceramic catalyst at high temperatures, in the presence of oxygen, so that only carbon dioxide and water are released to the atmosphere.

C. Characteristics of the 'Mixed Waste' at Issue in this Report

For purposes of this report, 'mixed waste' means waste that contains both hazardous waste and radioactive material that is subject to the requirements of the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA), which apply to generation of waste and to wastes already stored. In some cases, this waste is also contaminated with PCBs, which are regulated under the Toxic Substances Control Act (TSCA). The EPA and the States enforce the requirements imposed by RCRA and TSCA. DOE sites that store, treat, or dispose of mixed waste are regulated under RCRA, TSCA, and the AEA. In addition, mixed waste buried in the ground at DOE facilities is subject to section 120(a)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. The term 'mixed waste' is used frequently in this report as a generic term for all the contaminated radioactive wastes under consideration by the Panel, although strictly speaking radioactive waste containing only PCBs (which are not regulated under RCRA as 'hazardous') is not 'mixed waste' under the prevailing technical definition.

Hazardous and radioactive wastes pose difficult challenges to DOE as owner and to EPA and States as regulators of these wastes. DOE must manage, treat, and dispose of these mixed wastes in an environmentally sound and cost-effective manner to ensure public health and safety.

1. Origin, Forms, and Status of the Stored Mixed Wastes at INEEL

DOE currently stores approximately 65,000 cubic meters of radioactive waste at the Transuranic Storage Area (TSA) at the Radioactive Waste Management Complex (RWMC) at the INEEL. Most of this waste, a product of nuclear weapons production operations at the Rocky Flats Plant in Colorado, was transported to the INEEL before the current definition of TRU waste was established (prior to 1982). This waste is managed as TRU waste, although not all of it meets the current definition. Approximately 95 percent of this waste is classified as 'mixed waste'. Some contains PCBs, which are regulated under TSCA. It should be

emphasized that at this time we do not know precisely what is in all 65,000 cubic meters of waste, since not all has been characterized (e.g., pre-1973 drums, depending on interpretation of the data, comprise 7 to 18 percent of the total stored volume). In addition, a small volume of the waste may contain mercury, a metal that vaporizes at relatively low temperatures and is particularly difficult for off-gas systems to manage.

Of the 65,000 cubic meters, approximately 52,000 cubic meters (80 percent) is in wooden boxes and metal drums that were stacked on an asphalt pad and covered with tarps, plywood, and then soil to form an earthen-covered berm. The earthen-covered berm is enclosed within a metal building called the Transuranic Storage Area Retrieval Enclosure (TSA-RE), a RCRA interim status facility. Approximately 13,000 cubic meters of the waste (the other 20 percent) is stored in adjacent RCRA-permitted facilities at the RWMC.

Without treatment, a portion of these 65,000 cubic meters does not currently meet requirements for shipment to and disposal at the WIPP, nor does it meet other regulatory requirements for waste disposal and transportation that are reviewed in subsection D below. Initial planning for the Advanced Mixed Waste Treatment Project (AMWTP) incorporated the assumption that 78 percent of the waste would require incineration in order to meet these requirements. This included all non-debris and combustible debris (typically paper, rags, plastic and rubber). Improved understanding of the waste has resulted in successively lower estimates, and by early 1997 the AMWTP contractor had determined that only non-debris waste should be incinerated. As a result, the amount to be treated was reduced to 22 percent of the total.

In 1996, Congress exempted all waste designated for disposal at WIPP from the RCRA Land Disposal Restrictions (LDR). The Panel's understanding is that this action rested, at least in part, on the recognition that deep disposal at WIPP posed fewer hazards than the surface or near-surface disposal contemplated in the RCRA regime. This further reduced the quantity of waste to be treated, although the change did not become fully effective until a contract modification in early 2000, following regulatory action by the State of New Mexico. Only a fraction of many of the waste streams will now require treatment under existing shipment and disposal regulations. The current estimate is approximately 1,500 cubic meters (or about 2 percent), based on review of the envelope of waste comprising the full 65,000 cubic meters, published information about the waste, anecdotal evidence, and subsequent analysis or examination of the wastes.⁶ The actual volume requiring treatment will be determined only after individualized analysis of each container, which must be completed before any waste is shipped or treated. The Panel does not expect the final volume requiring treatment to exceed the current estimate substantially, and indeed it could be significantly less.

At the AMWTP, these wastes will be received for inspection, characterization and then shipment or processing. Receipt is in wooden boxes, bins, or 55- and 83-gallon drums (which are generally lined with a high density polyethylene liner). The waste is usually contained in one or more plastic bags or in a smaller container (such as a one-gallon polyethylene container) wrapped in one or more plastic bags that are then placed in a large plastic bag inside a 55-gallon drum. Where the condition of the 55-gallon drum is suspect, it will be placed in an 83-gallon overpack drum to prevent the spread of contamination.

⁶ If the uncharacterized waste is similar in form to the characterized waste, as there is good reason to believe, the margin of error in this estimate is 10 to 20 percent. Expert testimony before the Panel suggested that the total volume of waste requiring treatment may be even smaller than this estimate suggests.

2. Other Mixed Wastes at INEEL

The Panel has focused upon the waste requirements defined in its mandate. During our deliberations, however, we heard much about another large quantity of waste on the INEEL site that arrived between 1952 and 1970, in addition to the 65,000 cubic meters addressed in the Panel's charter. This additional waste is buried in pits and trenches on an 88-acre disposal area.

The volume of this waste has been estimated at anywhere from 57,000 to 186,000 cubic meters in various published accounts. These very large differences appear to be caused principally by uncertainties about the volumes of contaminated soil in the neighborhood of the buried waste, which can only be determined by detailed testing and mapping of the actual conditions of the pits and trenches. However, the precise volumes are not the important issue. Whether the additional amounts are comparable to the 65,000 cubic meters at the TSA, or are two or three or more times greater, the fact remains that volumes of waste of the same general kind and at least equal magnitude to that under consideration by the Panel remain on the INEEL site. This waste is buried under conditions that are much less contained and much less predictable than the waste in the Panel charter, and the Panel urges that increased emphasis be given to this in some ways more worrisome quantity of waste. It must be immediately and seriously addressed by the Department.

This waste has been known to be a problem for many years, and the Panel is aware that DOE has a continuing program that attempts to deal with it. DOE is working with EPA Region X and the Idaho Department of Environmental Quality to develop and implement a remedy for the buried waste under the INEEL CERCLA cleanup program. A Record of Decision identifying the remedy is scheduled to be issued in December 2002.

However, no viable cleanup plan has yet been devised. It is generally agreed that these wastes are not properly contained. In fact, they pose a substantial threat to the Snake River Plain aquifer underlying the site. This aquifer is one of the largest underground water bodies in America, and any threat to it carries with it legitimate cause for concern. In the public comment periods of the Panel's meetings, this buried waste emerged repeatedly as a matter of utmost concern to the citizenry. In light of these facts, the Panel notes that the problem is serious, and urges the DOE to put increased emphasis on adequately defining the subsurface phenomena involved, and as quickly as possible to put in place comprehensive plans that will protect the environment and in particular the aquifer before significant crises can develop.

D. Why do Mixed Wastes Require Treatment?

Wastes must be treated for two principal reasons: (1) to meet transportation requirements and (2) to meet WIPP WAC. Elements of these two overlapping sets of requirements are specified by regulations or set by permits. Transportation requirements restrict the shipment of materials that would create a hazard during transit. The WIPP WAC restricts the amount and nature of waste components that can be accepted. Three INEEL waste components can trigger a need for treatment: potential hydrogen generators, flammable volatile organic compounds (VOCs), and PCBs.

The Nuclear Regulatory Commission has imposed a flammable gas (e.g., hydrogen, methane, etc.) concentration limit on contact-handled TRU waste transported using the Transuranic Package Transporter, Model II (TRUPACT-II). This limit is set at the lower explosive limit of 5 percent by volume for hydrogen in air. To meet this limit, hydrogen generation rates are limited by the WIPP WAC and by the TRUPACT II (shipping container) specifications. Hydrogen can be produced by the action of alpha particles on water or organic materials and the restriction calls for evaluation of steady-state hydrogen release rates for every container.

VOCs are limited by transportation requirements, which are intended to avoid fire hazards during shipping. VOCs must be measured in the headspace of every container.

PCB disposal is restricted by WIPP WAC to concentrations below 50 parts-per-million. The PCB concentration must be verified by records or by sampling and analysis.

Transportation requirements and WIPP WAC require inspection of each package. That is, packages can only be certified for shipment or disposal based on knowledge of their contents, and not on the fact that the contents have undergone a particular treatment or set of treatments.

The wastes transported to and accepted at the WIPP facility are controlled by a variety of requirements, including but not limited to:

- New Mexico Hazardous Waste Act (incorporating 40 CFR)
- WIPP Hazardous Waste Facility Permit (HWFP)
- TRUPACT II (shipping container) Safety Analysis Report For Packaging (SARP)
- Department of Transportation Regulations (49 CFR)
- WIPP Safety Analysis Report (SAR)
- WIPP WAC

These sources provide the criteria (summarized in Table 3) for management, storage, transportation to, and disposal of mixed waste at the WIPP facility.

At INEEL, the AMWTP will process stored mixed TRU waste for disposal in New Mexico at WIPP, and mixed low-level waste for disposal in another appropriate facility. The process will include waste retrieval, characterization, sorting, size reduction, repackaging, sorption, supercompaction, certification, and loading of the waste for shipment. Waste that does not meet the applicable disposal requirements will remain in storage at INEEL until appropriate processing is available.

One recurring issue for the Panel was the option of transporting the INEEL mixed wastes without further treatment, either to WIPP or a commercial disposal site. As indicated earlier, this is not possible under current regulations. For example, WIPP will not accept wastes with PCB concentrations of 50 ppm or greater. Those regulations could change over the period of the DOE/Idaho agreement; indeed, applications now pending before the EPA seek amendments to WIPP's WAC that would affect the treatment required in order to ship INEEL mixed wastes to WIPP. If EPA concurs, DOE would need also to petition the State of New Mexico for a change to the permit. Any such regulatory changes would require extensive consultations with interested parties and states, and no amendments in the WIPP WAC are possible without the consent of the State of New Mexico. Accordingly, while the Panel recognizes that waste

disposal regulations can evolve and will influence any long-term R&D strategy, the Panel's recommendations do not assume amendments to the current regime.

Table 3. Comparison of Disposal and Transportation Requirements

WAC Section	Requirement	Transportation	Disposal SAR	Disposal RCRA
3.3.2	Fissile Material Quantity	Pu-239 limits for 55-gallon drums, pipe components, SWBs, and TDOPs (including 2 times the measurement error).	Pu-239 limits for 55-gallon drums, SWBs, and TDOPs (including 2 times the measurement error)	No requirements
3.3.3	TRU Alpha Activity Concentration	Dewatered, soiled or solidified TRU and tritium-contaminated materials and wastes.	> 100 nCi/g	No requirements > 100 nCi/g is part of the TRU waste definition in the HWFP
3.3.4	Pu-239 Equivalent Activity	No requirements	Pu-Equivalent Ci limits for 55-gallon drums, SWBs, and TDOPs.	No requirements
3.3.5	Radiation Dose Rate	Surface dose rate \leq 200 mrem/hr	Surface dose rate \leq 200 mrem/hr	No requirements Surface dose rate \leq 200 mrem/hr is part of the definition in the HWFP
3.4.1	Liquid	< 1% by volume of the payload container	< 1% by volume of the payload container	< 1% by volume of the payload container
3.4.2	Sealed Containers	Sealed containers > 4 liters prohibited	No requirements	Sealed containers > 4 liters prohibited
3.5.1	Pyrophoric Materials	Pyrophoric radioactive materials < 1% by weight	Pyrophoric radioactive materials < 1% by weight	Non-radionuclide pyrophoric materials are prohibited
3.5.2	Hazardous Waste	No requirements	No requirements	EPA hazardous waste numbers not listed in the HWFP are prohibited.
3.5.3	Chemical Compatibility	Chemical constituents shall confirm to the allowable chemical lists in the TRUPACT-II SARP.	Wastes containing chemicals that would cause adverse reactions with other payload containers are prohibited.	Wastes incompatible with backfill, seal and panel closure materials, container and packaging materials, shipping container materials, or other wastes are prohibited.
3.5.4	Explosives, Corrosives, and Compressed Gasses	Explosives, corrosives, and compressed gasses are prohibited	Explosives, corrosives, and compressed gasses are prohibited.	Explosives, corrosives, and compressed gases are prohibited.
3.5.5	Headspace Gas VOC Concentration	Flammable VOCs equal to or less than 500 ppm in the headspace of any payload container	No requirements	Headspace gas must be reported using sampling and analysis
3.5.6	PCBs	No Requirements	There is a bounding requirement	PCB concentration \geq 50 ppm are prohibited
3.6.2	Decay Heat	Decay heat of each payload containers \leq limit in the TRUPACT-II SARP.	No requirements	No requirements
3.6.3	Test Category Waste	Steady-state hydrogen gas generation release rate shall not exceed the limit specified in the TRUPACT-II SARP.	No requirements	No requirements
3.6.4	Flammable VOCs	Equal to or less than 500 ppm in the headspace of any payload container	No requirements	No requirements

Note: SWB = Standard Waste Box
TDOP = Ten Drum Overpack

II. Criteria for Evaluating Technological Alternatives to Incineration

The Panel adopted the following seven criteria for evaluating alternatives to incineration, and included these criteria in an August 2000 RFI:

1. Environmental, Safety and Health (ES&H) Risk Considerations

The safety of the system, potential ES&H risks and the difficulty in designing and constructing a system to meet the ES&H requirements in radioactive service with special emphasis on upset conditions.

2. Stakeholder and Regulatory Interests

The degree to which there may be resistance or delays in implementing the technology or system due to either public concerns or regulatory requirements.

3. Functional and Technical Performance

The technical performance of the treatment process to include destruction efficiency, volume reduction capability, secondary waste generation, robustness and flexibility of the system, final waste form performance and capability to be shipped.

4. Operational Reliability

The reliability and availability of the treatment process, its complexity, and the potential exposure to maintenance workers.

5. Pre- and Post-Treatment Requirements

The pre-treatment and post-treatment requirements of the waste, and the requirements for treating the effluents from the process.

6. Economic Viability

The total life-cycle cost of the system, the cost per unit volume of waste treated, the market for the technology, and the potential that the technology will be commercially available to treat the waste.

7. Maturity

The level of development of the technology, field experience with the technology in radioactive service, and whether the technology will be available in the time frame required.

In its application of the criteria, particularly those bearing on ES&H, the Panel placed special emphasis on performance under potential 'upset conditions'. In addition, the Panel fully recognizes that worker safety has been and remains a significant concern of all well-managed programs. The Panel wishes to underscore that this concern is an important part of its ES&H criterion.

Although meeting all applicable ES&H regulations is an essential criterion for any technology, the Panel believes that an even more stringent standard should be applied during the evaluation process. Specifically, a technology should be highly favored if it can demonstrably meet such regulations by very large margins, affording much higher degrees of protection and much higher confidence in that protection. The crucial words here are 'demonstrably' and 'large margins,' because only then can both the technical community and the larger public have strong confidence in the proposed technology. We have tried to apply this philosophy throughout our evaluations.

III. Overview of the Technological Alternatives

Many parties have brought to the Panel a broad array of technological alternatives to incineration. We have reviewed a large number of options at very different stages of development. From the perspective of research, development, demonstration and deployment (RDD&D), the challenge is to apply inevitably constrained resources productively without prematurely narrowing the field of potential candidates. The Panel's aim is to help DOE assemble an RDD&D technology portfolio that is diverse in both technology characteristics and levels of maturity; to that end, we have identified what we think are the most promising of the relatively mature and the still emerging options. We also sought to narrow the field in a productive way. Some elements of the portfolio should be ready for comparison testing on an aggressive schedule over the next several years, while others will need substantially more time (while still being potentially available to meet DOE's commitments to the State of Idaho).

A. Description of the Alternatives

1. Thermal Treatment without Incineration

Thermal treatment of hazardous waste involves use of high temperature as the primary means to change the chemical, physical, or biological character and/or composition of the waste in the absence of air or free oxygen and without a flame. Relatively high temperatures decompose organic compounds, convert them to gases, and break their chemical bonds to form organic fragments that may require subsequent oxidization or reduction. If the decomposition products are allowed to cool in an inert environment, the products are typically carbon, and a gas containing CO, H₂, HCl, CH₄, and low molecular weight hydrocarbons (e.g., syngas). If sufficient oxygen is present, the oxygen will combine with the organic fragments to form CO₂ and H₂O. A reducing environment implies the presence of a material with a high affinity for oxygen (e.g., hydrogen or aluminum) and the absence of free oxygen. The reductant reacts with the organic fragments to produce carbon, H₂, CH₄, HCl, or Al₂O₃ (depending on the environment and stability of the compounds at the process temperature) and low molecular weight hydrocarbons from the reduction of straight-chained and aromatic hydrocarbons.

Incineration, by contrast, involves use of fuel (usually natural gas or fuel oil, but sometimes the waste itself) with air or oxygen to produce a flame for the destruction and oxidation of the organic waste material. Typically, a secondary combustion chamber with a flame is also required to complete oxidation of any organic material escaping in gases from the main combustion chamber. Incinerators require high volumes of air and extreme turbulence to ensure adequate mixing of the waste and vapors with air, and adequate time to complete the oxidation. Because of gases from the combustion of the fuel and the excess air, incinerators generate large volumes of off-gases requiring treatment before release.

Thermal treatment processes not involving incineration include plasma arc melters, DC-arc melters, metal melters, steam reformers, molten salt oxidation, and supercritical water oxidation, each of which operates under different thermal and environmental conditions.

Plasma or DC-arc melters may be operated in at least three modes: an oxidation mode in which sufficient oxygen is supplied to oxidize the organic material; a pyrolysis mode (e.g., an oxygen deficient atmosphere); or a steam-reforming mode. In the steam-reforming mode,

steam provides both hydrogen and oxygen to react with the high temperature decomposition products.

Metal melters operate in a reducing mode in which the molten metal (such as iron or aluminum) has a high affinity for oxygen.

Steam reformers operate at lower temperatures than melters and interact steam directly with heated waste materials in the absence of free oxygen; steam provides a source of both hydrogen and oxygen to produce a combustible gas mixture of CO, H₂, CO₂, H₂O, CH₄, HCl and low molecular weight hydrocarbons.

In molten salt systems, organic waste and oxygen are injected into a hot molten salt bath that provides the thermal energy to break the chemical bonds of the organic material, and a medium that enables intimate contact between the oxygen and the organic fragments.

Supercritical water oxidation is a thermal process in which high temperature and high pressure are used to generate a supercritical state of water. Supercritical water readily dissolves organic material and stimulates rapid reaction between the organic material and the oxygen to produce CO₂ and H₂O. This reaction is similar to, but much more rapid than, the conventional chemical processes described next.

2. Aqueous-Based Chemical Oxidation

Aqueous-based chemical oxidation uses chemical oxidants other than oxygen or air as the primary means to destroy or detoxify hazardous materials. Moderate increases in temperature can be used to accelerate the rates of the organic destruction reactions, but the temperature alone is not sufficient to break the chemical bonds. Chemical oxidation processes use strong oxidants in an aqueous, acidic solution. Examples of strong inorganic oxidants are nitric acid, Ag²⁺, Ce⁴⁺, Fe³⁺, and ammonium peroxydisulfate [(NH₄)₂S₂O₈]. The organics are typically converted to H₂O, CO, CO₂, HCl, and mineral salts. Because the reactions are strongly surface area dependent, solids and some liquids require significant size reduction and/or mixing for adequate oxidation to occur, whereas soluble organics are more easily oxidized. Because the reactions take place at low temperature and in a liquid state, the times required for the reactions are much longer than for thermal systems, and typically, more secondary waste is generated by the oxidizing agents.

3. Dehalogenation

Dehalogenation refers to chemical reactions in which halogens (chlorine, bromine, iodine) are removed from the molecular structure of organic compounds and replaced by other atoms to form non-hazardous or less hazardous products. For example, the solvated electron process is used to replace chlorine in PCBs. Byproducts from treating PCBs include hydrocarbons, sodium chloride, and sodium amide.

4. Separation

Three types of separation processes are used for removal of organic material from a waste matrix: soil washing, solvent extraction and thermal desorption.

Soil washing uses an aqueous solution and detergent to remove organic material from the surface of soil particles and to separate fine particulates (which contain most of the organic contaminants in the porous fines) from the coarse soil. Soil washing does not destroy the organic material but produces three products: a wastewater stream, a sludge of contaminated fine particulates, and soil that may contain regulated levels of heavy metals and radionuclides.

Solvent extraction uses a solvent to remove soluble contaminants from the waste (not unlike dry cleaning). A subsequent step removes the contaminants from the solvent, which can be re-used, leaving the liquid organic contaminant to be treated by other means. A special case of solvent extraction uses supercritical carbon dioxide to remove organics from the waste.

Thermal desorption uses relatively high temperatures, and sometimes a vacuum, to convert organic contaminants from a solid waste to a gas and extract them. These volatile and semi-volatile organic contaminants are then condensed and collected in an off-gas system for subsequent treatment by other means, which can be technically difficult for some contaminants (e.g., radionuclides and mercury). In some cases, heat and vacuum can pyrolyze non-volatile organic material (plastics, wood, PVC, etc.) to produce volatilized organics and a residue that remains in the desorber.

5. Biological Treatment

Biological treatment (or biodegradation) refers to the processing of organic waste material using microorganisms such as bacteria and fungi. Aerobic degradation is performed by microorganisms, which require oxygen for growth. Aerobic process residues are usually CO, CO₂, H₂O, salts and biomass sludge (dead cell material). Anaerobic degradation is carried out in the absence of oxygen and yields CH₄, CO₂, and biomass. Since the contaminants must be available to the microorganisms, contaminants that are not water-soluble (e.g., solids and immiscible organics) are more difficult to treat. Chlorinated organics are difficult to treat because their degradation is not a significant source of energy for the bacteria. Nonetheless, some bacteria do degrade chlorinated organics in the course of metabolizing other, more easily degraded compounds.

B. Evaluation of the Alternatives

In aid of its evaluation, the Panel formed a Technical Subpanel chaired by Dr. Molina, which also included Dr. Anderson, Dr. Budnitz, Dr. Resnikoff, and Dr. Till. The Subpanel and the rest of the Panel also benefited from extensive assessments prepared by Mr. William Schwinkendorf (chairing a DOE team), Mr. James Cudahy, Dr. Francis Holm, and Dr. Peter Lederman, all of which are part of the record of the proceedings that produced this report.

The choice of technologies depends on the purpose of the treatment. As indicated in Section I-D, this purpose consists of removal from the waste stream of potential hydrogen generators, VOCs, PCBs and possibly the ignitable and corrosive streams that carry the D001 and D002 EPA hazardous waste codes.

Destruction of the unwanted components can be accomplished either before or after separation from the main waste stream. In general, technologies that satisfy all the treatment needs simultaneously are preferable. In any case, it is important to assess the fate of the radioactive

components to ensure that they remain in the solid waste stream for disposal. This, in turn, requires actual tests with authentic mixed waste.

Each treatment option creates its own waste streams, some of which are potentially hazardous and thus may require additional remedial strategies that themselves form an important part of any life-cycle comparison of the risks and costs of the technological alternatives. Thus, it is important to evaluate not only the main treatment process itself, but also the additional steps necessary to deal with the required pretreatment of the waste as well as the secondary waste streams and their treatment.

The Panel evaluated the technological alternatives described in Section III-A utilizing the published criteria from Section II of this report. Most, but not all, technologies were brought to the Panel in response to the RFI described in Section I-A-2. The Panel's intent was not to endorse or reject specific commercial applications, but rather to focus on categories of technologies, identifying those that appear most promising for near-term application and for longer-term developmental funding. We have grouped the technological alternatives in three categories for discussion below: (1) those that clearly appear promising and should have highest priority for funding; (2) potentially promising technologies for which important unresolved issues remain; and (3) technologies to which the Panel accords lowest priority. Of course, even the most promising alternatives are not yet fully demonstrated, in particular with mixed waste. None of the alternatives are ready for immediate implementation, and subsequent sections of this report address next steps in the development and testing process.

1. Most Promising Technologies

The most promising technologies are relatively mature, so that (a) there are fewer issues regarding their capabilities to treat the DOE waste in question; (b) they generally are robust (e.g., they can treat a variety of waste types with a minimal pre-treatment); (c) they have minimal secondary wastes, which can be successfully treated; and (d) they appear to pose less risk to workers, the public and the environment.

a. Steam Reforming

Steam reforming coupled with volatilization directly from waste drums is a very promising technology to remove and destroy organic components in the waste stream. It is a robust, mature technology, applicable to a wide variety of waste streams and requiring little or no pretreatment. It operates in a reducing environment (i.e., in the absence of oxygen), producing an off-gas stream consisting of organic effluents (syngas), carbon dioxide and water vapor. This gaseous stream requires treatment to decompose the organic effluents (e.g., oxidation by a high-temperature ceramic catalyst), but the emissions to the environment can be measured and controlled and are likely to be minor. The relatively low temperature should allow the plutonium and most other radionuclides and heavy metals to be retained in the residue, which can be sent to a disposal site. However, some radionuclides and metals may be volatilized and must be captured by off-gas systems.⁷

⁷ To the extent that some steam reforming technology variants require levitation of a heterogeneous mixture, significant technical issues remain for resolution.

b. Thermal Vacuum Desorption

This separation process removes volatile and semi-volatile organics from the inorganic portion of the waste stream and pyrolyzes non-volatile organics in an oxygen-starved atmosphere to produce organic vapors and a solid residue. The volatilized organics may be treated by some other means: oxidized in a high-temperature ceramic catalyst or absorbed onto a carbon bed or condensed back to a liquid for subsequent destruction, or possibly treatment at an existing commercial facility. The low gas flow and low temperature minimizes particulate carryover into the off-gas system and should allow the plutonium and most other radionuclides and heavy metals to be retained in the residual solids. Thus, the emissions to the environment can be controlled and are likely to be minor. Little or no pretreatment is required for a wide variety of wastes.

c. DC-Arc Melter

This is a process with very high destruction efficiency. It is very robust, can treat any waste or medium with minimal or no pretreatment, and produces a stable waste form. The DC-arc melter uses carbon electrodes to strike an arc in a bath of molten slag. Use of consumable carbon electrodes that are continuously inserted into the reaction chamber eliminates the need to shut down for electrode replacement or maintenance and the need for a torch gas. The high temperatures produced by the arc convert the organic waste into light organics and primary elements in a steam-reforming or reducing atmosphere. The combustible syngas is cleaned in the off-gas system and oxidized to CO₂ and H₂O in ceramic bed oxidizers. The potential for air pollution is low due to the use of electrical heating in the absence of free oxygen and the low amount of off-gas. The inorganic portion of the waste is retained in a stable, leach-resistant slag, which may be necessary for a mixed non-TRU waste that will be disposed of in a RCRA-regulated landfill.

d. Plasma Torch

Plasma torch systems are similar to DC-arc systems in that an arc is struck between a copper electrode and either a bath of molten slag or another electrode of opposite polarity.⁸ As with DC-arc systems, the plasma torch system has very high destruction efficiency, is very robust, and can treat any waste or medium with minimal or no pretreatment. The inorganic portion of the waste is retained in a stable, leach-resistant slag, which may be necessary for mixed non-TRU waste that will be disposed of in a RCRA-regulated landfill. However, the water-cooled copper torch must be replaced periodically to prevent burn-through at the attachment point of the arc and a subsequent steam explosion due to rapid heating of the released cooling water. The air pollution control system is somewhat larger than for the DC-arc due to the need for an arc-stabilizing torch gas. Concerns have been raised regarding the reliability of this technology.

2. Potentially Promising Technologies with Unresolved Issues

From the RFI and other sources, the Panel identified a number of technologies that may contribute to solving the INEEL waste treatment problem. However, potentially significant issues need to be addressed before final decisions are made about integrating

⁸ The plasma torch technologies evaluated by the Panel should be distinguished from 'plasma arc incinerators,' as defined by EPA in 40 CFR section 260.10.

these technologies into DOE's RDD&D program. These technologies are generally less mature than those in the first category, are less robust, or have questionable ability to safely treat DOE waste. These technologies include mediated electrochemical oxidation, microwave decomposition, supercritical water oxidation, and solvated electron dehalogenation.

For each of these potentially viable alternatives, the Panel's views are summarized below.

a. Mediated Electrochemical Oxidation

Mediated electrochemical oxidation relies on an oxidizing element (e.g., silver or cerium) to destroy organic compounds. Metals, including plutonium and americium, may be dissolved in the anolyte solution. Recovery of the oxidizing element from the anolyte and reuse back in the process is critical for economic operation. It is not clear if recovery/reuse is possible or economically viable in the presence of radionuclides. Also, to reduce process retention times and increase solubility of organic constituents, waste streams are fed to the system as liquids or slurry. This may require significant waste pre-treatment. Other issues include the capability to treat PCBs adequately, and the highly corrosive nature of the process and related safety concerns.

Positive characteristics include low temperature, low off-gas, and an apparent ability to treat diverse waste streams. The Panel's concerns center on 1) recovery/reuse of the anolyte solution; 2) amount of pre-treatment; and 3) corrosion and erosion of the system components.

b. Microwave Decomposition

This technology involves a specific type of chemical decomposition, and may have promise for the treatment of INEEL wastes, but it has been applied only to limited waste streams (medical waste and tires). Research and development is needed to determine its efficacy for treating radioactive and TRU wastes. Other potential unknowns and concerns include this technology's ability to treat PCBs, amount of pre-treatment, nature of the effluents, including the level of off-gas treatment required, and radionuclide accumulation in carbon precipitated on the walls of the treatment chamber (this char could present significant decontamination and worker safety issues).

Positive attributes include low off-gas and low system operating temperature and pressure.

c. Supercritical Water Oxidation

At supercritical pressure and temperature conditions, water can dissolve organic constituents. This is a relatively mature technology with a long history of development for specific applications. Positive attributes of the supercritical water oxidation system include very low off-gas, high destruction efficiencies for organics, and effluents that are relatively easy to manage, including brine, filtered solids and salts.

On the other hand, the high pressure (and the difficulty in injecting particulate-laden erosive slurries into the process) and corrosiveness of the system present significant

safety concerns. Moreover, the waste stream feed must be in a liquid or slurry form, which requires substantial pre-treatment of wastes. Proponents anticipate using a bulk feed system, but key details are lacking on its design and development.

d. Solvated Electron Dehalogenation

In this technology, solvated electrons, created in a mixture of anhydrous ammonia, sodium metal, and waste, remove halogens (primarily chlorine) from organic molecules. This is a relatively mature and simple technology that operates at low temperature with low off-gas and good destruction efficiencies for chlorinated compounds.

Potential concerns with the solvated electron technology include: 1) the management of treatment residues, including further treatment of non-chlorinated organics to meet WIPP WAC; 2) the amount of pre-treatment needed to maximize exposure of the chlorinated compounds to the electron solution; 3) the process's ability to treat the diversity of INEEL wastes (waste pH and moisture content appear to be important); and, 4) safety associated with handling sodium and anhydrous ammonia and high system pressure (200 psi) in a radioactive environment.

3. Lowest Priority Technologies

In its review, the Panel was impressed by the number and variety of treatment processes submitted for consideration in response to the RFI. Given constrained R&D resources, the Panel felt compelled to adopt a winnowing process to yield a manageable number of candidates for further testing and development. Most of the treatment options submitted to the Panel clearly have promise for some forms of waste, but our charge compels a focus on very specific wastes.

The Panel concluded that technologies not recommended in this report for further development and testing were qualitatively less promising, across the full range of characteristics necessary to deal with the INEEL wastes. Several of these technologies were not applicable to the DOE wastes in question, others had serious safety issues, and others were so immature or had so little information available that an informed evaluation was impossible. In reviewing candidates for near-term testing, the Panel sought convincing evidence of technological maturity; where the issue was eligibility for further development, our focus was promise of superiority in simplicity, efficiency and economics.

The technologies examined by the Panel and placed in this third category include 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.

4. Conclusions and Recommendations

The Panel finds that there are promising technological alternatives to incineration. At present, such technologies have not been fully demonstrated and need to be further developed, adapted and tested with actual mixed waste streams.

In the Panel's judgment, this evaluation has identified a varied set of technologies that deserve a place in DOE's RDD&D program. The Panel's recommendations also include basic scientific work that should broaden the base of technologies further. The nation should emerge within a few years with improved and feasible solutions to a costly dilemma.

The Panel recommends that DOE seriously consider technologies identified in the most promising category as alternatives for an incinerator at the AMWTP. Tests of these should be conducted on both surrogates and actual wastes to demonstrate their applicability. These tests should be concluded within 3 to 5 years, and should include total system evaluations including pre- and post-treatment requirements and should seek to identify performance under potential upset conditions.

The Panel also notes that no single technology may by itself be adequate to meet the desired ES&H standards and achieve the desired destruction of hazardous and PCB waste. Robust solutions are likely to require combinations of several technologies. Some of the most promising technologies yield secondary wastes that require further treatment. For example, steam reforming generates a combustible gas that may require subsequent thermal oxidation using a catalytic reactor to accomplish destruction without incineration. Dehalogenation can effectively destroy PCBs, but it leaves non-halogenated hydrocarbons and many of the VOCs untouched; the treated wastes still contain enough of these materials so that shipment or disposal may not be possible without further treatments. For wastes being sent to a burial site, further treatments of the hazardous inorganic chemicals (e.g., stabilization) may be needed to meet land disposal requirements. Greater stabilization of the final waste may be required for mixed waste burial sites, compared with TRU wastes disposed of at WIPP.

The Panel also recommends that DOE consider less mature technologies for further development and testing, with the aim of either advancing them to readiness for deployment or eliminating them from further consideration.

Finally, 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. It is important and appropriate that DOE address the completion of relatively near term waste management actions such as meeting the agreement schedule for removal of stored mixed TRU and low-level waste from Idaho. Nonetheless, as noted elsewhere in this report, there are other wastes that will need to be treated, and the total problem will not be quickly solved. New technologies will rely on new science that can only result from investments in basic and applied research.

IV. DOE's Current Plan for Developing Technological Alternatives to Incineration

A. Overview of the Evolving DOE Plan

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. This subsection summarizes the current status of that plan. A complete executive summary of DOE's RDD&D plan appears in Appendix V.

A recent review of the DOE Environmental Quality R&D Portfolio concluded that, "The greatest gap identified among mixed waste technologies is the need for alternatives to incineration." Moreover, "Although there has been R&D on other technologies for destroying hazardous organics and for volume reduction, little such R&D is now under way and, more importantly, no specific technology is currently acceptable to replace incineration." The review concluded that, "Just as there is a gap identified with alternatives to incineration, there is an opportunity to fill that gap. Several candidate technologies have been brought forth in the past and prioritization of those to identify most likely successors, followed by development and demonstration activities should commence."⁹

DOE has made provision for public review of all elements of this plan, and revisions are possible as that review proceeds. The Panel places particular emphasis on this issue, and Subsection B below presents comments and recommendations on public involvement and other elements of the DOE plan.

The preliminary DOE plan includes stages of development ranging from basic science research through full-scale integrated demonstrations. The development and deployment plan which would be initiated in FY 2001 by DOE's Transuranic and Mixed Waste Focus Area (TMFA) includes provisions for regulatory and public involvement. Regulatory issues will be addressed by working directly with the various state and federal agencies (e.g., the EPA and state environmental regulators) throughout the alternatives development process. A DOE-EPA Memorandum of Understanding is already in place for this purpose. Developers will be informed of the data needed for permitting purposes, and will be notified of pending regulatory changes that may affect the future applicability of their alternative technology.

Technical issues will be addressed through a development effort involving side-by-side comparisons of emerging alternative technologies. Technologies selected for comparative study will be relatively mature. The comparative study will collect the necessary performance, design, scale-up, and permitting data for each selected technology. Testing with identical waste surrogates and/or actual wastes will ensure that each alternative technology generates comparable data.

Starting in FY 2001, the TMFA will establish facilities for the comparison tests and issue the appropriate competitive calls to initiate the testing program in FY 2002. DOE's Western Environmental Technology Office (WETO) in Butte, Montana will support the majority of the comparison testing, and would be equipped with the required additional monitoring and analytical equipment in FY 2001. Based on the competitive solicitation issued in FY 2001, three to five primary alternative treatment processes would be selected for comparison testing at WETO in FY 2002. The current strategy is to select enough processes to represent the three general classes of alternatives: thermal, aqueous-based chemical oxidation, and separations.

The two-year long comparative study of mature alternatives will be supplemented with a series of basic science research efforts and with development activities to optimize the auxiliary systems required for completely integrated alternative methods. The efforts in basic science research would span three years and, at a minimum, would include studies in materials research, off-gas pollutant formation, and long-term waste form stability. Auxiliary system testing would include activities involving pretreatment, waste feed pre-sizing, off-gas monitoring, and residue stabilization. Upon completion of the comparison testing in FY 2003, two to three of the better

⁹ "Adequacy Analysis of the Environmental Quality Research and Development Portfolio" (September 2000).

performing alternatives would be selected for integrated prototype testing, starting in early FY 2005. If appropriate, the current plan is to conduct this final test phase at a single location. Integrated testing is expected to last at least two years and to culminate with deployments by FY 2007.

Following extended discussion at its October public meeting in Denver, the Panel asked DOE staff to provide initial estimates of budget impacts associated with the principal elements of its preliminary draft plan, which are summarized below.

B. The Panel's Conclusions and Recommendations Regarding the DOE Plan

The Panel appreciates and generally supports DOE's substantial ongoing efforts to devise a strategy for developing technological alternatives to incineration. This section presents our recommendations for designing and executing that strategy. If these recommendations are followed, the Panel believes that 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.

BUDGETARY NEEDS: It is the view of the Panel that the TMFA is not funded adequately to underwrite the testing of the technological alternatives to incineration. As an essential first step, the Panel endorses the budget additions summarized in Table 4. These additions reflect an analysis prepared by DOE staff at the Panel's request, based on the new DOE RDD&D plan that is described in Section IV-A. The Panel has not tried to allocate the additions among the line items in Table 4 (that is properly a DOE management function), but urgent needs start with proof testing of candidate technologies, using the actual materials involved. Even focusing only on the relatively mature alternatives with the most immediate promise of meeting commitments to the State of Idaho, none have had the benefit of demonstration of capability to treat the wastes at issue here. And longer-term alternatives that appear to have advantages in overall robustness or in specialized areas with potential application across the DOE complex, need not only testing but extensive developmental work. The Panel also believes that more basic work on processes will identify much-improved alternatives that could pay off handsomely down the road. Adequate funding is necessary to make all of this possible. The Panel intends no implication that any other DOE budget allocation should be reduced to accommodate its proposal.

For materials specifically requiring treatment in lieu of incineration, there is no substitute for proof testing of each process with the actual materials to be treated. Testing of surrogate materials can create considerable useful knowledge, but only testing with actual materials will reveal the inevitable surprises that are experienced in practice. For example, some elements, notably americium, can be difficult to contain. Where there is plutonium there is americium.¹⁰ For both, adequate confinement is crucial. Worker exposure to both is of the highest concern, and worker uptake of transuranics must be zero. Processes that break down very stable compounds such as PCBs are of necessity vigorous, and establishing where the transuranics go is of considerable importance to the viability of the process.

Such testing will cost in the range of several million dollars a year, with total costs ultimately in the range of a few tens of millions. But the costs of failure are in the hundreds of millions of dollars, and much more than dollars is at stake. In light of the attention that has now been

¹⁰ Pu-241 decays with a 14-year half-life to produce Am-241.

focused on the issue and the likelihood of continued skepticism by the public and by the states involved, even partial success will not be good enough.

The Panel believes that some of the unsuccessful efforts in the past to deal with the waste in Idaho might have been avoided if more adequate proof testing had been done before large commitments were made. For this reason, the Panel has strong convictions about the value of proof testing. Where as here, good faith is in question, and testing beyond that dictated by normal engineering considerations is advisable. Economies made possible without adequate validation would be unwise.

The Panel concludes that the TMFA at INEEL is the logical home for coordinating this testing work. The testing program should be cognizant of and responsive to the needs of the entire DOE complex. Such testing can be expected to settle the issue of adequacy of process. It should also give a real and palpable demonstration of Departmental good faith in doing all that could reasonably be asked in accomplishing what needs to be done. Put directly, proven success through properly directed testing provides the best hope of eliminating the need for incineration. For all these reasons, we believe this work should be given high priority.

Table 4. Preliminary Analysis of Budget Impact of Draft RDD&D Plan for Alternatives to Incineration. (All values are shown in millions of dollars).

[CAUTION: This draft budget has not been fully reviewed internally at the DOE and does not necessarily represent its views or recommendations.]

ACTIVITY	2001		2002		2003	2004	TOTALS	
	Original	Panel Version	Original	Panel Version	Panel Version	Panel Version	Original	Panel Version
TECHNICAL		9		20	29	28		87
Comparison Testing and Developments								
Competed Alternatives			.05				.05	
Surrogate Testing			4.50				16.50	
Actual Waste Testing							16.00	
Leveraged Alternatives	1.80*						5.80	
Prepare Test Facilities to Host Comparisons	.25						.25	
Specific Development for Transuranic Waste	2.10		1.70				8.30	
Integrated Demonstrations							4.00	
Basic Science and Applied Research **	.75		3.00				19.75	
Testing of Auxiliary Systems	.70		.50				2.25	
REGULATORY	.10	.4	.10	.5	.5	.5	1.20	2
STAKEHOLDER	.05 *	.5	.05	.5	.5	.5	1.10	2
TOTALS	5.75	10	9.90	21	30	29	75.2	91
* Draft RDD&D plan is preliminary and has not been fully developed or reviewed internally								
** There is a research proposal call planned for FY 2002 to solicit solutions to TRU/Mixed Waste problems								

This work is useful, however, only if it underlies and supports actual treatment of the waste. Successful proof testing only shows the way. The Panel is concerned that mechanisms are not yet in place to ensure that the results of such testing form the basis for the actual treatment. There is a contract in place with BNFL, and DOE continues to emphasize privatization of the treatment process. The Panel has no comment on this, one way or the other. But the Panel does have a view that there is an unmet need for organizational definition, to ensure that technology with the greatest chance of success is in fact implemented. The very formation of the Panel

indicates that the situation in Idaho requires DOE to assume full responsibility for whether or not the waste treatment processes are satisfactory for the task at hand.

It is not sufficient to say that success is the responsibility of the contractor. 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 that the job is getting done well. Commercial interests associated with a privatized project must not dictate the selection and testing of specific technologies; much more weight should be given to the major benefit flowing to the nation from a proven technology for this class of waste. For beyond the measures necessary to resolve the impasse that produced this Panel, there are the volumes of buried TRU waste that we addressed previously in this report, as well as other TRU waste across the complex, both from legacy and from on-going and future program and decommissioning activities. Some of this waste will need treatment.

Also in this regard, the Panel underscores its strong support for increased and continuing basic scientific and developmental work over the longer term on processes to deal with mixed waste. We are aware of and applaud the TMFA plans to deploy alternatives to incineration across the DOE complex by 2007. But the nation has what is often called 'a 50-year problem,' involving both legacy and ongoing waste generation. Breakthroughs in cost, convenience and safety of processes are possible only if pursued. A simple analogy may be useful: the end-all in air transport was thought to have been achieved by 1939, until proof of the jet engine changed the picture completely. In the mixed waste area, the huge costs contemplated across the nation reinforce the importance of continued search for more and better technological alternatives.

Finally, the Panel believes strongly that its budgetary recommendations should be supported with an infusion of new federal funds rather than internal transfers from other vital efforts to solve problems associated with mixed waste, buried wastes at INEEL and elsewhere, and high-level radioactive waste.

TECHNOLOGY INTEGRATION: DOE should make every reasonable effort to ensure that the Panel's recommended alternatives are included in the comparative and integration phases of its RDD&D process. 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.

SYSTEMS APPROACH: In evaluating the most promising alternatives to incineration, the Panel urges the DOE to take a systems approach, and to consider the alternative technologies (especially the air effluent containment technologies) as a system under both normal and upset conditions. For example, under upset conditions, will fire suppression systems plug HEPA filters at a time when they are most needed? In particular, the Panel urges rigorous evaluation of whether the reliability and efficacy of the various effluent control systems will be sufficient to protect workers, the public, and the environment. In other words, will these systems meet appropriate standards after accounting for the probability of upset conditions as well as normal conditions? The Panel also urges DOE and other federal agencies independently to evaluate the air effluent containment systems with surrogate and alpha-emitting waste, to determine the appropriate decontamination factors.

TECHNOLOGY EVALUATION: DOE should use the Panel's seven criteria in evaluating alternative technologies in the comparative and integration phases of the RDD&D. The primary emphasis should be on the alternative's protection of the environment, safety, and health.

PUBLIC INVOLVEMENT: The DOE plan summarized in Section IV-A recognizes 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 INEEL TRU and mixed waste. Specifically, the Panel recommends that 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) by making sufficient, specific budgetary provision for technical assistance to committees of citizen advisors, and finally by ensuring ongoing involvement by those committees throughout the RDD&D process. These committees also should have a role in the peer review process that DOE uses to evaluate technology alternatives.

The Panel believes that citizen stakeholder involvement at all stages of the process is essential for successful deployment of waste treatment technologies. Citizen stakeholders should include people of various expertise from around the country and region.

The Panel encourages the Department in its attempts to involve the public and to include funds in its FY 2001 and later budgets for that purpose. Broad-based and meaningful public involvement requires both expenditures and a carefully thought out disbursement process. The Panel endorses a 2001 national conference on alternative technologies to incineration, and feels it is important and necessary for DOE to involve, in both the Steering Committee (see principles below) and the conference itself, not only the local CABs but also state, local and tribal governments, and national environmental, labor and other relevant policy groups with interests, commitment and expertise on the issues. Conference objectives should include public education, and discussion of an ongoing role for stakeholder groups in the RDD&D process. A third party facilitator and participation by interested companies and agencies are also recommended.

The Panel's recommendations for public involvement reflect these principles:

- The national conference on alternatives to incineration should be planned through a Steering Committee, as described above, which should be charged with ensuring that major stakeholders participate.
- Organization of the conference should include a group of public representatives from all of the regions where the alternative technologies to incineration may be candidates for use at DOE sites.
- 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.
- State and EPA regional regulators for DOE sites should be kept informed or invited to periodically attend information reviews on the technology alternatives.

- Financial assistance should be provided to reimburse expenses for ongoing public participation and to engage, as needed, independent experts responsive to the needs of the public representatives.
- Discussions of methods to organize and continue public participation at the national level should be a major topic at the 2001 conference.

NEXT STEPS FOR DOE AND SEAB: The Panel expects that the DOE draft RDD&D, outlined in Section IV-A, will change in response to the Panel's recommendations. The Panel's recommendations for technological development should be followed without arbitrariness in the early assignment of priorities among technologies and processes. In particular, DOE should first categorize in detail the wastes that need to be treated, then, link the actual wastes to processes in proposed work scopes. To simplify for emphasis: DOE must identify which processes are to treat what wastes.

DOE's initial selections of alternative technologies should be made on the basis of the Panel recommendations. The Panel is also vitally interested in the science-based portion of the DOE plan. 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 the Department has had the opportunity to recast its initial proposal to reflect the Panel's findings and recommendations.

APPENDIX I
Terms of Reference

APPENDIX I

Terms of Reference

Secretary of Energy Advisory Board
Panel on Emerging Technological Alternatives to Incineration

Terms of Reference

Objectives and Scope of Activities:

To evaluate and recommend emerging nonincineration technologies efforts for treatment and disposal of mixed waste on which the Assistant Secretary of Environmental Management's Office of Science and Technology should focus efforts for development, testing, permitting and deployment. The Panel will evaluate the technologies according to the criteria set forth in this charter.

Background:

Secretary Bill Richardson established the Panel to assess and recommend technological initiatives that the department should pursue to establish alternatives to incineration. The Panel was an important component of the Secretary's decision to postpone construction of an incinerator to treat nuclear waste stored at the Department's Idaho National Engineering and Environmental Laboratory (INEEL).

Description of the Panel's Duties:

The SEAB Panel on Emerging Technological Alternatives to Incineration will evaluate and recommend emerging nonincineration technologies for treatment and disposal of mixed waste on which the Assistant Secretary of Environmental Management's Office of Science and Technology should focus efforts for development, testing, permitting, and deployment.

The Panel will evaluate technologies to treat low-level, alpha low-level and transuranic wastes containing polychlorinated biphenyls (PCBs) and hazardous constituents, including the up to 14,000 cubic meters of such wastes that the DOE had planned to incinerate in the Advanced Mixed Waste Treatment Facility (AMWTF) at INEEL.

The Panel will also 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 Settlement Agreement and Consent Order signed by the State of Idaho, DOE, and the Navy in October 1995. That agreement requires the Department to remove 65,000 cubic meters of waste at the INEEL from Idaho by the end of 2018. The evaluation should also address the technical concerns raised by the public about the incinerator DOE has proposed as part of the AMWTF.

As a Subpanel of the Secretary of Energy Advisory Board, the Panel's final document will be a report that will be presented in a public forum. A copy of the report will be

posted on the web site and made available to the public prior to its presentation to allow the public to prepare questions and comments. Opportunities for public comment will be made throughout the process.

Reporting:

The Panel should complete its evaluation and provide recommendations and a report to the Secretary through the SEAB no later than December 15, 2000. Results of the Panel's evaluation and recommendations will be shared with the Governors of Idaho and Wyoming and the public.

Estimated Number and Frequency of Meetings:

The Panel is expected to meet at least four times before December 15. Meetings will be scheduled as the Panel deems necessary to accomplish its duties and purposes.

Membership:

The Panel will consist of nine members who have expertise and experience in the management of hazardous wastes and related treatment technologies. DOE has nominated five members. The Governors of Idaho and Wyoming have nominated one each. The Panel will also include two representatives nominated by public interest groups.

Chair of the Panel:

The Secretary of Energy, in consultation with the Governors of Idaho and Wyoming, will select the Chair.

Working Groups:

To facilitate the functioning of the Panel, it may establish working groups on its own initiative. Working groups would undertake fact finding and analysis on behalf of the Panel with respect to matters within the charter of the Panel. Given the broad range of issues to be considered, the Panel may ask working groups to explore certain issues in greater detail. For example, the Panel may ask smaller groups of two or three individuals to review various categories of technologies or specific problems in greater detail. Working groups will report back to the full Panel.

The Chair (or Co-chairs), in consultation with the department, will appoint members of any working groups established by the Panel. Working groups may include members who are not members of the Panel in order that the Panel may obtain additional expertise. Working groups will meet as the Panel deems appropriate.

Duration and Termination Date:

This charter shall expire on December 15, 2000 subject to extension or dissolution by the Secretary of Energy.

APPENDIX II

Biographical Summaries of Panel Members

APPENDIX II

Biographical Summaries of Panel Members

Ralph Cavanagh, Chairman, is a senior staff attorney at the San Francisco office the Natural Resources Defense Council (NRDC), a nonprofit environmental-advocacy organization. Prior to rejoining NRDC, Mr. Cavanagh served as an attorney-advisor to the U.S. Department of Justice. He has held appointments as a lecturer at Stanford and Harvard Law Schools and visiting professor of law at the University of California at Berkeley (Boalt Hall). He served on the Energy Engineering Board of the National Academy of Sciences (1987-93), and as vice chair of the Coalition on Energy Efficiency and Renewable Energy Technologies (CEERT). Mr. Cavanagh has also served on the Energy Subcommittee of the President's Commission on Environmental Quality and the Advisory Council of the Electric Power Research Company. He received his undergraduate and law degrees from Yale University.

Dr. Mario Molina, Vice-Chairman, is Institute Professor at the Massachusetts Institute of Technology. He was awarded the Nobel Prize in Chemistry in 1995 for the discovery of the theory that fluorocarbons deplete the ozone layer of the stratosphere. He was a Jet Propulsion Lab Senior Research Scientist for the California Institute of Technology. In addition, he has been a researcher, and associate professor at the University of California. He received his Bachelors degree from the Universidad Nacional Autonoma de Mexico and a doctorate in physical chemistry from the University of California at Berkeley.

Dr. Carl Anderson is currently the manager of the Wyoming Department of Environmental Quality's hazardous waste permitting and corrective action program, which he helped develop and implement in 1995. He has broad experience in all aspects of hazardous waste permitting and corrective action, including remedial technologies. Dr. Anderson received Bachelors and Masters degrees in geology from Idaho State University and a doctorate in geology from the University of Wyoming.

Andrew Athy, Jr. is a partner in the Washington, D.C. law firm of O'Neill, Athy and Casey. In January 1999, Secretary Richardson named Athy chairman of the Secretary of Energy Advisory Board. From 1978 to 1981, he served as counsel to the U.S. House of Representatives Energy and Commerce Subcommittee on Energy and Power; from 1976 to 1978, he was an attorney in the Office of General Counsel of the Federal Election Commission; and from 1973 to 1975, Athy was Assistant Attorney General in the Criminal Division of the Commonwealth of Massachusetts. Mr. Athy received an undergraduate degree from the University of Pennsylvania and a law degree from the Georgetown University Law Center.

Paul Bardacke is a founding partner in the New Mexico law firm of Eaves, Bardacke, Baugh, Kierst & Kiernan. He was previously a partner in the law firm Sutin, Thayer & Browne. Mr. Bardacke served as Attorney General for the state of New Mexico (1983 to 1986) and was appointed Special U.S. Attorney for the District of New Mexico (1984 to 1985). He is a Fellow of the American College of Trial Lawyers and is also a member of

the American, New Mexico and California Bar Associations. In his legal career, Mr. Bardacke has addressed a number of environmental cases, including cases involving the safety and regulatory requirements of hazardous waste incineration. He received a Bachelors degree cum laude from the University of California at Santa Barbara and a law degree from the University of California at Berkeley.

Robert J. Budnitz is President of Future Resources Associates Inc. in Berkeley, California. Previously, he served as Deputy Director and Director of the U.S. Nuclear Regulatory Commission's Office of Nuclear Regulatory Research, and he also held several management positions at the Lawrence Berkeley Laboratory of the University of California. His professional expertise and interests have focused on the environmental impacts, hazards, and safety analysis of nuclear materials, particularly of the nuclear fuel cycle. He has been prominent in the field of nuclear reactor safety assessment and waste-repository performance assessment, including probabilistic risk assessment. Dr. Budnitz has served on numerous investigative and advisory panels of scientific societies, government agencies, and committees of the National Research Council. His most recent National Research Council service was with the Board on Radioactive Waste Management Committee on Buried and Tank Wastes and the Committee on Technical Bases for Yucca Mountain Standards. He received a Bachelors degree from Yale University and a doctorate degree in physics from Harvard University.

Gretchen Long Glickman is a resident of Jackson, Wyoming. She is Chairman of the Board of Trustees of the Institute of Ecosystem Studies based in Millbrook, N.Y. She also serves as the Vice Chairman of the National Parks Conservation Association; Chairman of the Murie Center in Jackson, Wyo.; a Trustee of the Teton Science School in Jackson, Wyo.; and a Trustee of the D.C.-based Rails to Trails Conservancy. Ms. Long Glickman is a graduate of Harvard Business School and was a professional executive search consultant during her business career. She is the past Vice Chairman of Environmental Defense and the past Chairman of National Outdoor Leadership School (NOLS) and past Chairman of the Greater Yellowstone Coalition.

Dr. Marvin Resnikoff is Senior Associate at Radioactive Waste Management Associates in New York City and has concentrated exclusively on radioactive waste issues since 1974. He was formerly Research Director of the Radioactive Waste Campaign, during which time he authored *Living Without Landfills*, the Campaign's book on 'low-level' waste, and co-authored *Deadly Defense, A Citizen Guide to Military Landfills*. He is an expert in nuclear waste management and has testified often before State Legislatures and the U.S. Congress. Dr. Resnikoff has prepared numerous reports on incineration of radioactive materials, transportation of irradiated fuel and plutonium, reprocessing, and management of low-level radioactive waste. He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky, radioactive landfill, the Wayne and Maywood, New Jersey, thorium superfund sites and on proposed low-level radioactive waste facilities at Martinsville (IL), Boyd County (NE), Wake County (NC), Ward Valley (CA), and Hudspeth County (TX). He has conducted studies on transportation accident risks and probabilities for the State of Nevada and is currently technical consultant to the

State of Utah on the proposed dry cask storage facility and proposed storage/transportation casks. Dr. Resnikoff is a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics.

Dr. Charles Till served as the Associate Laboratory Director for Engineering Research, Argonne National Laboratory from 1980 to 1998. In this role he directed all fission reactor work, along with fusion, non-nuclear energy supply R&D, chemical engineering, and applied materials technology, programs which comprised about half of all scientific activities at the Laboratory. An internationally recognized expert in matters dealing with nuclear power, nuclear waste, and nuclear safety, he was Chairman of the Nuclear Energy Agency Committee on Reactor Physics from 1978 to 1980, which coordinated such development worldwide. He was Technical Director of the Fast Reactor Working Group for U.S. participation in the International Nuclear Fuel Cycle Evaluation, whose purpose was to limit proliferation risk from civilian reactor activities. He received his Ph.D. in nuclear engineering from the Imperial College, University of London, England. He is a member of the National Academy of Engineering and a Fellow of the American Nuclear Society.

APPENDIX III
Request For Information (RFI), Commerce Business Daily (CBD)
Announcement and List of Responders

APPENDIX III
Request For Information (RFI), Commerce Business Daily (CBD)
Announcement and List of Responders

[Commerce Business Daily: Posted in CBDNet on August 25, 2000][Printed Issue Date: August 29, 2000] From the Commerce Business Daily Online via GPO Access [cbdnet.access.gpo.gov]

SUBJECT: REQUEST FOR DATA AND INFORMATION ON ALTERNATIVE TECHNOLOGIES TO INCINERATION FOR MIXED TRANSURANIC AND ALPHA LOW-LEVEL WASTE

DESCRIPTION: Request for Information DEPARTMENT OF ENERGY

The U.S. DOE is seeking information on emerging technologies as alternatives to incineration for review by the Secretary of Energy Scientific Advisory Board, Blue Ribbon Panel on Emerging Technological Alternatives to Incineration. This is not a solicitation announcement for proposals and no contract will be awarded as a direct result of the information provided. No reimbursements will be made for any costs associated with preparation of responses to this request.

ACTION: Request for data and information on alternative technologies to incineration for mixed transuranic and alpha low-level waste.

SUMMARY: The Department of Energy (DOE) seeks information from firms and organizations with capabilities and interest in existing and emerging non-incineration technologies for the treatment of Mixed Alpha and Mixed Transuranic (TRU) waste currently being stored at the Idaho National Engineering and Environmental Laboratory (INEEL). The information is sought to inform the Blue Ribbon Panel on Emerging Technological Alternatives to Incineration. The Panel, as part of the Secretary's Energy Advisory Board, is a duly constituted advisory committee under the Federal Advisory Committee Act (FACA) governed by the Act's rules.

DATES: Submit data and information within 30 days of this announcement.

ADDRESSES: All responses should be in writing and be provided to the Executive Director of the Secretary of Energy Advisory Board, Mary Louise Wagner, US Department of Energy, Forrestal Building, 1000 Independence Avenue, Washington D.C. 20585. It should be marked Attention: Blue Ribbon Panel on Alternatives to Incineration.

SUPPLEMENTARY INFORMATION

Background: INEEL is one of DOE's primary centers for research and development activities on reactor performance, materials testing, environmental monitoring, natural

resources research and planning, and waste processing. In addition to nuclear reactor research, INEEL supports reactor operations; processing and storage of high-level waste (HLW), low-level mixed waste (LLMW), and low-level waste (LLW); the disposal of LLW; and, storage of TRU waste generated by defense program activities. DOE has been storing TRU waste at the INEEL since the early 1970s.

The Settlement Agreement and Consent Order signed by the State of Idaho, DOE, and the Navy requires the removal of this waste by 2018. To treat the TRU and alpha contaminated mixed waste at INEEL, the Department is planning an Advanced Mixed Waste Treatment Project (AMWTP) to be constructed and operated at INEEL. Although incineration was initially proposed as part of this facility, the Secretary has chosen to postpone the incinerator and await the recommendation of the Blue Ribbon Panel on emerging technological alternatives that may be capable of treating the waste. Accordingly, the Department has requested the State of Idaho and EPA only proceed with regulatory approval of the non-incineration components of the AMWTP. Currently, DOE is committed to the goal of identifying environmentally sound alternatives to incineration.

The Secretary of Energy has appointed the Panel to evaluate and recommend new technology initiatives that the Department should consider as alternatives to incineration of mixed transuranic and mixed alpha bearing waste that include shipment of the TRU waste to the Waste Isolation Pilot Plant in New Mexico. In particular, the Panel will assess emerging technologies that could treat such wastes contaminated with polychlorinated biphenyls (PCBs) and other hazardous constituents. The Panel is then to make recommendations to the DOE by December 15, 2000 regarding alternatives.

Request for Data and Information: Information provided in response to this RFI will be the sole source made available from industrial and academic organizations to the Panel as the means by which the Panel can review and consider alternatives from the industrial and public perspective. The Panel seeks information that may not be under the purview of the Department of Energy and associated laboratories and contractors. This request for information is voluntary and solely for the purposes of the Panel review. No individual response back to the providers of the information is planned but rather the Panel report will reflect consideration of the input received from responses to this RFI.

Although the Panel would prefer to review non-proprietary information, proprietary information will be accepted. If you wish to include proprietary information in your response, the title page of the response must be marked with the following legend:

Use and Disclosure of Proprietary Information This document includes proprietary information that shall not be disclosed outside the Panel and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than review by the Panel. This restriction does not limit the right of the Panel, its members, or the Government to use information contained in the proprietary information if they are obtained from another source without restriction. The information subject to this restriction is contained on pages [insert page numbers].

You shall also mark each page containing proprietary information with the following legend:

"Use or disclosure of information contained on this page is subject to the restriction on the title page of this document."

The Panel will use the information provided to evaluate and recommend approaches and focus to be taken by the Department concerning the development, testing, permitting, and deployment of emerging non-incineration technologies.

This RFI is not an opportunity or obligation to provide goods or services to DOE. All information provided is strictly voluntary without expectations of remuneration from the Department. Responses to this RFI should address each of the criterion listed on the following page. Limit responses to no more than a total of 35 typed pages using a font size of no less than 10 point, Arial or similar. Responses must include a one-two page overview of the technology or system, as well as a one-page table that summarizes the key characteristics for each of the seven individual criteria. To be considered, all responses are due within 30 calendar days of the date of this RFI notice.

The Panel has selected criteria as guidelines for making recommendations to the Department on emerging alternative technologies. Information supplied in response to this RFI should indicate the status data, knowledge, testing, and operating experience relative to following criteria:

1. Environmental, Safety and Health (ES&H) Risk Considerations (Describe the safety of the system, potential ES&H risks and the difficulty in designing and constructing a system to meet the safety and environmental health requirements in radioactive service.)
2. Stakeholder and Regulatory Interests (Describe the degree to which there may be resistance or delays in implementing the technology or system due to either public concerns or regulatory requirements.)
3. Functional and Technical Performance (Describe the technical performance of the treatment process to include destruction efficiency, volume reduction capability, secondary waste generation, robustness and flexibility of the system to process diverse types of waste, final waste form performance & characteristics, and its capability to be shipped.)
4. Operational Reliability (Describe the reliability and availability of the treatment process, its complexity, and the potential exposure to maintenance workers.)
5. Pre- and Post-Treatment (Describe the pre-treatment and post-treatment

requirements of the waste including expected amounts and the requirements for treating the effluents from the process.)

6. Economic Viability (Describe the total life-cycle cost of the system, the cost per unit volume of waste treated, the market for the technology, and the potential that the technology will be commercially available to treat the waste.)

7. Maturity (Describe the level of development of the technology, field experience with the technology in radioactive service, and whether the technology will be available in the time frame required, i.e., removal of this waste by 2018.)

Most of the waste treated at the AMWTP will be packaged for shipment offsite for disposal at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. Alpha LLMW must be treated to comply with RCRA land disposal restriction (LDR) standards and the mixed TRU waste must be treated to meet the WIPP waste acceptance criteria (WAC). WIPP WAC physical properties include: Free liquid content is less than 1 volume percent of external container; or less than 1 inch or 2.5 cm in bottom of internal containers; no sealed containers greater than 4 liters.

WIPP WAC chemical properties are: less than 1 percent radionuclide pyrophorics, no non-radionuclide pyrophorics; hazardous waste characterized in accordance with approved site-specific criteria limited to RCRA hazardous waste codes as listed in WIPP WAC Table 3.5.2; no chemicals or materials that are incompatible; no explosives, corrosives or compressed gases; PCB concentration less than 50 ppm; wastes containing asbestos should be identified; every container headspace will be sampled for volatile organic compounds. Additional information on WIPP WAC should be reviewed at <http://www.wipp.carlsbad.nm.us/wipp.htm>.

Suitable non-incineration technology must be available in time to complete the treatment and shipment of a minimum of about 3000 cubic meters of INEEL TRU waste. Certain wastes will require alternative treatment prior to shipment to WIPP or land disposal if incineration is not used. Such wastes may contain the following contaminants:

Polychlorinated biphenyls (PCBs) in concentrations equal to or greater than 50 parts per million (ppm), Containers with a potential for a flammable concentration of gas in the headspace due to the presence of volatile organic compounds (VOCs) or from significant hydrogen gas generation due to radiolysis, Containers with free liquids, Reactive or pyrophoric materials. Bulk composition of these wastes includes paper, oils and other organics, cloth, metals, glass, empty bottles and absorbent, and process sludges.

LIST OF RESPONDERS

- 1 AEA Technology Eng. Services
- 2 ATG
- 3 CerOx Corporation
- 4 Clean Technology Int'l
- 5 Commodore Advanced Sciences
- 6 Delphi Research Inc
- 7 DURATEK
- 8 Electro-Pyrolysis, Inc
- 9 Environmental Technology
- 10 Environmental Waste International
- 11 General Atomics
- 12 High Mesa Technologies
- 13 Integrated Environmental Tech.
- 14 MicroBasix
- 15 Nukem Nuclear Technologies
- 16 Perma-Fix
- 17 RACE, LLC
- 18 SAIC
- 19 SEPRADYNE Corp.
- 20 STUDSVIK, Inc.
- 21 Westinghouse Plasma Corp.

APPENDIX IV
Waste Streams Potentially Requiring Treatment at AMWTP, by
Charles Till

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Waste Streams Potentially Requiring Treatment at AMWTP, by Charles Till

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
003	Organic setups; oil soils		X	~ 1425	<p>A fraction of this waste is expected to be contaminated with PCB's in excess of 50 ppm, the current WIPP limit. The organic setups waste were produced from treatment of liquid organic wastes generated by various plutonium and nonplutonium operations. The organic wastes were mixed with calcium silicate to form a grease paste-like material. Small amounts of oil-dri absorbent were usually mixed with the waste.</p> <p>Organic wastes such as degreasing agents (primarily trichloroethane), lathe coolant (machining oil and carbon tetrachloride), and hydraulic were are generated primarily by plutonium fabrication operations. Other organic wastes include carbon tetrachloride; trichloroethylene; hydraulic, gearbox, and spindle-oils; and trace concentrations of miscellaneous organic laboratory wastes. (organophosphates, nitrobenzene, etc.) In addition, unknown volumes of oil containing polychlorinated biphenyls (PCB) were processed with other organic wastes until 1979. Degreasing solvents generated by operations are contaminated with beryllium. A typical 55 gal drum contains approximately 30 gal of organic waste and 100 lb of calcium silicate.</p> <p>This stream is a major contributor to the wastes requiring treatment either as a result of PCB contamination or because of the presence of flammable VOCs. BNFL Inc. believes that approximately 80percent of the waste in this category will require treatment, with PCB contamination driving the treatment of a few hundred m³ of the waste.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
203	Paper, metal, and glass		X	26.3	<p>This waste stream is listed in the HWMA/TSCA permit application as a PCB waste stream. This waste stream, generated at Battelle Columbus Laboratories, contains a mixture of combustible and noncombustible items in roughly equal proportions. Combustible items include paper and paper products. Noncombustibles are primarily metal and some glass.</p> <p>The organic content is about 9 lb/ft³ in drums and about 5 lb/ft³ in bins. Combustibles, including packaging, may exceed 25 volume percent. The levels of dispersible fines should be within WIPP-WAC limits. No sludges or free liquids should be present. No explosive or pyrophoric materials should be in this waste.</p> <p>This IDC is a relatively low volume stream but 203 carries a code for PCBs and thus requires treatment. The PCB contamination is contained in 1-gallon metal cans (estimated at 20 1-gallon metal cans.)</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
001	First stage sludge		X	2888.7	<p>This waste consists of a wet sludge produced from treating aqueous process wastes, such as ion exchange column effluent, distillates, and caustic scrub solutions generated by Plutonium Recovery Operations at Rocky Flats (Building 771). Portland cement was added to the waste package for absorption of free liquids. Waste drums may periodically contain surgeon's gloves.</p> <p>Since the fall of 1979, first-stage sludge (IDC 001) and Second stage sludge (IDC 002) were combined into Content Code 1 - Combined sludge.</p> <p>Sludge was produced by treating aqueous wastes by the carrier precipitation process. Aqueous wastes were made basic, if necessary, with sodium hydroxide. Radioactive elements such as plutonium and americium were chemically precipitated from the liquid waste. Treatment chemicals included ferric sulfate, calcium chloride, magnesium sulfate, and flocculating agents. The treatment process produced a precipitate of the hydrated oxides of iron, magnesium, aluminum, silicon, etc., which also carried the hydrated oxides of plutonium and americium. The precipitate or slurry was filtered to produce a sludge containing 50 to 70 weight percent water.</p> <p>Materials in this waste group (IDCs 001, 002 and 800) may meet the definition of corrosivity as defined in 40 CFR 261.22 to the presence of caustic free liquids. Free liquids were identified in some sludge drums. Analysis...indicates a pH range of 8 to 12. Although the pH does not meet the definition of corrosivity these results are limited and may not be representative of the entire inventory. According to (RFETS Bldg. 774) log books, the liquids treated were consistently above pH=12.5.</p> <p>BNFL believes that the presence of corrosive liquids cannot be discounted, and further that there is some possibility of flammable VOCs being present. BNFL estimates that up to 25percent of the combined volume of IDC 001 and IDC 002 may require treatment either to remove the free liquids or to deal with flammable VOCs.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
002	Second Stage sludge		X	2555.7	<p>This waste consists of wet sludge produced from treatment of all other plant radioactive and/or chemical contaminated wastes and further treatment of the first-stage effluent. Portland cement was added to the waste package for absorption of free liquids.</p> <p>Second-stage sludge drums packaged prior to 1973 may contain other waste such as electric motors, bottles of chemical (usually liquid) wastes, mercury and lithium batteries, and small amounts of contaminated mercury in pint bottles. Radioactive sources were also periodically included in second-stage drums through 1979.</p> <p>See also additional comments ("Sludge was produced....."and following) under IDC 001.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
800	Solidified Sludge		X	326.4	<p>The process that produced solidified sludge from Rocky Flats Building 774 (IDC 800) was very similar to IDC 001. The sludge was co-fed into a drum with a diatomite and Portland cement mixture which formed a solid monolith after curing. IDC 800 was generated from 1986 until March 1991.</p> <p>See also additional comments ("Materials in this waste group...") under IDC001.</p> <p>The BNFL analysis of this waste stream indicated that the process used in its generation involved an immobilization technique that might be expected to limit the occurrence of free liquids. BNFL therefore assumes that the probability of this stream requiring treatment is low, and that it will not contribute materially to the overall volume requiring treatment in this group.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
007	Dried Sludge		X	1097.9	<p>Rocky Flats solidified sludge consists of immobilized low-level mixed waste materials from decontamination-precipitation and neutralization processes in the Building 374 Liquid Waste Treatment Facility. The wastewater treatment operation included neutralization, radioactive decontamination (precipitation), filtration, evaporation, spray drying, salt immobilization, and filtrate sludge immobilization. The sludge from the rotary drum vacuum filter had a dry appearance but was still very moist. The dried sludge was transferred from the dryer directly into a 55-gallon drum. The resulting waste consisted of dispersible fines and was assigned IDC 007.</p> <p>Materials in this group (IDCs 007, 803 and 807) may meet the definition of corrosivity due to the presence of caustic free liquids...it is suspected bypass sludge generated before April 1986 may have dewatered. Free liquids...were identified in 4 drums of IDC 007...Analysis of the liquids indicate of pH range of 7 to 12. Although the pH does not meet the definition of corrosivity, these results are limited and may not be representative of the entire inventory. According to generator knowledge and Rocky Flats Bldg. 374 treatment log books, the pH of liquids treated was as high as 14 and was consistently above 12.5.</p> <p>BNFL notes that this is a relatively large waste stream and that liquids have been detected in some drums. Although modest pH values of 7-12 were noted, perhaps due to reaction with CO₂, the possibility of high alkalinity free liquids cannot be precluded. In the BNFL view, there is a high likelihood that these wastes may require treatment, and possibly up to 75percent might fall into the treatment category.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
803	Wet sludge-cemented		X	33.6	<p>This waste consists of sludge dried in a dryer, and mixed with Portland cement and water, which cured to form a solid monolith.</p> <p>See additional comments ("This materials in this waste group..." and following) under IDC 007.</p> <p>In the BNFL analysis, IDC 803 and 807 wastes were considered together with IDC 007 as a group. See the comments on waste volume under IDC 007.</p>
807	Solidified bypass sludge		X	267.1	<p>This waste consists of sludge that bypassed the dryer and was mixed with diatomite and Portland cement. IDC 807 sludge is the same as the IDC 007 sludge generated using the bypass system.</p> <p>See additional comments ("The materials in this waste group...." and following) under IDC 007.</p> <p>In the BNFL analysis, IDC 803 and 807 wastes were considered together with IDC 007 as a group. See the comments on waste volume under IDC 007.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
440	Glass	X		508.2	<p>This waste consists of glass generated by plutonium production, recovery, treatment, laboratory and maintenance operations at many locations at Rocky Flats. The waste consists of items such as bottles, vials, light bulbs, labware, glovebox windows, and process equipment.</p> <p>These materials may meet the definition of ignitable due to the presence of ignitable free liquids. The materials themselves are not liquid, and absorbents were added to wastes having the potential of generating free liquids (e.g. glass vitals containing liquid). However, free liquids were identified in a few drums of glass waste. Headspace gas analysis indicates that the liquids contain cyclohexane; an ignitable liquid.</p> <p>BNFL assumes that there is a moderate possibility of this stream requiring treatment. It is estimated that up to 50percent of the volume could fall into the treatment category.</p>
441	Raschig rings, unleached		X	348.2	<p>This waste consists of Raschig rings (borosilicate glass rings) used to maintain subcritical conditions in fissile solution storage tanks that were not safe by dimension. Unleached Raschig rings may meet the definition corrosivity due to the presence of acid or caustic free liquids. The material in this group is not a liquid, and absorbents were added to wastes having the potential of generating free liquids. However, unleached raschig rings removed from tanks that contained acids or bases could potentially contain corrosive fuel liquids.</p> <p>BNFL believes it unlikely that these wastes will make a significant contribution to the treatment category.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
290	Sludge filter		X	1	<p>This waste stream, generated at Rocky Flats Plant, consists of only one (1) drum of wet sludge from the incinerator off-gas system, recovery building filter plenums, pumps, etc. Content Code 290 was replaced with Code 292 in 1974.</p> <p>This waste contains free liquids. Organic content is less than 14 lb/ft³. No explosive, pyrophoric, or corrosive materials should be in the waste.</p> <p>The filter sludge was packaged in 1-quart ice cream cartons. Each carton was sealed. It is believed that each carton was bagged and sealed in a Vollrath 8802 stainless steel can. Cans were assayed and then placed in groups of 20 to 25 in prepared 55-gallon drums.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
292	Cemented Sludge		X	135.8	<p>Incinerator sludge (IDC 292) packaged prior to 1977 was placed in a polyvinyl chloride bag and sealed with tape. The bag was then double-contained in plastic and placed in a 1-gallon metal paint can containing Portland cement. Additional cement was added to the top of the waste before the paint can lid was closed. Beginning in 1977, the sludge was collected in 2-or 4 liter Nalgene bottles. Portland cement was added in layers as the bottles filled with sludge. The sludge was capped with cement, the bottle lid was installed, and the bottle was double-bagged. The sludge may also be packaged in several plastic bags within the drum. Each individual package was bagged out of the glovebox and placed in two plastic bags that were sealed with tape. The packages were assayed and placed into a 55-gallon drum. Up to 25 cans or 20 bottles were placed in a drum depending on assay. IDC 292 may exhibit the characteristic of corrosivity due to the presence of caustic free liquids.</p> <p>In BNFL's view, this waste stream has a moderate probability of contributing to the treated waste, perhaps as much as 75percent of the volume of IDC 290 and 292.</p>
105	Empty bottle and absorbent			0.7	<p>This waste stream consists of PE and glass bottles used to transport liquids wastes. The organic content is around 5 lb/ft³. The levels of dispersible fines should be within WIPP-WAC limits. No sludges or free liquids should be present, except for small quantities of wet vermiculite. No explosive or pyrophoric materials should be in the waste.</p> <p>BNFL notes that this is a very small waste stream with a very low likelihood of requiring treatment.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
802	Solidified Lab Waste	X		16.3	<p>IDC 802 is not identified in the AK document as a characteristic waste. This waste stream was generated at Mound Laboratory and consists of neoprene gloves, neoprene O-rings, and lead-lined gloves. Limited amounts of waste from Mound content codes 801, 804, and 812 may be included.</p> <p>BNFL analysis is that IDC 802 is a small volume that has a low chance of containing cyclohexane, and that this waste stream will make no significant contribution to the treatment category.</p>
005	Evaporator Salts	X		8.0	<p>This waste consists of a salt residue generated from concentrating and drying liquid waste from concentrating and drying liquid waste from solar evaporator ponds. The approximate chemical makeup is 60percent sodium nitrate, 30percent potassium nitrate, and 10percent 'miscellaneous'. Limited amounts of other wastes such as surgeons gloves, paper, rags, and metal may be found. Portland cement was added to damp or wet salt when necessary.</p> <p>Noting that the drum may contain both liquids and nitrates, BNFL believes that up to 75percent of this low-volume stream may require treatment.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
834	High Level Acid	X	X	187.7	<p>This waste comes from Mound Laboratory. It consists of acid liquids, mainly nitric, absorbed onto a clay called Florco. The Florco is then placed in a drum bag in a drum lined with a 90-mil poly liner. Analytical assay values are available for each drum.</p> <p>For both IDC 834 and 835, the BNFL view is that both streams were extensively sorbed and are not expected to exhibit free liquids. Neutralization of caustic and buffering by the clay also would tend to reduce the extremes of pH.</p>
835	High Level Caustic		X	348.8	<p>This waste comes from Mound Laboratory. It consists of caustic waste and neutralized waste liquids, absorbed onto a clay called Florco. The Florco is then placed in a drum bag in a drum lined with a 90-mil poly liner. Analytical assay values are available for each drum.</p> <p>See BNFL comments above under IDC 834.</p>

Waste Streams Potentially Requiring Treatment at AMWTP

IDC	Name	D001	D002	Volume (m ³)	Comment
811	Evaporator and Dissolver sludge	X		0.8	<p>This waste stream, generated at Mound Laboratory, consists of dry evaporator and dissolver sludge and insoluble residue. The consistency ranges from powder to sand-like particles. Limited amounts of other noncombustible wastes including Content Codes 803, 805, 810, 813, 814, 826, and 832 may be included. A few containers may have limited amounts of beryllium-contaminated wastes including glass, paper, gloves, and sample precipitates.</p> <p>The drums contain free liquids. The expected organic content in the drums is less than 14lb/ft³. No explosive, pyrophoric, or corrosive materials should be in the waste.</p> <p>BNFL comments that this is a very low volume waste stream unlikely to contribute significantly.</p>
430	Resin, Ion Column unleached	X		12.7	<p>This waste, generated at the Rocky Flats Plant, consists of anionic and cationic exchange resins used in the purification and recovery of plutonium and americium, respectively. The anionic resins were DOWEX 1-X4 and the cationic resins were DOWEX 50W-X8, both being polystyrene-divinylbenzene copolymers.</p> <p>BNFL notes that this small-volume stream might require 10percent of the stream volume to be treated.</p>

¹ The volumes listed are not indicative of the amount of waste that requires treatment--the volumes indicated are the totals for the stream.

APPENDIX V
Executive Summary
Transuranic and Mixed Waste Focus Area,
Alternatives to Incineration: Preliminary Research, Development,
Demonstration and Deployment (RDD&D) Plan
October 2000

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For over ten years, the Department of Energy (DOE) has successfully incinerated a variety of the organic-based mixed wastes that were generated from its past and present nuclear energy, waste remediation, and weapons missions. However, some of these waste streams are not amenable to efficient incineration since they contain transuranics, mercuric compounds, explosives, and/or reactives. Additionally, public concern over incinerator emissions, and the recently mandated Environmental Protection Agency (EPA) requirements to enhance monitoring and treatment of these emissions, has caused the DOE to consider closure of all three of its mixed waste incinerators complex wide. As a result, the DOE's Transuranic and Mixed Waste Focus Area (TMFA) has established a new plan for developing, and deploying the cost effective and timely alternative technologies necessary for replacing the role of incineration.¹¹

The strategy presented in the plan is most applicable to those wastes that will be generated in the out years as a result of extensive remediation and DOE site closure activities. The majority of the legacy mixed waste volumes immediately displaced as a result of near -term incineration closure may be treated through the private sector and may not be, except in specific cases, impacted by the plan.

The preliminary plan to develop these alternative methods requires a broad range of efforts over the various stages of development, including those of basic science research and full-scale integrated demonstrations. To be successful, the specific development and deployment plan to be initiated in FY 2001 by DOE's Transuranic and Mixed Waste Focus Area (TMFA) must include regulatory and public input, in addition to the traditional technical component. The regulatory issues are to be addressed by working directly with the various State and Federal agencies (e.g., the Environmental Protection Agency/EPA) throughout the alternatives development process. Through communication with these agencies, various developers will be informed of the data needed to ensure permitting, and will be notified of pending regulatory changes that may effect the future applicability of their alternative technology. Likewise stakeholder and public issues will be addressed by presenting the strategy, as well as periodic status reports to established stakeholder groups. As a result of the presentations, stakeholders will play an active role in the process by providing criteria for selecting and testing alternatives. Additionally,

¹¹ A budget for the plan has also been prepared and it provides recommended estimates of resources for the next four fiscal years. This budget is presented as a Table in Section IV A. Overview of the Evolving DOE Plan. As indicated by the table, the present TMFA allocated FY2001-2002 budgets are tabulated along with a recommended plus-up budget required to address the proposed plan.

public perception will be gauged through the presentations and various efforts of the alternatives development plan will be redirected, altered, or terminated as appropriate.

Technical issues will be addressed through a development effort involving a side-by-side comparative study of emerging alternative methods to incineration. Based, in part on an independent peer review, methods selected for the study will include near ready or relatively mature technologies. The comparative study will involve collecting the necessary performance, design, scale-up, and permitting data for each selected technology. Testing with identical waste surrogates and actual wastes will ensure that each alternative technology generates comparable data. Starting in FY 2001, the TMFA will prepare the required facilities for housing the comparison tests and issue the appropriate competitive calls to initiate the testing program in FY 2002.

DOE's Western Environmental Technology Office (WETO) in Butte MT will support the majority of the comparison testing and will be equipped with the required additional monitoring and analytical equipment in FY2001. Based on the competitive solicitation issued in 2001, three to five primary alternative treatment processes will be selected for comparison testing at WETO in FY 2002. The current strategy is to select enough processes to represent the three general classes of alternatives: thermal, aqueous based chemical oxidation (including dehalogenation), and separations. In addition to the primary alternative test units to be located at WETO, on-going tests of other alternative methods at other locations will be leveraged and altered in a manner to make them consistent with the comparative studies at WETO. A number of these leveraged alternative methods will involve on-going TMFA funded projects already addressing specific DOE issues in regard to both mixed low-level and transuranic waste. In addition to surrogate waste testing at WETO and alternative sites, demonstrations using actual wastes of interest will be performed on selected technologies with the highest potential for success. Additionally, if the requested budget levels are obtained for FY-2001, limited testing on selected technologies will be initiated as early as FY-2001.

The scheduled three-year long comparative study of near ready or mature alternatives will be supplemented with a series of basic science research efforts, as well as with development activities to optimize the ancillary systems required for completely integrated alternative methods. The efforts in basic science research will span three years and, at a minimum, will include extensive studies in material research, off-gas pollutant formation, and long-term waste form stability, as well as on new concepts for organic separation and destruction. Ancillary system testing will include activities involving pretreatment, waste feed pre-sizing, off-gas monitoring, and residue stabilization. Upon completion of the comparison testing in FY-2004, two to three of the higher performing alternatives will be selected for integrated prototype testing, starting in early FY2006. The selection will be based on an additional peer review by an independent consulting panel as well as on any feedback received from the established public stakeholder groups. If appropriate, the current plan is to conduct this final test phase at a single location. This integrated testing is expected to last at least two years, culminating with deployments by 2007.