Comments of the Institute for Energy and Environmental Research on the Department of Energy Advanced Mixed Waste Treatment Facility RCRA and TSCA Permit

Introduction

The treatment of waste containing both a radioactive component and a hazardous component is one of the most difficult challenges faced by the Department of Energy in its clean-up of the nuclear weapons production complex. The Department of Energy is proposing to hire BNFL, Inc. (an American subsidiary of British Nuclear Fuels Limited) to build and operate a treatment facility in order to prepare waste at the Idaho National Engineering and Environmental Laboratory (INEEL) for disposal. The Institute for Energy and Environmental Research (IEER) has previously commented on this project and continues to maintain the position that the focus of DOE and BNFL on this waste stream, and the particular waste treatment chosen, is not protective of public health and the environment. We have therefore attached our previous comments as an Appendix to these comments as they are integral to the analysis presented herein.

The purpose of these comments is to analyze the application that has been submitted to the Environmental Protection Agency and the Idaho Department of Environmental Quality for the construction and operation of the Advanced Mixed Waste Treatment Facility. The Department of Energy and BNFL have submitted this application under the Resource Conservation and Recovery Act (and its equivalent under State of Idaho law, the Hazardous Waste Management Act) and the Toxic Substances and Control Act. These comments are submitted by the Institute for Energy and Environmental Research both on its own behalf and on behalf of the Snake River Alliance of Idaho at their request.

In particular, these comments will focus on the treatment technologies chosen by DOE and BNFL and the related regulatory requirements under RCRA and TSCA as set forth in the Code of Federal Regulations. The purpose of both RCRA and TSCA is protection of the environment and public health through proper storage, treatment and disposal of hazardous and toxic waste. In order to accomplish this task, the DOE must find the best mix of technologies in order to both meet its regulatory requirements and be as protective as possible. This is particularly important in this case, as these wastes pose particular hazards, both to the environment and to the workers processing the waste. Not only is this waste radioactive as well as hazardous, it contains significant amounts of plutonium, which poses unique challenges.

A review of the Application and the relevant regulations clearly indicates that the assessment of the options made by the Energy Department, and its contractor BNFL, is seriously and fundamentally deficient in a number of respects. By excluding treatment options and technologies that have the potential to reduce the risks of waste treatment, and by proposing some treatment that is unnecessary under the regulations, the Energy Department has not fulfilled its underlying obligation to protect the environment and public health.

Treatment of Mixed Waste Containing Plutonium

One technology that has been used extensively to treat both hazardous and non-hazardous waste is incineration, essentially burning the waste at high temperatures in order to destroy specific toxic compounds and/or reduce the volume of the waste by burning some of its components. Because of its widespread use for treating hazardous and non-hazardous waste, incineration has also become a standard proposed treatment for mixed wastes. However, there are a number of problems with incineration in general and with the incineration of mixed waste in particular [1]

- Incineration does not destroy the radioactivity of the waste. Radioactivity is a function of the nuclear structure of individual atoms. Thus, while incineration can burn the material contaminated by a radioactive isotope or destroy the chemical bonds between the isotope and other atoms, it cannot destroy the nucleus of the atom, which is the cause of the radioactivity. Incineration can, however, change the chemical or physical form in which the radioisotope is present (e.g. releasing radioactive gases such as tritium or creating plutonium bearing ash from plutonium bearing solids)

- Incineration does not destroy heavy metals, which are a significant problem in many hazardous waste streams.

- Incineration results in new toxic compounds being formed due to incomplete combustion. These toxic compounds, such as dioxins and furans are themselves hazardous.

- Incineration regulations rely upon Trial Test Burns to determine performance. While it is assumed that the test burns (which are supposed to measure the efficacy of the incinerator in destroying particularly difficult compounds to destroy) result in optimal destruction, problems with the test burn process and its reliance on principal organic hazardous constituents (POHC) have been discovered. This procedure also assumes, at least implicitly, that waste composition is uniform enough and known well enough that test burn emissions will be characteristic of operating conditions.

- Incineration results in significant production of gases and particulates that must be controlled through air pollution control systems. Such APCS do not directly monitor the emissions of toxic compounds of concern. Rather there is a reliance on monitoring the performance of the incinerator and other factors (such as the pressure drop across the HEPA filter) to determine whether the APCS is working as planned.

All of these problems and others have caused widespread concern about incineration. The question of the quality of waste characterization will be a particularly important one for the permitting of this facility. A highly variable waste composition creates numerous problems for waste incinerators, including variations in the emissions. As noted by the DOE, the “The presence of TRU radionuclides and the associated radiation fields severely limit the amount of chemical sampling and analysis that can be safely performed by generators and by AMWTF personnel.” [2] Furthermore, these wastes were produced as the result of a variety of processes with little regard at the time of production for waste characterization. Thus, this waste is unlike much hazardous waste from the commercial sector where knowledge of waste production processes and waste composition is more proximate to the time of disposal and is generally not affected by the action of radioactivity.

The methodology for permitting waste incinerators was developed in the context of commercial hazardous waste, not Energy Department mixed waste. Even in the commercial sector, the trial burn permitting process is complicated and problematic. In the case of the AMWTF, it is necessary for EPA, DOE, and Idaho DEQ to demonstrate, in this specific instance, prior to issuance of the permit, that using trial burns is appropriate. Otherwise, EPA must devise and demonstrate a permitting process which accounts for the particular difficulties posed by mixed waste, particularly waste that is poorly characterized. Furthermore, as no information is currently available as to the nature of the off-site waste the Energy Department proposes to send to the AMWTF, a prohibition should be placed on off-site waste being treated at the AMWTF. If a permit is issued, it should explicitly exclude off-site wastes, for which a new testing and permitting process would likely be needed.

The necessary reliance of incineration systems on air pollution control systems is particularly worrisome in the case of the AMWTF. The Defense Nuclear Facilities Safety Board (DNFSB), the federal organization responsible for monitoring and ensuring safety at DOE's nuclear weapons facilities, has recently released a report on the high efficiency particulate filters which form a major component of any APCS. That report concluded that "confinement ventilation systems at some DOE facilities may be vulnerable to failure when most needed." [3] The report notes that the infrastructure that supports DOE's HEPA filter program is "failing." [4] It is clear from the report that these problems affect not only the HEPA filters currently in place at DOE facilities, but also those to be installed at DOE facilities. In part this is the result of the elimination of HEPA filter testing programs, which assured quality control for filters to be installed. However, there are also other problems detailed in the report, including the performance of the filters under accident scenarios.

The problems posed by incineration have been recognized, even from within elements of the DOE. For example, an internal review of plans for a mixed waste incinerator at the Lawrence Livermore National Laboratory stated: We have never been comfortable with the EPA's position that incineration of mixed waste to eliminate its chemical toxicity should be the first procedural step and burial of its radioactive residuals the second step. This approach commits to volatilization of important radionuclides, including tritium, carbon-14 and several isotopes of iodine. Furthermore, the incineration of non-volatile nuclides, including those of uranium and plutonium, leads to a finite, *although exceedingly small*, probability of radioactivity being emitted from the incinerator stack.

We view incineration as a violation of the cardinal principal of radioactive waste management; namely, containing radioactivity rather than spreading it. [5]

The Energy Department, in response to concerns over the incineration of mixed waste, established a program to analyze, develop, and implement alternative treatment technologies. [6] As a result, a number of new technologies have been developed and some have been commercialized and implemented. At least two of these technologies were developed as direct replacements for incinerators (see below).

Incineration is a particularly problematic technology when one is dealing with plutonium bearing wastes. Not only does incineration not destroy the plutonium, it converts it into small particles. Plutonium is at its most harmful when breathed in and lodged in the lungs. [7] Thus, rather than rendering the waste less toxic, incineration converts plutonium into a more dangerous, respirable form, posing needless risks to both workers and the general public. Plutonium contamination of treatment facilities also complicates the eventual decontamination and decommissioning of such facilities. Plutonium in ash form is more likely to spread the contamination within the facility. While the temperatures attained during incineration do not reach the volatilization temperature of plutonium, it is still possible to have some emissions from incineration. These risks may be increased during accident scenarios.

It is precisely such concerns that have led one of the co-permittees of this facility, BNFL, to reject the incineration of plutonium bearing wastes in its facilities in the United Kingdom and to generally avoid incineration of any radioactively contaminated waste. For example, an audit of BNFL sites by Her Majesty's Nuclear Installations Inspectorate and Her Majesty's Inspectorate of Pollution noted that "incineration of LLW is not considered by BNFL to be a preferred method of volume reduction." [8] In the United Kingdom, plutonium-bearing transuranic wastes are considered Intermediate Level Wastes, not LLW. By implication, incineration of such transuranic wastes would be even more inappropriate.

An Advisory Committee on the Safety of Nuclear Installations also noted that the "commitment to incineration in Germany and Sweden is in contrast to the general rejection of the process at Sellafield." [9] Sellafield is one of BNFL's main sites in the United Kingdom. The Advisory Committee even cites a BNFL study which came to the conclusion that the potential for destruction of organics and reduction in volume with incineration was outweighed by the disadvantages of higher worker exposures and increased decommissioning problems. There is currently no indication that BNFL incinerates any of its radioactive waste, particularly any bearing plutonium.

BNFL uses another of the technologies proposed for the AMWTF, supercompaction, in its UK operations only for the compaction of low-level waste. The supercompaction of transuranic waste increases the risk of a criticality in the facility (since the volume in which the plutonium is located is being reduced and the configuration is changing). There is also an elevated risk of explosions, partly due to the build-up of ignitable and reactive gases in the waste due to the radiolytic decomposition of plastics. [10]

The paucity of experience in incinerating or supercompacting plutonium bearing mixed wastes contradicts the position of the DOE that "The technologies selected have already been used at other facilities for treating radioactive wastes – we know from experience that they can be integrated into an efficient process able to be operated safely, with minimum maintenance." [11] Incineration and compaction are not at all well-established technologies as applied to transuranic waste. In particular, it is clear that the party with prime responsibility for ensuring that the facility operates safely, BNFL has no facilities to incinerate or compact such waste.

Consideration of treatment of radioactive mixed waste must also take into account the requirement to keep exposures to, and doses from, radioactivity As Low As Reasonable Achievable (ALARA). As defined by the Energy Department in its Environmental Impact Statement for the AMWTF, ALARA is "A process by which a graded approach is applied to maintaining dose levels to workers and the public and releases of radioactive materials to the environment as low as reasonable achievable." [12] Thus, any consideration of mixed waste treatment, and consideration of the technology options for mixed waste treatment, should take into account the radioactivity of the waste in addition to the hazardous characteristic of the waste. Only by considering both, can the doses be kept as low as reasonably achievable.

Best Demonstrated Available Technologies

The particular mix of technologies chosen by the co-permittees for treating the 65,000 cubic meters of waste at the Radioactive Waste Management Complex of the Idaho National Engineering and Environmental Laboratory is based on a concept know as the Best Demonstrated Available Technology (BDAT). The idea behind BDAT is that a particular specified technology is the standard technology to be used in treating that waste because it has been proven to work. For example, as discussed below, incineration and high efficiency boilers are the specified BDAT for waste contaminated with polychlorinated biphenyls (PCBs). However, as will be shown below, the co-permittees have not necessarily chosen the Best Demonstrated Available Technology, particularly when considering the radioactive characteristic of the waste.

While the regulations may specify a BDAT, any proposed treatment facility does not necessarily have to use that technology if an alternative can be shown to be better for the particular waste being treated. This is accounted for in the regulations. The Department of Energy and BNFL, in assessing the technologies to be used in this facility have dismissed technologies that may provide equal or better performance with fewer environmental risks than the existing BDAT. For example, two alternative thermal treatment technologies exist which could replace incineration for the treatment of homogenous solids, soils, and PCBs. They could also treat debris waste. These are the DC Graphite Arc Melter and the Plasma Hearth Process.

Both the DC Arc Melter and the Plasma Hearth Process have undergone extensive research, design and development. While IEER does not endorse any particular alternative technology at this stage, it is incumbent upon the co-permittees to analyze all of their available options. Despite the fact that development work on both of these technologies was ongoing at the Idaho facility and resulted in Innovative Technology Summaries in November 1998 and May 1999, the DOE’s NEPA analysis dismissed both of them based upon a report written in 1995. [13] The DOE did not take into account in conducting its analysis any of the developments subsequent to 1995, including the commercialization of both of the technologies. [14]

The potential advantages of these processes stem from the fact that they achieve all three goals of volume reduction, organics destruction, and immobilization with one process. They do not create an ash product that can be emitted and requires immobilization in the manner that incineration does. Thus, many of the constituents of concerns, such as plutonium, are immediately immobilized in the slag that is produced.

The ability of the co-permittees to utilize either of these processes for the treatment of each waste stream is discussed below with reference to the relevant section of the Code of Federal Regulations. It should be noted that there are currently no BDATs specified for the mixed wastes considered for treatment in the AMWTF. Currently four types of mixed waste have specified technologies. They are:

1. Radioactive Lead Solids (Macroencapsulation)
2. Radioactive Elemental Mercury (Amalgamation)
3. Radioactive Hydraulic Oil contaminated with Mercury (incineration)
4. Radioactive High Level Wastes (Vitrification) [15]

In all four cases, the specified treatment technology is different than that specified for waste containing only the hazardous component.

Thus, the relevant treatment standards in the case of TRU waste are those that apply to the hazardous portion of the waste. However, if one of the alternative technologies were utilized and found to perform better than incineration or other treatment technologies for both the destruction of organics and the immobilization of Pu and other radionuclides, then that technology could become the specified BDAT for TRU mixed waste.

In fact, it is clear that the Energy Department and BNFL did not consider the radioactive characteristics of the waste when determining the treatment technologies to implement:The wastes at TSA vary greatly in their physical and chemical makeup. In choosing a suite of technologies to treat these varied wastes, preference was given to “Best Demonstrated Available Technologies,” specified by the U.S. Environmental Protection Agency (EPA) as the most effective commercially available means of treating specific types of hazardous waste. These technologies substantially reduce the toxicity of hazardous waste or reduce the likelihood that hazardous constituents will migrate from the waste. For example, EPA has identified combustion/incineration as the technology-based standard for treating ignitable wastes (such as oils and greases) and macroencapuslation as the treatment standard for radioactive lead solids. [16]

Thus, there appears to have been no attempt to consider the impact of radioactivity on the appropriateness of the treatment processes (which were developed in the context of hazardous non-radioactive waste). By ignoring the radioactive character of the waste, the DOE and BNFL cannot ensure that they have chosen the best technology for these particular wastes. It should also be noted that the regulations actually specify three possibilities for ignitable waste: (i) Deactivation, followed by treatment to meet disposal standards, (ii) incineration, and (iii) recovery of organics.

Treatment of Debris Waste

Debris waste can either be treated to remove or reduce the hazardous characteristic of the waste (e.g. extraction of a toxic metal) or immobilized in order to prevent hazardous materials from entering into the biosphere. The two technologies proposed for treatment of debris waste in the AMWTF are supercompaction and macroencapsulation. Macroencapsulation would either be done directly, for waste that cannot be compacted, or after compaction. According to the Department of Energy and BNFL, super-compaction and macroencapsulation will be conducted in order to achieve the following three purposes:

- Meet the Land Disposal Requirements of the Resource Conservation and Recovery Act (the application does note that this is being done despite the fact that the Waste Isolation Pilot Plant has been exempted from the RCRA LDR) [17]
- Reduce the volume of the waste
- Ensure that all of the waste meets the definition of transuranic waste by having 100 nCi/g of plutonium or other long-lived alpha emitting radionuclides above uranium on the periodic table

Among these three, meeting the LDR is the only requirement based on the regulations of RCRA or TSCA. However, for the debris waste to meet the LDR for RCRA it would not require super-compaction.

Under 40CFR268.45 Table 1, encapsulation appears to be the primary technology that can meet the requirements for this debris waste. [18]

The supercompaction offers no advantages in terms of meeting the LDR. Supercompaction will reduce the volume of the waste to be disposed of in the Waste Isolation Pilot Plant. Volume reduction is generally done to reduce storage, treatment, and disposal costs. However, it has not been made clear by DOE and BNFL how these cost savings will be accomplished in this particular case. First and foremost, as DOE has acknowledged, there will be no savings in the area of transportation. As the DOE noted in its Final Environmental Impact Statement for the AMWTF, “due to weight loading limits of the TRUPACT II container, these cost savings would be minimal.” [19] Second, DOE and BNFL seem to have not analyzed and compared the potential cost-savings that would result from segregating and disposing of the low-level and transuranic mixed waste separately. Given the differences in disposal costs between the two types of waste, these cost savings may be comparable to the savings from compaction without the risk of added processing.

However, without supercompaction a large portion of the waste would not meet the limit set for the definition of transuranic waste and would, therefore, not meet the Waste Acceptance Criteria of the Waste Isolation Pilot Plant. However, the purpose of waste treatment and RCRA is to protect public health. Therefore, in considering the permit application submitted by the DOE and BNFL, the criteria used by EPA and Idaho DEQ should be the regulatory requirements of RCRA and TSCA, in the overall context of public health protection. Ensuring that the waste meets the Waste Acceptance Criteria of any particular facility should not be a consideration in the permitting process, particularly if doing so would involve unnecessary or risky treatment.

In fact, the DOE has two basic options to ensure that the waste being shipped to the Waste Isolation Pilot Plant meets the regulatory definition of transuranic waste. The first, and the one chosen by DOE, is to compact and mix the waste so that each resulting drum meets the limit, even if one of the compacted drums did not meet the limit originally. The second option available to the DOE is to characterize and segregate the waste in order to separate the TRU from the LLW.

The waste could be characterized, segregated and pre-treated according to whether it is low-level or transuranic waste. The DOE and BNFL rejected the option of characterizing and segregating the waste because of the dangers of chemically sampling the waste. However, the relevant segregation is not according to hazardous waste classification but rather according to whether the waste meets the current definition of TRU waste. This does not require chemical analyses. Furthermore, under the current plan, each drum, box, or container will be radioassayed and characterized prior to pre-treatment in the AMWTF. [20] Thus, in analyzing such an option, much of the existing facility design could be retained. DOE should have analyzed whether macro-encapsulation of the waste separately would meet the LDR requirements for both waste types and how this would affect disposal options. There does not appear to be any physical or regulatory requirement that would eliminate such an option from the list of alternatives for analysis.

A second option for the debris waste would be to replace both the super-compactor/macro-encapsulation option and the incinerator with an alternative treatment technology that could accept debris waste as well. The DC Arc Melter and the Plasma Hearth Process are two such potential technologies. The relative merits of processing the debris waste in a thermal rather than non-thermal immobilization technology would have to be considered. However, the co-permittees have not conducted such an analysis.

Given the risks of conducting any industrial process with plutonium, and the specific risks of supercompacting plutonium bearing waste, minimizing treatment while still meeting regulatory requirements should be a priority. DOE and BNFL have not analyzed all of their alternatives for debris waste to adequately ensure they have chosen the proper mix of technologies.

Treatment of PCBs

Within the waste to be treated at INEEL there is 1,560 cubic meters of waste that is believed to contain PCBs above the limit requiring treatment. These wastes come from two identified waste streams. Approximately 1,537 m^3 of the PCB waste comes from Rocky Flats and consists of absorbed PCB liquids or oils used in both plutonium and non-plutonium operations. Some of this waste does not meet the current definition of TRU waste and is classified as alpha-low level mixed waste. [21] The rest come from Batelle and consists of absorbed waste oils. The radionuclide concentration of this waste is not currently known to IEER.

The Department of Energy and BNFL have argued that “the EPA specifies that incineration be used before disposing of waste containing certain toxic organics, like polychlorinated biphenyls (PCBs), which are contained in some of the TSA waste.” [22] The regulations governing the implementation of the Toxic Substances Control Act for disposal of polychlorinated biphenyls (PCBs) specifically identifies incineration as the technology to be used for disposal of certain PCB wastes (40 CFR 761.60). The regulatory requirements depend on the characteristics of the waste, including PCB concentration, physical form, and source of the waste. In arguing that they are *required* to incinerate the waste, the co-permittees have neglected to take the federal regulations fully into account.

The Code of Federal Regulations also specifies that when disposing of PCB mixed waste the treatment and disposal option should account for both the radioactive and the toxic nature of the waste (40 CFR 761.50 (b)(7)). Given the discussion above concerning the significant negative impacts of incineration in general, and mixed waste incineration in particular, this part of the federal regulations is particularly relevant.

The federal regulations also specify that, while incineration is the specified treatment technology for the particular waste at INEEL known to contain PCBs, it is possible to use an alternative treatment technology (40 CFR 761.60 (e)) with the permission of the EPA Administrator. Such a technology can be approved so long as it provides performance equal to or better than an incinerator. Significantly, authorization to use alternative treatment technologies has been granted. The Environmental Protection Agency already recognizes a number of approved non-incineration technologies for the treatment of PCB waste, including two alternate thermal technologies. [23]

Thus, had the Department of Energy and BNFL been interested in utilizing the technology which would be most protective of public health while still meeting their regulatory obligations, a much larger suite of treatment technologies would have been evaluated. Instead, as discussed above, two such technologies were available for consideration and were summarily dismissed by the co-permittees. A more complete comparative environmental impact analysis may have resulted in a different technology choice. Given the concerns over incineration, the regulatory requirement to account for both the radioactive and hazardous components of the waste, and the possibility of approval for an alternative treatment technology, the co-permittees were wrong to dismiss the alternative treatment technologies.

The co-permittees also did not adequately analyze three other options available to them in dealing with the PCB waste. Depending on both the radioactive content of the waste (i.e. does the particular waste streams contain PCBs classified as alpha-low level mixed waste or transuranic mixed waste) and the PCB concentration of the waste, the co-permittees could have the option to treat the waste off-site, dispose of it in a chemical low-level mixed waste landfill on-site or off-site, or repackage and store solely the PCB waste until alternative treatment and disposal options become available. Since it is known that at least a portion of the largest PCB waste stream is not considered TRU waste, these options should have been analyzed.

In terms of regulatory restrictions on storage, the application states that PCB suspect bulk electrical equipment will be repackaged and stored in the Type II storage modules and then shipped to an approved off-site disposal facility. [24] Thus storage of PCB waste for treatment elsewhere is not out of the question. Storage of PCB waste pending assessment or development of a better treatment and disposal option would still be in compliance with the applicable regulations. According to 40 CFR 761.65 (a)(1), radioactive PCB waste is exempt from the ordinary limitation of one year for PCB storage.

Pursuing an exploration of these three options carries even greater weight when one considers that (i) only a relatively small quantity of waste (only 1,560 cubic meters out of a total of 65,000 cubic meters) is known to be PCB contaminated [25] and (ii) PCB contamination is the only waste for which incineration is the specified treatment technology (though, as discussed above, this may not be an issue). Thus, all possible options for treatment and disposal of this waste should have been fully delineated and evaluated.

Treatment of Non-Debris Homogenous Solids and Soils

The treatment standards for the homogenous solids and soils proposed to be incinerated in the AMWTF generally do not specify a BDAT. Rather, the standards are based upon concentration levels of the particular hazardous substance in the waste. [26] In other words, waste must be treated by any appropriate means that will result in the reduction of the toxicity of the waste to the levels specified in the regulation. There is no argument based upon BDAT for rejecting the use of alternative thermal treatment technologies.

According to 40 CFR 268.44 it is also possible to ask for a variance from the specified treatment standard if the waste that is being treated is different than the waste used to establish the standard. The presence of radioactivity in the waste is a strong argument for considering the waste at INEEL different than the waste considered in setting the treatment standards. Thus, if any of the waste did actually require incineration according to the regulations, DOE and BNFL could have requested a variance to use another technology if it was felt that it would be more protective of the environment and public health. Such a variance could result in a treatability study by the EPA and the establishment of a new treatment standard, including the specification of a treatment technology, for this type of mixed waste.

The argument for choosing incineration as the treatment technology for these wastes stems from the fact that incineration is already the specified technology for the PCB waste and can also achieve the regulatory limits for these wastes. This is, in essence, the path of least resistance. Again, as above, the DOE and BNFL could have evaluated one of the other treatment technologies or one of the options involving waste characterization and segregation. This would have been acceptable within the framework of the federal regulations.

Another reason that incineration has been chosen for these wastes is that the mixture of ashes would meet the definition of transuranic waste and would thus meet the criteria for disposal in WIPP. As has been noted elsewhere, another method for meeting the WIPP criteria would be separate treatment of low-level and TRU waste.

Incineration of these wastes may also violate another dilution prohibition under the Resource Conservation and Recovery Act. Under 40 CFR 268.3 (c) combustion of inorganic waste containing certain hazardous waste codes (listed in Appendix XI of 40 CFR Part 268) is considered to be dilution. Nearly all of the homogenous solid wastes and soils considered for treatment at the AMWTF contain hazardous constituents banned from combustion by Appendix XI. While there are exceptions to this rule, [27] a significant portion, particularly the inorganic solids, do not appear to meet at least two of the five exceptions (they are not debris waste contaminated with metal-bearing hazardous waste and they were not co-generated with waste requiring combustion). There is insufficient information provided to determine whether they would meet the other three exceptions (concentrations of specific constituents greater than found in 40 CFR 268.48, heating values greater than or equal to 5,000 BTU per pound, or greater than 1% total organic carbon).

DOE has stated in its application that these wastes do not fall under the dilution restrictions of 40 CFR 268.3 (c). This conclusion appears to be based on the fact that most of the wastes also have other Hazardous Waste Numbers associated with them (D001, D018-D043, or F001-F005). [28] According to the application, “These wastes are not subject to the dilution by incineration restriction even if the wastes also have HWNs restricted under 40 CFR 268.Appendix XI, or if the wastes do not meet one of the criteria in 40 CFR 268.3(c).” [29] In other words, it appears to be the position of the Energy Department that the only wastes that fall under the dilution restriction are those that contain *only* the Hazardous Waste Numbers listed in Appendix XI. However, neither the Code of Federal Regulations, nor an explanatory memo by the EPA, [30] specifies that the waste must contain only the Appendix XI wastes. For example, the CFR states that “Combustion of the hazardous waste codes listed in Appendix XI of this part is prohibited, unless the waste, at the point of generation, or after any bona fide treatment such as cyanide destruction prior to combustion, can be demonstrated to comply with one of the following criteria (unless otherwise specifically prohibited from combustion).” [31] The criteria are the five mentioned above, the presence of other hazardous waste codes is not one of the exceptions. Until such time that DOE can provide documentary evidence that the homogenous solids and soils would qualify for one of the above exceptions, the permit should exclude such waste from the incinerator. As this would restrict the vast majority of the waste currently planned for incineration, it would call into question the desirability of constructing and operating the incinerator.

Options Insufficiently Considered by the Permittees

As has been indicated by the above review of waste treatment requirements and options for the waste to be treated at the AMWTF, there are a number of options that were inadequately considered by the co-permittees:

1. Alternative Thermal and Non-Thermal Treatment Technologies: At least two technologies have been identified that had the potential to meet all of the regulatory requirements and all of the added requirements of the DOE for treating the waste at INEEL. These technologies could have significantly better performance for treating mixed waste, particularly waste containing plutonium, than the treatment options chosen (especially when compared to incineration). Consideration of these technologies was eliminated based upon out-of-date information and a narrow view of the relevant regulations. The DOE and BNFL did not take into account the flexibility afforded by the regulations in choosing treatment technologies. That flexibility is included precisely for such situations. Mixed waste incineration is categorically different than hazardous waste incineration in that radioactivity is converted into fine particles, which is undesirable from a health and environmental standpoint, by the very same process that is designed to destroy the hazardous constituents. This fundamental consideration has not been given due weight and factored in the choice of treatment technologies.

   According to the DOE Environmental Impact Statement (Appendix F), bids for this project were submitted which used technologies other than incineration. After a review of the three competitive bids (each based on a particular technology), the Energy Department selected BNFL. Subsequently, the only thermal treatment technology that was considered was incineration. It is not clear why DOE selected a particular contractor, with a bid for a specific technology, *prior* to conducting a public environmental review of all of the options. It is also not clear why technologies advanced enough to form the basis for a competitive bid were not analyzed as reasonable alternatives.

2. A Characterization and Segregation Facility: Such a facility would characterize and segregate the waste according to the following rough categories:
   - low-level debris waste
   - transuranic debris waste
   - low-level homogenous solids and soils
   - transuranic homogenous solids and soils
   - low-level PCB waste
   - transuranic PCB waste

   Such an option would provide the DOE with more information upon which to choose an appropriate treatment technology which is based upon treating each waste stream in a manner that both meets regulatory requirements and is protective of the environment and public health.

   The Energy Department rejected the overall concept of characterization and segregation early on, primarily for cost and worker safety reasons. However, cost considerations should not have prevented a full consideration of all of the options in a public environmental review. As for worker risks, these should be minimized. However, as noted elsewhere, the facility will be characterizing the waste under the current treatment plan. The Energy Department has not provided documentation as to the increased worker risks from characterization and segregation, nor an analysis as to whether these risks might be off-set by changes in treatment processes that could be made possible by characterization.

3. A Characterization, Segregation, and Encapsulation Facility: Same as above, except both the low-level and TRU debris waste would be encapsulated in order to meet the RCRA LDRs. Thus the debris waste, which comprises about 70% of the waste would be ready for disposal, each stream at its appropriate facility. The remaining low-level homogenous solids, soils, and possibly PCB waste could possibly be shipped off-site for treatment or disposed of on-site at a low-level mixed waste disposal facility. This would only leave the transuranic homogenous solids, soils, and PCBs. These would be repackaged in appropriate containers and stored in the RCRA compliant storage modules for treatment or disposal at a later date. During this time alternative technologies may be further developed that can better treat the remaining wastes.

Option number one, alternative treatments, could be combined with option number three. Thus segregated debris would be encapsulated and segregated homogenous solids and soils, as well as PCBs would be thermally treated using an alternate technology. Such an option would appear to meet all of the regulatory requirements and should have been considered.

The DOE and BNFL consideration of such options is seriously defective. For example, they rejected offsite treatment options without analysis. Another option involving non-thermal treatment was focussed on non-RCRA related criteria in its rejection. In doing so, the DOE conflated three different treatment drivers: meeting the waste acceptance criteria for the Waste Isolation Pilot Plant, meeting the deadlines of the Settlement Agreement/Consent Order, and meeting the requirements of the Resource Conservation and Recovery Act and the Toxic Substance Control Act.

- Non-Thermal Treatment: This option would have only included the super-compaction and encapsulation portions of the treatment facility (in addition to the pre-treatment). Those wastes that could not meet the WIPP waste acceptance criteria after supercompaction and macroencapsulation would be repackaged for storage. This would amount to approximately 8,000-14,000 cubic meters. This option was analyzed and rejected. It was noted that it does not meet the regulatory requirements or the Settlement Agreement/Consent Order. It should be noted that even with the AMWTF operating under its current configuration, it would not be able to treat all of the 65,000 cubic meters of waste.

- Treatment at Privatized Facility in Richland: Waste that could meet the Waste Acceptance Criteria (WAC) for the Richland facility and transportation requirements would be sent to the facility in Washington. The rest of the waste would have to be treated in Idaho. The facility in Washington cannot accept TRU waste, nor can it accept waste containing arsenic, asbestos, and beryllium. The DOE dismissed this option because the facility has a planned capacity of 2,400 cubic meters of waste per year while the waste requiring treatment at INEEL would amount to 5,000 cubic meters per year.

First, it should be noted that the reason provided by the Department of Energy for dismissing treatment in Richland is based on a mathematically incorrect claim. The DOE claims that the Hanford facility’s capacity is only 2,400 cubic meters per year compared to the 5,000 cubic meters per year of INEEL waste needing treatment. The DOE’s reasoning is based on adding up two different categories of waste for the purpose of its calculations, resulting in a total of up to 5,000 cubic meters per years. However, as the EIS notes, the Richland facility cannot handle TRU waste. The maximum amount of low-level waste that INEEL could send Richland would be 25,000 cubic meters of waste in all, which comes to 1,923 cubic meters per year, assuming all of it met the Richland waste acceptance criteria. The DOE has not indicated whether this more realistic maximum amount would place an undue burden on the Richland facility's capacity. The DOE also did not analyze other treatment facilities, such as the Consolidated Incineration Facility at the Savannah River Site. [32] The DOE has failed to properly analyze the options and has not considered their relative environmental impacts.

Second, the DOE did not analyze combinations of the available options to see whether any combination would better fit the BDAT criterion. For instance, if non-thermal treatment were used for the majority of the waste, then only 8,000-14,000 cubic meters would remain. Some of this waste could be sent to the Richland site, representing a true maximum amount that would be sent off-site of 615-1,076 cubic meters per year. Unfortunately, the data provided specifying the characteristics of the different waste streams does not include the information necessary to make definitive a conclusion concerning these various options.

Conclusion

The goal of hazardous and radioactive waste treatment is to reduce the impact on the environment and public health. However, one of the principles guiding such treatment should be to minimize the impact of such treatment. The challenge of treating waste that is a mixture of hazardous materials and radionuclides, including plutonium, should have made DOE consider all available options. In fact, the regulations require that the DOE consider both the hazardous and radioactive components of the waste in determining treatment. The regulations also require that DOE keep radiation doses As Low As Reasonably Achievable (ALARA). This is a fundamental flaw in the application by the DOE and BNFL for a permit to construct and operate the AMWTF. The Environmental Protection Agency and the Idaho Department of Environmental Quality, as the regulatory bodies, should ensure that treatment to meet RCRA/TSCA requirements should take into account the overall risk of such actions, including accounting for the radioactive nature of the waste.

Alternatives which were reasonable and which the DOE knew might have had an impact on the dose from such a facility were not adequately considered. The application by DOE/BNFL is based upon technology choices. It is the responsibility of the EPA and IDEQ in the permitting process to ensure that all of the appropriate and reasonable alternatives were considered prior to a decision to use any particular technology. EPA/IDEQ should not accept an application containing treatment choices based upon an inadequate comparison of options.

DOE has also allowed factors other than protection of the environment, such as the waste acceptance criteria for the Waste Isolation Pilot Plant and the Settlement Agreement with the State of Idaho, to influence its decisions, resulting in unnecessary processing. The goal of the Energy Department to send all of the waste to the Waste Isolation Pilot Plant resulted in technology choices which included unnecessary processes, such as supercompaction, for meeting regulatory requirements. It also resulted in the rejection of alternatives that would supposedly not meet these other objectives. The goal of meeting the waste acceptance criteria for a specific facility or an arbitrary deadline cannot be allowed to override the goals of health and environmental protection that are explicit and implicit in the regulation that requires the use of the BDAT. EPA and IDEQ should consider the application and the treatment choices made therein, solely on the basis of RCRA(HWMA)/TSCA regulations in the overall context of, and for the overall regulation of, protection of public health, workers, and the environment.

There are several other alternatives that may better meet the RCRA/TSCA criteria of BDAT. While we are not advocating any of these at this time, since the DOE has failed to provide appropriate information on these options, we conclude that a valid permit cannot be issued for the proposed facility. The analysis of the DOE and BNFL is so deficient on so many counts that a determination as to the BDAT is not possible. Moreover, there is enough information to suggest that the chosen technology is unlikely to be the BDAT in this situation.

Additional Resources

IEER Comments on Advanced Mixed Waste Treatment Project Draft EIS (August 1998)
Fact Sheet: Incineration of Radioactive and Mixed Waste

Notes:

1. A more detailed discussion of the issue of mixed waste incineration can be found in David Kershner, Scott Saleska and Arjun Makhijani, *IEER "Science for Democratic Action" Paper #2: Radioactive and Mixed Waste Incineration*. The Institute for Energy and Environmental Research, June 1993. For the convenience of the Environmental Protection Agency and the Idaho Department of Environmental Quality, this report is attached to these comments. ? Return
2. AMWTF HWMA/TSCA Permit Application, Book 1 General Facility, C-1-1. ? Return
3. Roger Zavadoski and Dudley Thompson, "HEPA Filters used in the Department of Energy's Hazardous Facilities." Defense Nuclear Facilities Safety Board Technical Report. DNFSB/TECH-23. May 1999. p. iv. It should be noted that this report follows an earlier 1990 report from the DNFSB. The current report notes that the DOE has not implemented the recommendations that resulted from the earlier report. Thus, this is a problem that DOE has known about for a significant period of time. ? Return
4. Ibid. ? Return
5. Mortimer Mendelsohn, John D. Anderson, Thomas Crites, Christopher Gatrousis, Alexander Glass, Glenn Mara, Robert Schock, and Roger Werne, *Final Report of the Director's Internal Panel on the Decontamination and Waste Treatment Facility (DWTF)* . Livermore, CA, February 21, 1990. As cited in Kershner, Saleska, and Makhijani 1993, p. 21. ? Return
6. For example, see Schwinkendorf, et al, *Alternatives to Incineration Technical Area Status Report*. Prepared for the Mixed Waste Integrated Program, U.S. Department of Energy, Office of technology Development, DOE/MWIP-26, April 1995 and Schwinkendorf, et al, *Evaluation of Alternative Nonflame Technologies for Destruction of Hazardous Organic Waste*. Idaho National Engineering Laboratory, INEL/EXT-97-00123, April 1997. ? Return
7. See International Physicians for the Prevention of Nuclear War and Institute for Energy and Environmental Research, *Plutonium: Deadly Gold of the Nuclear Age*. Cambridge: International Physicians Press, 1992. ? Return
8. Her Majesty's Nuclear Installations Inspectorate and Her Majesty's Inspectorate of Pollution, *The Management of Solid Radioactive Waste at Sellafield and Drigg*. Vol. 1, 1996. p. 15. ? Return
9. Advisory Committee on the Safety of Nuclear Installations (ACSNI), *Study Group on the*

Accumulation of Radioactive Waste: Report on the Accumulation of Radioactive Waste at BNFL Sellafield and at UK Power Stations. 1992. p. 9. ? Return

10. For more information see IEER's attached comments on the AMWTP Environmental Impact Statement. ? Return
11. AMWTF HWMA/TSCA Permit Application, Book 4, Thermal Treatment, Appendix D-6, p. ES-5. ? Return
12. U.S. Department of Energy, Idaho National Engineering and Environmental Laboratory, *Advanced Mixed Waste treatment Project: Final Environmental Impact Statement*. DOE/EIS-0290, January 1999, p. D-2. ? Return
13. A detailed description of these technologies and their potential advantages and disadvantages for treating mixed waste is beyond the scope of this paper. For more information see U.S. Department of Energy, Office of Environmental Management, Office of Science and Technology, Mixed Waste Focus Area, *Innovative Technology Summary Report: Graphite Electrode DC Arc Furnace*. DOE/EM-0431, OST #1652, May 1999 and *Innovative Technology Summary Report: Plasma Hearth Process*. OST #26, November 1998. ? Return
14. Bill Owca, "Program Director's Message," *Mixed Waste Focus Area Annual report 1998*. U.S. Department of Energy. ? Return
15. "Effects of RCRA LDR Regulations on Mixed Waste Management" U.S. EPA Mixed Waste Team. http://www.epa.gov/radiation/mixed-waste/mw_pg29.htm (viewed on 1/20/2000, last updated March 4, 1998) and 40 CFR 268.40 Table: Treatment Standards for Hazardous Waste. ? Return
16. AMWTF HWMA/TSCA Permit Application, Book 4, Thermal Treatment, Appendix D-6, p. ES-3. ? Return
17. This raises an important issue. 40 CFR 268.3 prohibits the dilution of waste in order to avoid treatment to meet land disposal restrictions. Low-level mixed waste is ordinarily subject to the land disposal restrictions. However, if low-level mixed waste is treated with TRU mixed waste and sent to WIPP it would be sent to a facility that is exempt from LDR. Thus, the low-level mixed waste would in essence have been diluted in order to avoid land disposal restrictions that would otherwise be in effect. While DOE and BNFL plan to treat the waste such that it meets the LDR, there is no requirement for them to do so, as the final destination is an exempt facility. This raises the question as to whether treating the LLMW and the TRU waste and mixing them should be considered dilution even if the final product meets the LDR. This also assumes that DOE and BNFL will continue to treat to LDR for the duration of the permit. ? Return
18. There are a number of other technologies in Table 1 that could likely treat the debris for one or more of the hazardous constituents in the waste. However, it seems likely that a number of treatment process would have to be undertaken in order reduce the toxicity of the waste. It appears that the DOE and BNFL have decided that either the technologies are insufficient or that even after treatment the waste will still meet the definition of hazardous waste and will require immobilization. They have therefore chosen the option of simply immobilizing the waste by encapsulation. ? Return
19. U.S. Department of Energy, Idaho National Engineering and Environmental Laboratory, *Advanced Mixed Waste treatment Project: Final Environmental Impact Statement*. DOE/EIS-0290, January 1999, p. F-15. ? Return
20. In terms of the radioactivity of the waste, it appears that the DOE already has knowledge of whether waste streams meet the definition of transuranic waste. ? Return
21. B.D. Raivo, et al. *Waste Description Information for transuranically-Contaminated Wastes Stored*

at the Idaho National Engineering Laboratory. Lockheed Martin, Idaho National Engineering Laboratory, INEL-95/0412, December 1995. p. A1-7 and B1-11. It is not clear how much of the RFETS 003 waste is classified as alpha low-level and how much is classified as TRU waste. ? Return

22. AMWTF HWMA/TSCA Permit Application, Book 4, Thermal Treatment, Appendix D-6, p. ES-4. ? Return
23. "Commercially Permitted PCB Disposal Companies," U.S. EPA Office of Pollution Prevention and Toxics, November 1999. http://www.epa.gov/opptintr/pcb/sotrdisp.html (viewed on 1/20/2000). The two companies approved for alternate thermal destruction are Geosafe Corporation of Richland WA and Maxymillion Technologies, Inc. of Pittsfield MA. ? Return
24. AMWTF HWMA/TSCA Permit Application, Book 1, p. C-0-2. ? Return
25. DOE 1999, Final EIS, p. F-16. Another 12,662 cubic meters is suspected to contain PCBs. It is expected that all of the suspect waste that is found to contain PCBs will be electrical equipment, which will be repackaged and not sent to the incinerator (see AMWTF HWMA/TSCA Permit Application, Book 1, p. C-0-2). ? Return
26. Mercury contaminated and ignitable wastes do have specified treatments in some cases. Mercury wastes will be handled by the Special Case Waste gloveblox, as will some ignitable waste. It is expected, according to the permit application, that only liquid ignitables will pose a problem in treatment. These liquid ignitable wastes will also be handled in the SCW glovebox. ? Return
27. These exceptions can be found in 40 CFR 268.3 (c). ? Return
28. AMWTF HWMA/TSCA Permit Application, Book 1 General Facility, p. C-1-5. ? Return
29. Ibid. ? Return
30. Elliott P. Laws, Memo to Waste Management Division Directors, Regions I-X, "RCRA Policy Statement: Clarification of the Land Disposal Restrictions' Dilution Prohibition and Combustion of Inorganic Metal-Bearing Hazardous Wastes." Undated. http://www.epa.gov/epaoswer/hazwaste/combust/general/memorcra.txt. ? Return
31. 40 CFR 268.3(c) ? Return
32. Currently, this facility does not accept off-site waste, but that is a goal of the site. See DOE Incinerator System Team, *Summary of DOE Incineration Capabilities*. U.S. Department of Energy, Idaho Operations Office, DOE/ID-10651, July 1998. p. 1. ? Return