State of Oregon

Department of Environmental Quality — Memorandum

Date: February 1, 2010

To: Environmental Quality Commission

From: Dick Pedersen, Director

Subject: Agenda item D, Action item: Best available technology determination for treatment of spent activated carbon at the Umatilla Chemical Agent Disposal Facility
February 18 - 19, 2010 EQC meeting

Why this is important

Oregon state law requires the Umatilla Chemical Agent Disposal Facility to use disposal methods that are the best available technology. To do so, EQC must determine that any proposed method is the best available technology to meet all regulatory criteria and is protective of public health and the environment.

DEQ recommendation and EQC motion

The Department of Environmental Quality recommends that the Environmental Quality Commission issue the following findings regarding the best available technology determination for treatment of spent carbon:

1. The metals-parts furnace is the best available technology for treatment of agent-contaminated spent carbon at the Umatilla Chemical Agent Disposal Facility;
2. The best available technology to manage sulfur-impregnated spent carbon is as routine hazardous waste upon confirmation of agent-free status, transferring it offsite to treat for mercury and other hazardous constituents as needed and then disposing it.
3. The requirement for quarterly progress reports by the Umatilla Chemical Agent Disposal Facility on the status of the design and implementation of the carbon micronization system for treatment of spent carbon is rescinded.

Background

In 1997, DEQ determined that the best available technology for disposal of chemical agent and munitions at the facility was the Army's baseline incineration system, which met all applicable regulatory criteria. The commission concurred that incineration was the best available technology.

In the final judgment in GASP, *et al*, v. EQC, *et al*, Case No. 9708-06159, known as GASP IV, the judge remanded to EQC three findings on the best available technology for the Umatilla facility. One of the remanded determinations is "the destruction of hazardous waste originally intended for the dunnage incinerator."

In evaluating this determination, EQC found, in September 2007, that the best available technology to treat secondary wastes was incineration in the metal parts furnace and deactivation furnace system with micronization to treat spent carbon.

The facility's hazardous waste permit requires on-site treatment of all agent-contaminated wastes. DEQ expects much of the spent carbon generated at the facility to meet the agent-free criteria established in the permit's compliance concentration limits.

For agent-contaminated spent carbon, DEQ determined that the use of the deactivation furnace system, along with a pretreatment micronization process, was the best available technology. As the chemical demilitarization program has matured, new evidence prompted DEQ to reevaluate the best available technology for agent-contaminated carbon.

Four factors prompt reconsideration of BAT for agent-contaminated spent carbon:

1. The quantities of agent-contaminated carbon requiring treatment are projected to be less than originally estimated, lessening the need for a large-capacity treatment operation. The Army, after a recalculation using facility-specific data projects that only 48,000 pounds of spent carbon will require treatment for agent contamination rather than the 72,000 pounds of spent carbon originally projected.
2. Operational experience at Johnston Atoll Chemical Agent Disposal System has revealed significant drawbacks associated with the micronization system, such as the risk of explosion due to the creation of carbon dust.
3. New information shows that transport of secondary waste to offsite commercial facilities can be achieved safely.
4. New technologies to treat secondary wastes have been developed and tested.

DEQ reevaluated the disposal technologies for agent-contaminated carbon based on these factors.

A separate class of spent carbon, sulfur-impregnated carbon, was installed in the pollution-abatement system filters for the metal-parts furnace and the liquid incinerators. Sulfur-impregnated carbon captures mercury emissions resulting from incineration of high-mercury mustard agent. DEQ has not addressed sulfur-impregnated carbon in a best available technology determination. In September 2008, EQC determined that mercury-contaminated spent carbon must remain in storage at the Umatilla Chemical

Agent Disposal Facility until a best available technology determination addresses its disposition. Because the sulfur-impregnated carbon filters are part of the pollution abatement system filters, DEQ does not expect them to be contaminated with agent. The Army will sample the filters to verify they are not contaminated, and compare the sampling results to the permit compliance concentration limits. The filters, however, may contain mercury or other hazardous constituents at levels requiring treatment, consistent with Resource Conservation and Recovery Act criteria, prior to disposal as hazardous waste. If agent-free status is confirmed, the filters may be shipped offsite as routine hazardous waste.

DEQ conducted a public comment period Nov. 18, 2009, through Jan. 20, 2010, to solicit information and opinions on the available treatment technologies for agent-contaminated carbon and on the proposed disposition of mercury-contaminated sulfur impregnated carbon. DEQ held a public information meeting and hearing Jan. 20, 2010, in Hermiston.

Key issues

There are two key issues:

1. **What is the best available technology for treatment of agent-contaminated spent carbon?**

   In order to determine the best available technology for the agent-contaminated spent carbon, DEQ investigated five demonstrated technologies:
   1. Offsite disposal in a commercial Resource Conservation and Recovery Act-permitted incinerator.
   2. Deactivation furnace system with carbon micronization, a treatment process in which the carbon is pulverized to a powdery consistency prior to being fed to the furnace.
   3. Metal parts furnace, a three-zone incinerator that uses a conveyor to transport waste through each zone. The Army is currently using a metal-parts furnace to treat mustard ton containers and secondary waste.
   4. Autoclave, a treatment apparatus that uses high-pressure steam at an elevated temperature to destroy agent.
   5. Plasma energy pyrolysis system, a process that uses high-temperature plasma induced by electrical discharge to convert organic materials to a gas, resulting in the decomposition of the organic materials into elemental components.

   Based on information received during the public comment period and evaluation of the above technologies, DEQ has determined that the metal parts furnace is the best available technology to treat agent-contaminated spent carbon. Please see attachment A for the evaluation of technologies, attachment B for public comments and attachment C for a table comparing various technologies.

2. **What is the appropriate disposition of agent-free, mercury-contaminated sulfur-impregnated carbon?**

DEQ did not investigate technologies for this material, because the waste should be free of agent contamination. DEQ recommends that, upon confirmation of agent-free status, this waste stream be managed as routine hazardous waste and transported offsite, for treatment of mercury as needed, and then disposal.

Attachments

A. Memorandum, "Best Available Technology Determination for Treatment of Spent Activated Carbon" (DEQ Item 10-0106)
B. Full text of comments received (DEQ Items 10-0003, 10-0004 and 10-0068)
C. Comparison chart of available technologies to treat spent activated carbon

Available Upon Request

1. US Army Chemical Materials Agency, 2009, "Umatilla Chemical Agent Disposal Facility, Best Available Technology Evaluation for Agent Contaminated Carbon, Final Draft," dated August 24, 2009 (DEQ Item 09-0893)
2. CMA, 2008, "Bounding Transportation Risk Assessment for >1 Vapor Screening Level (VSL) Waste," September (DEQ Item 09-1117)
3. CMA, 2008, "Addendum to the Bounding TRA: Assessment of Risk from Offsite Shipment of Spent Carbon," Final, June (DEQ Item 09-1119)
4. National Research Council, Committee to Examine the Disposal of Activated Carbon from the Heating, Ventilation, and Air Conditioning Systems at Chemical Agent Disposal Facilities, 2009, "Disposal of Activated Carbon from Chemical Agent Disposal Facilities," Washington, D.C. (DEQ Item 09-1040)
5. URS, 2009, "Carbon Treatability Study Report, Umatilla Chemical Agent Disposal Facility," February 16 (DEQ Item 09-1064)
6. Continental Research and Engineering, LLC, 2008, "Autoclave Evaluation Test Report," April 21 (DEQ Item 09-1120)
7. CMA, 2005, "Secondary & Closure Waste Treatment—Evaluation of Plasma Energy Pyrolysis System (PEPS)," June, Draft (redacted to remove financial information) (DEQ Item 09-1121)

Approved:

Division: ______________________________

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State of Oregon
Department of Environmental Quality Memorandum

DEQ Item No. 10-0106 (11)

To: Richard C. Duval, Administrator
Chemical Demilitarization Program

Date: January 29, 2010

From: M.J. Davis
Senior Compliance Inspector

Subject: Best Available Technology for Treatment of Spent Activated Carbon at the Umatilla Chemical Agent Disposal Facility

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This memorandum documents the Department's determination and recommendation to the Environmental Quality Commission (EQC) of best available technology as it pertains to treatment of agent-contaminated spent carbon at the Umatilla Chemical Agent Disposal Facility (UMCDF). This memorandum also documents the Department's determination and recommendation of best available technology for spent sulfur-impregnated carbon.

Cause for Reevaluation:

In Opinion and Order dated April 17, 2007 (Reference 1), Judge Michael Marcus of the Multnomah County Circuit Court remanded the Environmental Quality Commission's (EQC's) order issuing Hazardous Waste Permit No. ORQ 000 009 431 (Permit) to the UMCDF for the destruction of chemical agent and chemical agent-filled munitions and bulk items stored at the Umatilla Chemical Depot for further action as it pertains to the best available technology and no major adverse effect determinations required by Oregon Revised Statute (ORS) 466.055 (GASP, *et al*, v. Environmental Quality Commission, *et al*, Case No. 9708-06159 [GASP IV]). Judgment was entered in GASP IV on June 12, 2007 (Reference 2), and the Court directed the EQC to reassess the best available technology and no major adverse effect determinations in light of certain changes in facility design and new evidence.

> "It is ADJUDGED that the OREGON EQC'S determinations made pursuant to ORS 466.055 as to whether the Umatilla Chemical Agency *[sic]* Disposal Facility uses the best available technology and has no major adverse impact on public health or the environment in regard to (a) destruction of any mustard in any ton container that contains significantly higher mercury levels than previously reported; (b) the destruction of hazardous waste originally intended for the dunnage incinerator; and (c) the role of PFS carbon filters; are remanded to the State of Oregon Environmental Quality Commission for consideration and further proceedings consistent with the court's opinion of April 17, 2007."

The "best available technology" determination is required by ORS 466.055, "Criteria for new facility," which states, in part:

> "Before issuing a permit for a new facility designed to dispose of or treat hazardous waste or PCB, the Environmental Quality Commission must find, on the basis of information submitted by the applicant, the Department of Environmental Quality or any other interested party, that the proposed facility meets the following criteria . . .
>
> (3) The proposed facility uses the ***best available technology*** [emphasis added] for treating or disposing of hazardous waste or PCB as determined by the department or the United States Environmental Protection Agency . . ."

Consistent with the above, Oregon Administrative Rule (OAR) 340-120-0010(c) also states:

> "*Technology and Design*. The facility shall use the ***best available technology*** [emphasis added] as determined by the Department for treatment and disposal of hazardous waste and PCB. The facility shall use the highest and best practicable treatment and/or control as determined by the Department to protect public health and safety and the environment;"

Background

In February 1997, the EQC and Department issued Permit No. ORQ 000 009 431 to the UMCDF for the storage and treatment of the Umatilla Chemical Depot chemical weapons stockpile. As part of the permitting process, the EQC ensured and verified that several regulatory statutes (ORS 466.050, 466.055[1]-[5]) had been met (Reference 3). As identified above, ORS 466.055(3) requires the Department determine, and the EQC to make a finding, that the proposed facility uses the best available technology for treating agent-filled munitions and bulk items and the resulting secondary wastes. The EQC and the Department developed the following criteria (References 3 and 4 [Items 60, 63, 73, and 74]) from which to make a best available technology determination of the technology proposed for the UMCDF (incineration). These criteria were established primarily to compare the baseline incineration process in the U.S. Army's application to alternative technologies that were then in development.

<u>Best Available Technology Criteria</u>:

1. Types, quantities, and toxicity of discharges to the environment by operation of the proposed facility compared to the alternative technologies.

2. Risks of discharge from a catastrophic event or mechanical breakdown in operation of the proposed facility compared to the alternative technologies.

3. Safety of the operations of the proposed facility compared to the alternative technologies.

4. The rapidity with which each of the technologies can destroy the stockpile.

5. Impacts that each of the technologies have on consumption of natural resources.

6. Time required to test the technology and have it fully operational; impacts of time on overall risk of stockpile storage.

7. Cost.

Based on information reviewed by the Department from the Department of the Army and Ecology and Environment (an independent subcontractor to the Department) (Reference 5), the Department made a determination (Reference 6) and the EQC issued a finding (Reference 3) that incineration was the best available technology for disposing of the Umatilla Chemical Depot stockpile as well as the secondary wastes that would result from the treatment of the chemical weapons, and would not present a major adverse impact to public health/safety or the environment.

In September 2007, the EQC determined that the best available technology (BAT) for treatment of secondary wastes was incineration in the Metal Parts Furnace (MPF) and Deactivation Furnace System (with micronization for treatment of spent carbon) (Reference 7), obviating the need for construction and operation of a dunnage incinerator. The EQC also considered, in the secondary waste BAT, the option of off-site shipment and treatment of secondary wastes, but concluded that "[o]ff-site shipment increases risk to workers and transportation risks, and is opposed by key stakeholders such as the Confederated Tribes of the Umatilla" (Reference 7). In September 2008, the EQC determined that mercury-contaminated spent carbon must remain in storage at the UMCDF until a BAT determination addresses its disposition (Reference 8).

Spent Carbon

Activated carbon is used as an absorbent medium in various filters throughout the UMCDF. The National Research Council (NRC) recently released a report entitled "Disposal of Activated Carbon from Chemical Agent Disposal Facilities" (Reference 13). This report was prepared in response to a CMA request to the NRC "…to study, evaluate, and recommend the best methods for proper and safe disposal of the used carbon…" from chemical agent disposal facilities. All sources of spent carbon were examined in the study. The report concludes that only three types of filters are expected to be exposed to agent under normal operating conditions: (1) filters in the Munitions Demilitarization Building (MDB) heating, ventilation and air conditioning (HVAC) system; (2) filters installed on the vent line for the agent collection system (ACS) tanks; and (3) canister filters from the M40 masks worn by site workers (Reference 13). For the MDB HVAC filters, only the carbon contained in Banks 1 and 2 of the filter units are expected to be agent contaminated. The NRC conclusions are based on operating experience at the chemical agent disposal facilities, where agent monitors in the filter systems have not detected the presence of agent.

At the UMCDF, one of the largest sources of spent carbon is the MDB HVAC system, which is designed to maintain negative pressures (cascade ventilation) and capture contaminants, most critically, agent. The spent carbon from the MDB filters is the most likely carbon to be agent contaminated. Another large source of spent carbon is the Pollution Abatement System Filtration System (PFS) associated with each incinerator. Exhaust from each incinerator is filtered through a pollution abatement system and then drawn through PFS filters. Based on operating experience at chemical agent disposal facilities and on sampling results from trial burns, the NRC report (Reference 13) concludes that the PFS filters are not expected to be agent-contaminated. Other sources of carbon filters include M40 mask cartridges, MBD and laboratory filter vestibules, and depressurization glovebox exhaust filters.

Following the issuance of the NRC report (Reference 13), the UMCDF provided new projections of the amount of carbon that is agent-contaminated and requires treatment. Approximately 720,000 pounds of spent carbon is expected to be generated over the life of the UMCDF. The Secondary Waste BAT Data Package, prepared by the UMCDF contractor in 2007, estimated that approximately 73,000 pounds of spent carbon from the UMCDF MDB HVAC system will be agent-contaminated and will require treatment onsite (Reference 23); this estimate was based on an average carbon weight of 85 pounds per filter tray (Reference 24), consistent with information from Johnston Atoll Chemical Agent Disposal System (JACADS) and Tooele Chemical Agent Disposal Facility (TOCDF). More recent (2009) projections estimate that approximately 48,000 pounds of spent carbon from the UMCDF MDB HVAC system will require treatment onsite (Reference 9). This more recent estimate used UMCDF-specific information on tray weights (55 pounds of carbon per filter tray) (Reference 24). The 2007 Data Package also projected approximately 22,000 pounds of agent-contaminated carbon from the UMCDF agent collection tank filters; all of this carbon was treated in the MPF during the November 2008 treatability study (Reference 14). Although not a critical factor in reevaluating the best available technology determination, the reduction in amount of carbon requiring treatment enhances the viability of some treatment options.

Some filter banks within the PFS filters for the MPF and the liquid incinerators are filled with sulfur-impregnated carbon (SIC) during mustard ton container treatment operations. The SIC is used to capture mercury emissions. The SIC filters are not expected to be agent-contaminated, but the mercury content, as well as other hazardous constituents, may require treatment prior to disposal as hazardous waste. These filters will be sampled to verify that they are agent-free and also to determine the concentrations of mercury and other RCRA hazardous constituents. Under the RCRA land disposal restrictions, waste containing mercury at concentrations greater than or equal to 260 milligrams per kilogram (mg/kg) must be treated by incineration or retorting. For waste containing mercury at concentrations less than 260 mg/kg, the waste must meet the toxicity characteristic leaching procedure (TCLP) standard. If the TCLP standard is met, the waste may be land disposed; if not, the waste must be stabilized prior to land disposal. The Army projects that up to 144,000 pounds of mercury-contaminated SIC (Reference 9) will be generated at the UMCDF.

The DEQ is not investigating technologies for the SIC filters, because the waste should be free of agent contamination and is not expected to require treatment at the UMCDF. The DEQ is recommending that, upon confirmation of agent-free status, this waste stream may be managed as routine hazardous waste and transported offsite, for treatment of mercury and other hazardous constituents as needed, and then disposal.

The UMCDF permit establishes permit compliance concentrations (PCC), which allow waste to be sent offsite if agent concentrations are below the PCC limits. The PCC limits for water-insoluble solid wastes are 13 parts per billion (ppb) for VX, 16 ppb for GB, and 152 ppb for HD. As noted above, the agent concentrations in the vast majority of the spent carbon are expected to fall below the PCC limits. One critical element in demonstrating compliance with the PCC limits is the development and validation of an analytical method to determine the concentrations of agent in a carbon filter medium. This analytical method is the subject of a permit modification request (PMR) UMCDF-09-012-WAP(2) (PMR 09-012), submitted to the Department on October 30, 2009. Although PMR 09-012 has not been approved, the analytical method has been reviewed by EPA and by the DEQ laboratory. These reviews indicate that the analytical method is technically sound for spent activated carbon, but not for the subclass of sulfur-impregnated carbon. If the PMR is approved, this analytical method will be used to evaluate whether agent concentrations in the spent carbon are below the PCC limits and qualify for offsite disposal. Additional work is necessary to develop an adequate method for detecting agent on sulfur-impregnated carbon; no SIC will be sent offsite unless the Army can demonstrate, using an analytical method approved by the Department, that agent concentrations are less than the PCC limits.

Assessment:

At the time the secondary waste BAT determination was issued, the use of the Deactivation Furnace System (DFS), along with a pretreatment micronization process, was selected as the preferred disposal method for spent carbon (Reference 7). As the chemical demilitarization program has matured, new evidence indicates that the BAT for agent-contaminated carbon should be reevaluated. Four factors prompted reconsideration of BAT for spent carbon:

1. The quantities of agent-contaminated carbon requiring treatment are projected to be much less than originally estimated, lessening the need for a large-capacity treatment operation;
2. Operational experience at JACADS has revealed significant drawbacks associated with the micronization system;
3. New information indicates that transport of secondary waste to offsite commercial facilities can be achieved safely; and
4. New technologies for treatment of secondary wastes have been developed and tested.

Based on these factors, the Department reexamined the disposal technologies for agent-contaminated carbon.

In developing a list of technologies, the Department has limited the investigation to technologies that have been demonstrated to be capable, at a production level, of destroying agent contained in a carbon filter media. The Army has proposed five demonstrated technologies for disposal of agent-contaminated carbon: offsite disposal in a commercial RCRA-permitted incinerator; DFS with carbon micronization system (DFS-CMS); Metal Parts Furnace (MPF); autoclave; and Plasma Energy Pyrolysis System (PEPS®) (Reference 9). Additional information on these five technologies is provided below.

<u>Offsite Disposal in a Commercial Incinerator</u>

The UMCDF RCRA permit currently allows offsite disposal of secondary wastes which contain agent concentrations at levels below established PCCs ("agent-free criteria"). Agent concentrations in the great majority of the spent carbon at the UMCDF are expected to fall below the PCC limits and, if so, will be disposed offsite as hazardous waste (F998/F999) without treatment. (Note that the demonstration of compliance with the agent-free criteria is dependent upon the approval of analytical methods for agent on a carbon medium; these analytical methods have been submitted for DEQ review and approval in PMR 09-012.)

One of the options considered for treatment of agent-contaminated carbon is treatment in an offsite commercial incinerator permitted under the Resource Conservation and Recovery Act (RCRA). This option would require a modification to the UMCDF permit to allow waste with agent concentrations at or above the PCC limits to be transported offsite.

Approximately 48,000 pounds of agent-contaminated carbon (i.e., carbon containing agent concentrations greater than or equal to the PCC limits) will be generated. Although this spent carbon is not agent-free, the levels of agent may be within the limits established by the Army for offsite shipment of agent-contaminated secondary wastes. In 2008, the Army completed a bounding transportation risk assessment (TRA) for agent-contaminated secondary wastes (Reference 10) and issued guidance for shipping agent-contaminated secondary wastes (Reference 11). An addendum to the bounding TRA was prepared specifically to address transportation of agent-contaminated carbon (Reference 12). The carbon-specific addendum established the following maximum levels for agent-contaminated carbon that is to be shipped offsite: 13.4 parts per million (ppm) for VX, 0.4 ppm for GB, and 77 ppm for HD (Reference 12).

A number of commercial incinerators are available for spent carbon treatment. A typical incinerator would be designed much like the DFS, but on a larger scale. A rotary kiln lined with refractory brick would be the primary treatment chamber, followed by a secondary combustion chamber, and a flue gas treatment system. Spent carbon in drums could be fed directly to the furnace, with no need to unpack or store the drums. Typical residence time in the primary chamber is 30 to 90 minutes. Under this option, discharges to the environment would be limited to permitted levels; in addition, design and operating conditions would be in place to ensure safe operations and to prevent catastrophic events. Because an existing commercial incinerator would be used, consumption of resources would be low for the incremental amount of waste from the UMCDF, although some resources would be used in transporting the waste. Twenty truckloads of agent-contaminated carbon would be transported, using the loading estimates provided in the TRA addendum (Reference 12).

The offsite shipment option has been implemented at the Aberdeen Chemical Agent Disposal Facility and the Newport Chemical Agent Disposal Facility, with both shipping to an incinerator in Veolia, Texas (Reference 9). A commercial incinerator in Aragonite, Utah, is another option for offsite disposal. For the UMCDF to exercise the offsite option, a permit modification would be required to revise the current ban on shipment of any secondary waste that does not meet the agent-free criteria. The start-up period for the offsite option, including the permit modification process, is estimated to be 13 months and the total cost is estimated to be $0.946 million, according to estimates by the Army (Reference 22). Prior concerns about worker safety and transportation risks are mitigated by the smaller quantities to be shipped and by the Army's analysis in the TRA.

DFS-CMS

The DFS-CMS is the technology currently determined to be BAT for agent-contaminated carbon. The DFS is a rotary kiln incinerator currently in place at the UMCDF, although not operational following completion of the destruction of all energetics. A number of modifications are necessary to use the DFS to dispose of spent carbon. One of the most significant modifications is the installation of a new burner, including a refractory-lined tube where the micronized carbon will be combusted. Another signification change is the addition of the micronization system, which will facilitate effective combustion of the carbon and agent. Any solid residue or ash resulting from the spent carbon combustion will be collected for later treatment in the MPF to ensure complete destruction of the agent (Reference 9).

Because the DFS-CMS was used at JACADS, most design and operational requirements have been established. Modifications to the RCRA and air permits would be required to incorporate the CMS and the associated changes to the DFS. The agent destruction removal efficiency is expected to be greater than 99.99%, although any resulting ash would require subsequent treatment in the MPF to meet the Army's 5X/agent-free criteria (Reference 9); only small quantities of residual ash would be expected. A trial burn would be necessary to establish feed rates to ensure acceptable treatment and emissions levels. Consumption of resources would be typical of DFS operations at the UMCDF, although some additional resources would be used in the construction and operation of the micronization unit.

Once permitted, the DFS-CMS would process large quantities of waste in a short time (less than eight days for UMCDF agent-contaminated carbon), making this option the most expedient operationally. This option is expected to be the most costly (total life-cycle costs of $18.2 million), according to estimates by the Army (Reference 9). The National Research Council recommended that micronization not be used to prepare carbon for incineration, citing operational difficulties at JACADS and a concern regarding explosion potential of the micronized carbon (Reference 13). Although the Army has recognized concerns about the ability to safely operate this technology, their analysis indicates that the DFS-CMS could be safely operated with appropriate design and engineering controls (Reference 9).

MPF

The MPF is a three-zone incinerator which utilizes a conveyor to transport waste through the zones. The MPF is currently used to treat HD ton containers and secondary waste. At JACADS, use of the MPF was considered for the treatment of spent carbon, but, due to the limited throughput rate and the large quantity of carbon to be treated, the concept was not implemented (Reference 9). Because the amount of carbon requiring treatment is much less at the UMCDF than at JACADS, use of the MPF is a viable alternative (Reference 9).

At the UMCDF, no physical or permit modifications would be necessary to use the MPF to dispose of spent carbon, although a trial burn would be necessary to establish feed rates to ensure acceptable treatment and emissions levels, and to establish operating parameters. A treatability study was performed at the UMCDF in November 2008 to evaluate the effectiveness of treatment of agent-contaminated carbon in the MPF (Reference 14). The treatability study used carbon filters from the vents on the agent holding tanks. The results of the study indicate effective treatment, based on analysis of the carbon residues using the not-yet-approved analytical methods for carbon (Reference 14). Additional evaluation of effectiveness would be undertaken as part of the trial burn for the MPF. Consumption of resources would be typical of MPF operations at the UMCDF.

Because of the long-term use of the MPF, operations and maintenance activities are expected to be routine. The spent carbon would be fed to the furnace in the existing carbon filter trays, with no need to first remove the carbon from the trays. The agent destruction removal efficiency is expected to be greater than 99.99%. The total operational period for disposal of the spent carbon, using the MPF, is estimated to be 45 days (Reference 9). This option is expected to be the least costly (total life-cycle costs of $0.133 million), according to estimates by the Army (Reference 9).

Autoclave

The autoclave is a high-pressure vessel that is used to treat agent-contaminated wastes by steam hydrolysis in a cyclical process of hydrolysis, venting, and purging. The UMCDF does not have an autoclave, but an autoclave has been installed and is now being systemized at the TOCDF for treatment of secondary wastes (not including spent carbon). A modification to the RCRA permit would be required to install and operate an autoclave as a miscellaneous treatment unit at the UMCDF. Operating conditions, including feed rates, would need to be established and adequacy of treatment would need to be verified. In addition, air permit requirements, including the need for a scrubber, would have to be evaluated. The transportation and installation of an autoclave would consume additional resources.

Although the operation of the autoclave is expected to be safe and relatively simple, the startup process (permitting, procurement, installation, systemization, and demonstration) is expected to be time-consuming (up to 14 months) (Reference 9). Due to the operating temperature (less than 1,000 °F) of the autoclave, complete decontamination of the contaminated carbon may not be achieved (Reference 9), although surrogate testing indicates adequate destruction removal efficiency (Reference 15). Because the TOCDF autoclave is not currently permitted for spent carbon treatment, any lessons learned from TOCDF will be limited to operational aspects and not treatment effectiveness for agent-contaminated carbon. Bench-scale or pilot tests might be needed to reduce uncertainties regarding adequacy of treatment. The total operational period for disposal of the spent carbon, using the autoclave, is estimated to be 16 days and the total life-cycle cost is estimated to be $7.4 million, according to estimates by the Army (Reference 9).

PEPS®

The plasma energy pyrolysis system (PEPS®) is a thermal process that uses an electric arc as the heat source (Reference 16). The process, called controlled pyrolysis, uses high-temperature plasma induced by electrical discharge to convert organic materials to a gas. The organic materials decompose into elemental components and the inorganic materials and residues form a slag. An evaporative cooler is used to quench the exhaust gases, which then flow to a baghouse for removal of metals and acids (Reference 16). PEPS® was considered for treatment of secondary waste at TOCDF, but, with the decision to permit an autoclave, implementation of PEPS® has not been pursued. Permit modifications, for both the RCRA and air permits, would be required to install and operate PEPS® at the UMCDF. Operating conditions, including feed rates, would need to be established and adequacy of treatment would need to be verified.

Operation of PEPS® has been demonstrated for carbon spiked with metals and surrogates, but not with agent-contaminated carbon. Some demonstration program, akin to a trial burn, would be required for operation at the UMCDF. The Army owns PEPS®, a mobile unit located in Virginia. The unit would have to be transported to the UMCDF and a building to house the unit would have to be constructed. The transportation and installation of a PEPS® unit would consume additional resources. The startup process (transportation, construction, permitting, installation, systemization, and demonstration) is expected to be time-consuming (up to 27 months) (Reference 9). Due to the short residence time of waste in the PEPS®, complete decontamination of the contaminated carbon may not be achieved (Reference 9). In addition to concerns typical of processing agent, additional safety issues are associated with PEPS®: high-voltage power, very high operating temperatures, and management of molten slag discharges. The total operational period for disposal of the spent carbon, using PEPS®, is estimated to be 24 days and the total life-cycle cost is estimated to be $10.4 million, according to estimates by the Army (Reference 9).

Analysis

In the discussion that follows, the five technologies are analyzed in light of the best available technology analysis criteria established by the EQC. Enclosure 1 contains a comparison table summarizing this analysis.

1. Types, quantities, and toxicity of discharges to the environment by operation of the proposed facility compared to the alternative technologies.

   Incineration of agent-contaminated carbon, whether offsite at a commercial incinerator or onsite in the MPF or DFS/CMS, must meet all RCRA and air quality emission limits. Trial burns would be conducted at the MPF or DFS/CMS to demonstrate treatment effectiveness and compliance with emission limits. Waste residues from incineration include ash, slag, and brines used in the wet scrubber; all residues would be managed as hazardous waste.

   For the autoclave, a performance test would be required to demonstrate treatment effectiveness and compliance with emission limits. Of particular concern with the autoclave is the lack of exposure to high temperatures; adequate destruction of agent must be demonstrated to satisfy the Army's 5X criterion and the Department's agent-free criterion. The autoclave would not destroy the carbon, so the amount of remaining residue would be approximately the same as the waste originally treated; all residues would be managed as hazardous waste. The autoclave would produce off-gases and approximately 3,600 gallons of condensate.

The PEPS® unit would also require a performance test to demonstrate treatment effectiveness and compliance with emission limits; to date, the system has been successfully demonstrated using activated carbon spiked with surrogates. Reactor slag and baghouse filter dust would be the primary residues generated; all residues would be managed as hazardous waste.

All of the technologies under consideration are expected to meet permit requirements for emission limits. Trial burns would be necessary for the incinerator technologies to demonstrate treatment effectiveness. For the autoclave and PEPS, a demonstration of treatment effectiveness would be required. In general, expected residues from all technologies would be typical of combustion processes. The exception is residues associated with the autoclave, which would produce large quantities of residual carbon potentially requiring additional treatment prior to disposal.

2. <u>Risks of discharge from a catastrophic event or mechanical breakdown in operation of the proposed facility compared to the alternative technologies</u>.

   Although a quantitative risk assessment was not undertaken for treatment of agent-contaminated carbon, previous risk assessments (References 20 and 21) have addressed operations at the UMCDF. These risk assessments demonstrated that facility operations do not pose an unacceptable risk to human health and the environment. Any option selected for treatment of agent-contaminated carbon must undergo a trial burn or equivalent testing to demonstrate that treatment standards and emission limits are met. Risk of discharge from an offsite incinerator due to upset condition or catastrophic failure are expected to be low based on the operational history of commercial incinerators and the design features which automatically stop feed in the event of an upset. Similarly, based on design features and successful historical operation at the UMCDF, the risk of discharge due to upset condition or catastrophic failure related to operation of the furnaces within the MPF or DFS/CMS is expected to be low. The DFS carbon micronization system poses a unique threat of dust explosion, and the National Research Council has recommended against using this system for that reason (Reference 13).

   The autoclave operates at low to moderate temperatures and pressures for industrial applications. The system is simple, easy to operate, and would be equipped with pressure-relief systems and safety interlocks, and the risk of discharge due to upset condition or catastrophic failure is expected to be low.

   A 2005 assessment (Reference 18) identified potential over-pressurization of the PEPS® reactor as a concern, noting that there was "…a possibility that some of the agent or toxic gases could escape the process vessel without being fully destroyed under such unsteady operating conditions." In a second look that same year, the Army prepared a draft report that concluded that the PEPS® programmable logic control and interlock system worked effectively in over 800 hours of operation with varied waste feeds (Reference 16). That report recommended additional testing and transfer of the unit to TOCDF, but, to date, this transfer has not been implemented.

None of the candidate technologies pose an unacceptable risk of discharge from a catastrophic event or mechanical breakdown in operation, although some questions remain about the potential for over-pressurization of the PEPS® unit.

3. Safety of the operations of the proposed facility compared to the alternative technologies.

The incinerator technologies (offsite commercial incinerator, MPF, DFS/CMS) present some worker safety issues: high temperatures, steam supplies, moving equipment, chemical hazards, and the potential for agent-exposure. These issues have been managed effectively through design features, work procedures and training, limited access, and appropriate personnel protective equipment. The DFS carbon micronization system poses a unique threat of dust explosion, and the National Research Council has recommended against using this system for that reason (Reference 13). The Army has indicated that engineering controls would be effective in mitigating the dust explosion risk.

Operation of the autoclave poses no specific worker risks, other than risks typical of industrial settings (e.g. electrical equipment) and agent exposure. The PEPS® unit operates at very high temperatures and uses high-voltage power, presenting additional worker hazards. Additional feed handling equipment and ventilation systems would be needed to ensure safe operation of the PEPS® unit.

All of the candidate technologies appear to be acceptable in terms of safety. The PEPS® unit would require design upgrades and a subsequent demonstration to ensure safe operation.

4. The rapidity with which each of the technologies can destroy the stockpile.

Technology	Processing Time (days)*
Offsite Commercial Incineration	<1
Metal Parts Furnace	45
Deactivation Furnace with Micronization	7
Autoclave	16
PEPS®	24

* Reference 9 and 19

5. Impacts that each of the technologies have on consumption of natural resources.

Commercial incinerators consume natural gas, water, and electricity; however, the UMCDF carbon waste stream would represent less than an hour of operating time at the Aragonite commercial incinerator (Reference 19). Use of a commercial incinerator would require transportation (approximately 20 truckloads), which would consume fuel.

The two candidate incinerators (MPF and DFS/CMS) at the UMCDF consume natural gas, water, electricity, and chemical supplies (e.g., sodium hydroxide). Construction of the carbon micronization system would require additional resources (metal fabrication, industrial fittings, transportation of parts).

The autoclave would consume natural gas, water, and electricity; although it is expected the quantities would be less than an incineration process. Two significant sources of residues may be generated, which would require treatment, transportation, and disposal. The two sources of residues are residual carbon which may or may not achieve agent-free status and large quantities of condensate from the autoclave process. Additional resources would be consumed by the manufacture and transport of the autoclave unit.

The PEPS® technology would consume electricity, water, steam, fuel oil, nitrogen, and chemical supplies. Additional resources would be consumed by the addition of waste handling and ventilation systems for the PEPS® unit.

All of the candidate technologies consume large amounts of resources, with no clear differentiation among options.

6. Time required to test the technology and have it fully operational; impacts of time on overall risk of stockpile storage.

Technology	Start-Up Time (months)*
Offsite Commercial Incineration	13
Metal Parts Furnace	3
Deactivation Furnace with Micronization	10
Autoclave	10 – 14
PEPS®	16 – 27

* References 9 and 22

Although some of the candidate technologies have longer lead times, none of the estimated timeframes are so extensive as to impact the UMCDF closure schedule. Because the carbon medium offers very effective adsorption capacities, any agent trapped by the filter is not readily available for dispersal. In addition, the quantities of agent are small compared to munitions and bulk item storage. Finally, spent carbon is safely stored within containers in igloos. Although the lead times for implementation of the technology options vary considerably, the differences would not present a significant change in risk of stockpile storage.

7. Cost.

Technology	Total Life-Cycle Cost (Million $)*
Offsite Commercial Incineration	0.946
Metal Parts Furnace	0.133
Deactivation Furnace with Micronization	18.2
Autoclave	7.4
PEPS®	10.4

* Reference 9 and 22

Summary

Enclosure 1 contains a summary of the evaluation of the candidate technologies using the BAT criteria. Based on this evaluation, the use of the MPF ranks highest in meeting the BAT criteria. Although the evaluation included the option of offsite disposal in a commercial incinerator, this option was not deemed viable. A permit modification would be necessary to remove the prohibition on offsite disposal of waste containing agent concentrations greater than or equal to the PCC limits; public opposition to offsite disposal at that time could pose schedule challenges. In addition, public comments during this BAT evaluation process indicate that adequacy of treatment in a commercial incinerator might be in question. Based on these concerns, the recommendation focused on onsite options for treatment of agent-contaminated carbon.

A number of factors influenced this recommendation for the selection of the MPF as BAT for treatment of agent-contaminated carbon. Operation of the MPF presents the lowest risk of a catastrophic event based on its design and extensive operating record at the UMCDF. The MPF has consistently met air and RCRA standards while processing secondary waste, and compliance is expected throughout carbon filter processing. Results from a treatability study conducted in November 2008 show that the MPF effectively treated agent-contaminated carbon. An important note regarding the treatability study is that the analytical method used in this demonstration is the subject of a permit modification request not yet approved by the Department; an approved method is required prior to treatment of carbon in the MPF. Although the processing time (45 days) for the MPF is longer than other options, the start-up time (3 months) is considerably shorter; the total time required for MPF processing is reasonable and will not impact other operational or regulatory objectives (e.g., closure of the facility). Finally, the cost to process agent-contaminated carbon through the MPF is much less than the cost associated with other onsite options.

Public Comments

The Department received comments from three individuals or groups on this evaluation. The Department's response to comments is included in Attachment B. The actual comments received are included in Attachment C.

Related Topic--Continuing Progress Reports

In August 2004, the EQC issued a number of conditions tied to the authorization to commence chemical agent operations at the UMCDF (Reference 17). Condition 30 requires that the Permittees continue to submit quarterly progress reports concerning the status of the design and implementation of the carbon micronization system for treatment of spent carbon. As part of the best available technology determination for spent carbon, the Department is recommending that the EQC discontinue the requirement for quarterly progress reports on the carbon micronization system.

Department Recommendation

After evaluating the options for management of spent carbon at the UMCDF, the Department has made the following determinations and recommends that the EQC find the following:

1. The best available technology for treatment of agent-contaminated spent carbon is the MPF;
2. The best available technology for treatment of sulfur-impregnated carbon, upon confirmation of agent-free status using an analytical method approved by the Department, is management as routine hazardous waste and transport offsite for treatment of mercury and other hazardous constituents as needed, and then disposal; and
3. The requirement for quarterly progress reports by the UMCDF on the status of the design and implementation of the carbon micronization system for treatment of spent carbon is rescinded.

References:

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2. State of Oregon, Multnomah County Circuit Court, June 12, 2007, "Stipulated General Judgment," Case No. 9708-06159, GASP IV. DEQ Item 07-1227
3. EQC, February 10, 1997b, "Findings and Conclusions of the Commission and Order in the Matter of the Application of the United States Army for a Permit to Construct and Operate a Chemical Weapons Demilitarization Facility at the Umatilla Chemical Depot." DEQ Item 98-1458
4. Environmental Quality Commission (EQC), August 23, 1996a, "Minutes of the Two Hundred and Fifty-Fourth Meeting." DEQ Item 98-1379
5. Ecology and Environment, Inc. (E & E), November 1996, "Best Available Technology Findings Report: Umatilla Chemical Depot, Hermiston, Oregon," prepared for the State of Oregon Department of Environmental Quality (DEQ), Seattle, Washington. DEQ Item 1386

6. EQC, November 22, 1996b, Minutes of Environmental Quality Commission Special Session. DEQ Item 2433

7. EQC, September 11, 2007, "Order Determining Best Available Technology for Secondary Wastes" DEQ Item 07-1382

8. EQC, September 4, 2008, "Final Order Determining Best Available Technology for Mustard Agent Containing Higher than Anticipated Levels of Mercury" DEQ Item 08-0994

9. US Army Chemical Materials Agency (CMA), 2009, "Umatilla Chemical Agent Disposal Facility, Best Available Technology Evaluation for Agent Contaminated Carbon, Final Draft," dated August 24, 2009. DEQ Item 09-0893

10. CMA, 2008, "Bounding Transportation Risk Assessment for >1 Vapor Screening Level (VSL) Waste," September. DEQ Item 09-1117

11. CMA, 2008, "Requirements for Implementation of the US Army Chemical Materials Agency (CMA) Bounding Transportation Risk Assessment (TRA) for Shipment of Greater than 1 Vapor Screening Level (VSL) Chemical Agent Contaminated Secondary Waste," September 15. DEQ Item 09-1118

12. CMA, 2008, "Addendum to the Bounding TRA: Assessment of Risk from Offsite Shipment of Spent Carbon," Final, June. DEQ Item 09-1119

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14. URS, 2009, "Carbon Treatability Study Report, Umatilla Chemical Agent Disposal Facility," February 16. DEQ Item 09-1064

15. Continental Research and Engineering, LLC, 2008, "Autoclave Evaluation Test Report," April 21. DEQ Item 09-1120

16. CMA, 2005, "Secondary & Closure Waste Treatment—Evaluation of Plasma Energy Pyrolysis System (PEPS®)," June, Draft (redacted to remove financial information). DEQ Item 09-1121

17. EQC, August 13, 2004, "Findings and Conclusions of the Commission and Order: Umatilla Chemical Agent Disposal Facility Authorization to Commence Chemical Agent Operations" DEQ Item 04-1361

18. Science Applications International Corporation (SAIC), 2005, "FY04 Technology Evaluation for Chemical Demilitarization: Mobile Plasma Energy Pyrolysis System (PEPS®) for Secondary and Closure Waste Treatment—Technical Assessment," January. DEQ Item 10-0069

19. Utah Department of Environmental Quality web site, accessed 01/07/10, http://www.hazardouswaste.utah.gov/HWBranch/CFFSection/CommercialFederalFacilitiesSection.htm

20. Ecology and Environment, Inc., 1997, "Pre-Trial Burn Risk Assessment for the Proposed Umatilla Chemical Agent Disposal Facility," OU2043_S103, February. DEQ Item 2377

21. Ecology and Environment, Inc., 2008, "Calculating Human Health and Ecological Risks for the Umatilla Chemical Agent Disposal Facility, Hermiston, Oregon", 14:002688.OY32.50, January 31. DEQ Item 08-0148

22. Email communication, Ty Teigen, UMCDF Field Office, to M.J. Davis, Oregon DEQ, January 20, 2010. DEQ Item 10-0065

23. UMCDF, 2007, Secondary Waste Best Available Technology (BAT) Data Package, August 3. DEQ Item 07-1216

24. Email communication, Ty Teigen, UMCDF Field Office, to M.J. Davis, Oregon DEQ, December 10, 2009. DEQ Item 10-0094

cf: M.J. Davis, DEQ Hermiston

From: Richard Condit [mailto:richardc@whistleblower.org]
Sent: Monday, January 04, 2010 3:49 PM
To: CDP; DUVAL Rich
Cc: Karyn Jones; Bob Palzer; Paul Loney (OWF); Mick G. Harrison; thad@whistleblowerdefenders.com; Casey.Beard@csepp.org; MicroEnergy Systems-Annapolis
Subject: Comments re BAT for contaminated carbon
Importance: High

Richard C. Duval, Administrator
DEQ Chemical Demilitarization Program
256 E. Hurlburt Avenue
Hermiston, OR 97838Fax: (541) 567-4741
E-mail: cdp@deq.state.or.us
duval.Rich@deq.state.or.us

Dear Mr. Duval:

The following comments are being submitted on behalf of G.A.S.P., Oregon Sierra Club, Oregon Wildlife Federation, Judy Brown, Jan Lohman, Susan Jones, Debbie Burns, Karyn Jones and the Government Accountability Project (GAP).

1. As recent reports indicate (e.g., DEQ doc. 09-1131, 09-1146), the Metal Parts Furnace (MPF) continues to be an inappropriate selection for destruction of HD ton containers containing any type of heel. The incomplete combustion inherent in the MPF process exposes workers and the public to agent and other hazardous chemicals in unknown quantities that are not considered in any truly conservative and protective risk assessment. That excess CO is present indicates incomplete combustion is occurring. This promotes the production of Hazardous Air Pollutants (HAPS) PICs/POMs. These Products of Incomplete Combustion (PICS) are Polycyclic Organic Matter. Neutralization with an appropriate follow on process would have eliminated these problems. Moreover, the fact that the MPF is only required to attain 99.99% destruction of chemical warfare agents instead of 99.9999% or greater destruction combined with the incomplete combustion that has been demonstrated further evidences the inadequacy of the MPF. These undisputed facts rule out the MPF as an appropriate technology for destroying chemical agent and other toxins captured in the carbon filter media. We note and adopt, in support of this argument, the comments made by MicroEnergy Systems, Inc. (MSI). Specifically, MSI raises critical questions (unanswered by DEQ) about (a) why activated carbon is difficult to burn; and (b) the statistical/probabilistic characterization of activated carbon.

2. The DEQ staff report and related documents describing the alternative means of disposing of the UMCDF contaminated carbon are sorely inadequate and provide insufficient information for the public to comment and for the EQC to make a rational decision because critical information is left out. For example, the DEQ information fails to properly characterize the contaminated carbon or realistically predict what amounts of chemical agent, dioxin, furans, PCBs, mercury, lead, cadmium, arsenic, chromium, etc. will be present in the contaminated carbon and at what concentrations. The concentrations of agent and other toxins in the carbon is particularly important when considering incineration as a destruction technology because the smaller the concentration (e.g., less than 10,000 ppm) the less likely the incinerator can achieve a safe destruction efficiency. In addition, it is important to remember that toxic metals such as lead, mercury and arsenic are not destroyed during the incineration process.

3. The DEQ staff report and related documents are also fatally deficient because DEQ fails to articulate (a) the likely risks to the health of workers for each alternative; (b) the likely risks to the public for each alternative; (c) the likely risks to the environment (i.e., air, water, soil, wildlife, fish, vegetation) for each alternative. How then are the public and EQC to determine which alternative is BAT?

4. The DEQ refers to the report by the National Research Council (NRC) regarding the possible treatments for contaminated carbon. Referring to the NRC report, the DEQ states:

(a) “Another large source of spent carbon is the Pollution Abatement System Filtration System (PFS) associated with each incinerator. Exhaust from each incinerator is filtered through a pollution abatement system and then drawn through PFS filters. Based on operating experience at chemical agent disposal facilities and on sampling results from trial burns, the NRC report (Reference 13) concludes that the PFS filters are not expected to be agent contaminated.”

The PFS filters are not expected to be agent contaminated? What kind of slight-of-hand is the DEQ trying to pull here? The PFS filters were touted as one important reason why there should be no concern about releases of any agent into the environment, and, these filters were deemed necessary to meet various air emission standards. The only data referenced to support the quoted statement are “results from trial burns.” Why should the EQC and public rely on trial burn results when there should be ample data from actual agent operations? Trial burn data does not provide the EQC and public with the best data upon which to make a BAT decision.

(b) “DEQ is not investigating technologies for the SIC filters, because the waste should be free of agent contamination and is not expected to require treatment at the UMCDF. DEQ is proposing that, upon confirmation of agent-free status, this waste stream may be managed as routine hazardous waste and transported offsite, for treatment of mercury as needed, and then disposal.”

Beyond the concerns about agent contamination in the carbon filter media there is the question of the types and quantities of other toxic chemicals that were supposed to be captured in the carbon filters. Recall that back in 1997, the EQC chose incineration as BAT because the addition of carbon filters would provide a safety net that would protect the public and the environment from the dangers of dioxin, furan, and PCB emissions, etc. Toxic metals and chemical warfare agents are not the only risks posed by the disposal of contaminated carbon. No analysis is provided for these dangerous substances.

In sum, the DEQ has failed to address critical issues that must be determined before a BAT determination for the disposal of contaminated carbon can be rationally made. G.A.S.P., et al. urge the DEQ and EQC to address the issues raised herein and in the comments of others who have raised questions about the DEQ’s “facts” and analyses.

Respectfully,

Richard E. Condit
Counsel for G.A.S.P., et al.

10-0003

MicroEnergy Systems, Inc.

83 Shipwright Street
Annapolis, Maryland 21401
Ph. 410-280-6055

January 4, 2010

Mr. Rich Duval
Oregon Department of Environmental Quality
256 East Hurlburt
Suite 105
Hermiston, Oregon 97838

Dear Mr. Duval:

Enclosed for your review and consideration are two copies of our response to the: ***UMCDF Best Available Technology Determination: Treatment of Spent Activated Carbon at the Umatilla Chemical Agent Disposal Facility (DEQ No. 09-1155 (11).***

Public Notice DEQ Item No. 09-1160 (11)

If you have any questions, please do not hesitate to contact us at the above phone number or email at: microenergy@annapolis.net.

We are also submitting the attached response via email on January 4, 2010 so as to provide you a digital copy for your convenience.

Thank you for the opportunity to provide this response.

Sincerely,

Richard Sheahan, P.E.

RTS/ah

VIA: Federal Express – Air Bill No. 8533 3586 1013

Copy – also sent by email on 01/04/2010

MicroEnergy Systems, Inc. (MSI) is pleased to submit this document in reply to the November 19, 2009 Oregon DEQ invitation to provide written comments in response to the ***UMCDF Best Available Technology Determination: Treatment of Spent Activated Carbon at the Umatilla Chemical Agent Disposal Facility (DEQ No. 09-1155); herein, referred to as the "DEQ 09-1155".***

1. BEST AVAILABLE TECHNOLOGY (BAT) -- DOCUMENT OBJECTIVE

The objective of this document is to provide DEQ information related to the assessment of Best Available Technology (BAT) Determination for the disposal of spent activated carbon at UMCDF.

Currently the Carbon Micronization System (CMS) that successfully disposed all spent activated carbon at the Johnson Island Chemical Agent Disposal Facility (JACADS), is considered BAT at UMCDF, and is permitted as such.

It is estimated that approximately 720,000 pounds of spent activated carbon will be produced during the operational period of UMDCF.

Army has requested a permit modification to utilize a random - statistical - probabilistic sampling procedure to classify approximately 672,000 pounds, or about 93 percent of the total quantity of spent carbon as "agent free"; thus, potentially qualifying it to be shipped off-site for land filling.

Army acknowledges the remaining 48,000 pounds, or about seven (7) percent of all UMCDF spent activated carbon: (a). is certain to be agent-contaminated, (b). will require on-site disposal, (c). proposes disposal by a Metal Products Furnace (MPF), and (d). requests DEQ to designate MPF as BAT; thus, replacing the successfully utilized JACADS CMS as the current BAT.

Metal Parts Furnace is a much slower combustion process compared to carbon micronization. Thus; if the Army's probability sampling procedure is not approved, the time period required to dispose all 720,000 pounds would be so extended, it undoubtedly would make MPF unviable. However; even dealing with the lesser 48,000 pounds, MPF is problematic as explained in this document.

DEQ 09-1155 also suggests that off-site incineration might be considered as BAT.

Spent activated carbon is a very difficult material to burn for a number of demonstrable facts related to the fundamental principals of combustion. These principals should have been, but were not, mentioned by the Army in its permit modification request, and must be considered by DEQ in any BAT assessment.

In addition to the extended time-period issues of MPF, principals and facts of combustion are presented herein that question the logic and suitability of a MPF and off-site incineration for BAT consideration; otherwise, DEQ could be involved in a "double-down" gamble.

DEQ 09-1155 also references a National Academy of Science report; which unfortunately presents misrepresentations about problems encountered by the Carbon Micronization System (CMS) used to destroy spent carbon at JACADS. Information prepared by MSI is included herein, and dispels these misrepresentations.

Because the agent is so lethal and dangerous to public health and the environment, it is reasonable to question the validity and logic of: (a). using random statistical probability to classify most of UMCDF's spent carbon as "agent free", and (b). designating a less efficient MPF combustion system as BAT.

Such concepts raise an important analogy to "rolling dice".

2. CARBON MICRONIZATION SYSTEM

MicroEnergy Systems, Inc. (MSI) designed and developed the carbon micronization system (CMS) that successfully destroyed the contaminated activated carbon at JACADS.

MSI was initially approached in 1995 by Army ChemDemil personnel, who indicated that several Army sponsored conventional combustion tests were attempted to destroy contaminated activated carbon; all of which yielded unacceptable results, including the following:

- Two separate combustion tests were attempted in different ChemDemil Metal Products Furnaces (MPFs), yielding unacceptable combustion efficiency results.

- A combustion test involving 1,000 pounds of activated carbon was inputted into an operational ChemDemil DFS kiln; whereupon, about 1,000 pounds of material exited the kiln – in other words – it would not adequately burn at the kiln's elevated temperatures.

Based on these unacceptable combustion tests; and the proven performance of a MSI micronization system, MicroEnergy was commissioned to design, develop, test and demonstrate the CMS system utilized at JACADS; which it completed and led to the successful disposal of all carbon at JACADS.

3. WHY IS ACTIVATED CARBON DIFFICULT TO BURN?

As indicated above, when MicroEnergy was approached by Army ChemDemil personnel, they described reasons why unacceptable test results were achieved when attempts were made to burn activated carbon in its: (a). Metal Products Furnace, and (b). DFS kiln. Reasons that were explained included:

- Low volatile content of activated carbon.

- Large carbon particle sizes.

- "3-T's" of combustion

The following provides descriptive information about each of these issues.

4. LOW VOLATILE CONTENT OF ACTIVATED CARBON

When any solid fuel is burned, its volatile content will dictate its ease or difficulty in completing combustion.

Activated carbon has a very low volatile content; therefore, is a very difficult material to burn.

A similarly difficult fuel to burn is anthracite coal, which also has low volatile contents. This is the reason why anthracite coal is not commonly used for industrial or utility power production – it is just too difficult to burn.

Conversely; bituminous coals typically have higher volatile contents; thus, is a commonly used fuel for industrial and utility applications – because it is easy to burn.

For orientation, volatile content differences are indicated in the following side-by-side comparative analysis of the three indicated materials.

	ACTIVATED CARBON [REF:1-Sec.6] (JACADS)	**ANTHRACITE COAL** [REF:2-p.8-6] (Pennsylvania)	**BITUMINOUS COAL** [REF:2-p.8-6] (Kentucky)
Volatile	**3.44 %**	**6.20 %**	**36.70 %**
Fixed Carbon	91.33	79.40	57.50
Moisture	3.44	2.50	2.50
Sulfur	0.16	0.60	0.70
Ash	2.30	11.90	3.30
	=====	=====	=====
TOTAL	100.00 %	100.00 %	100.00 %

Because of the activated carbon's low volatile content, MicroEnergy had to design its CMS burner to co-fire both micronized activated carbon and propane together; otherwise, complete combustion would not have been achieved, which was confirmed during testing and development.

Propane was intimately mixed together with micronized activated carbon within the CMS burner's flame "envelope"; thus, supplementing the carbon's low volatile content, and ensuring complete and efficient combustion.

During the CMS acceptance demonstration - six combustion tests yielded unprecedented carbon conversion efficiencies ranging between 99.7 –to- 99.85 percent, which resulted only because of the extremely fine micronized carbon particle size and co-mixing and firing with propane.

Principals at the Pennsylvania State University Energy & Fuels Research Center, who provided MSI assistance in the CMS development, mentioned – "***That level of combustion efficiency for any solid material is unheard of with conventional systems".***

If CMS were utilized at UMCDF, natural gas would be used as the supplemental fuel. Propane was used at JACADS; because natural gas was not available at the island.

A Metal Parts Furnace (MPF) uses natural gas to heat to its furnace; but the gas would not be intimately mixed with activated carbon; therefore, complete combustion in a MPF would be significantly more difficult to achieve.

The same issue would relate to the use of an off-site commercial incinerator; as previously learned when ChemDemil personnel unsuccessfully test burned activated carbon in a DFS kiln.

5. LARGE CARBON PARTICLE SIZE

***Virgin Carbon Particle Size*:**
Virgin activated carbon used at JACADS was supplied by the Ionex Research Corporation, Lafayette, Colorado; which provided the following particle size distribution [REF:1-Sec.4]

Mesh Size	Particle Size (in)	Percent Retained
+6	----	0.0%
+8	0.0937	1.2%
+12	0.0661	52.5%
+16	0.0555	44.7%
-16	0.0555	1.0%
-18	0.0394	0.6%

Based on the above, a weighted average particle size equates to 0.058 inches (1,460 microns).

Micronized Carbon Particle Size:
During MSI's acceptance demonstration for its CMS, samples of micronized activated carbon were obtained and sent to the Pennsylvania State University Energy and Fuels Research Center to determine its particle size distribution [REF:1- Sec 9.7], which utilized two different devices, including: (a). HORIBA LA-900 Laser Scattering Particle Size Distribution Analyzer, and (b). Malvern 2600 Series Laser Diffraction Particle Sizer. Results were:

Percent Passing Indicated Particle Size	HORIBA (microns)	MALVERN (microns)
90 %	31.39	20.51
50 %	5.08	5.31
10%	1.34	2.23

A weighted average particle size based on the above distribution equates to 6.8 microns.

For visual particle size orientation - Photo No.1 presents an image of micronized activated carbon as viewed by the Pennsylvania State University Energy and Fuels Research Center scanning electron microscope, taken during the CMS development period. NOTE: The horizontal scale line equals 10 microns (about one-fifth the diameter of a human hair).

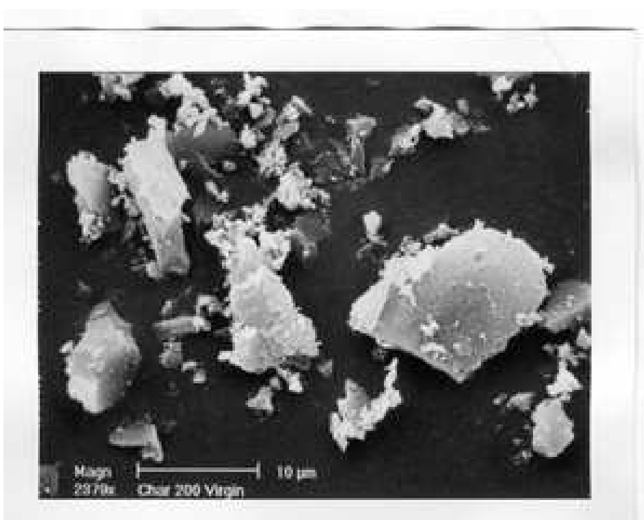

Photo No.1 – Micronized activated carbon sample viewed under electron scanning microscope.

NOTE: Magnification scale = 2,379.
Horizontal scale line = 10 microns

For comparative orientation, if five or six micronized carbon particles were lined up side-by-side, the resulting width would approximate the width of a human hair.

D^2 Law
A combustion principal states that the time duration it takes for a solid fuel particle to completely burn out relates to the second-power of its particle diameter [REF: 3].

Known as the "**D^2 Law**" the expression generally relates as: $T \approx D^2$ Where:

- $T \approx$ time to complete combustion
- $D \approx$ solid fuel particle diameter – raised to the second power.

As indicated above, average particle sizes for micronized and virgin-sized activated carbon are:

- Micronized activated carbon: 6.8 microns
- Virgin sized activated carbon: 1,500 microns

Applying the **D^2 Law** is why regular pulverized or other larger sized materials require significantly longer periods of time to complete burnout in conventional combustion processes.

AND

Why the time period for complete combustion of micronized activated carbon produced in the CMS at JACADS is infinitesimally shorter than that which would be required for virgin-sized activated carbon that would be used in a MPF or commercial incinerator.

The US Army CMA issued a document regarding BAT [REF: 4] wherein, it stated the following regarding "rapidity of destruction" for both a CMS and MPF:

> ***"Agent destruction efficiency > 99.99% and within a fraction of a second"***

Combustion burnout time for activated carbon in the CMS system is indeed a "fraction of a second".

However; it is highly unlikely - in fact the **D^2 Law** quantifies it to be impossible - for a combustion burn out time equal to a "fraction of a second" in a MPF or commercial incinerator.

6. '3-T's" OF COMBUSTION

A fundamental principal of combustion is its "3-T's" – Time, Temperature and Turbulence, each of which must be optimized to ensure complete combustion.

AND

Additionally, any fuel must have adequate air to complete combustion.

Thermodynamically, one pound of carbon requires exactly 11.51 pounds of air to complete combustion [REF: 2 – p. 9-2]. In any combustion process, a certain amount of additional air is always added to accommodate imperfections in the combustion burners and chambers.

However; in any high efficient combustion process, the required quantity of air assumes that there is almost perfect mixing of fuel particles with air.

In other words, for complete combustion of activated carbon, all fuel particles must be equally exposed to the required amount of air.

In a Metal Parts Furnace (MPF), the carbon would be introduced on existing filter trays.

As such, the carbon particles would be stacked one upon each other up to some depth within the filter trays.

Carbon particles on the very top layer probably would be exposed to sufficient combustion air; however, particles at the bottom and mid-layers of the stack would likely be "starved" for sufficient air - potentially yielding incomplete combustion.

Thus; one of the three principal "3-T's" of combustion – "Turbulence" – is a missing ingredient which enhances the potential for incomplete mixing of air and carbon in a MPF; thus, creating an impediment to efficient combustion.

Similarly, activated carbon resides on the floor and sides of a DFS kiln as it rotates and tumbles which does not impart a high degree of turbulence, nor does it have intimate mixing with a supplemental fuel, such as propane or natural gas.

7. COMBUSTION SUMMARY

Prior to commissioning MSI to develop the carbon micronization system (CMS), Army ChemDemil personnel unsuccessfully attempted to burn activated carbon in: (a). Metal Parts Furnace (MPF), and (b). DFS kiln. Reasons were explained for lack of success and were indicated as:

- Low volatile content of activated carbon.
- Relatively large virgin-sized activated carbon particles.
- Extended residency time required to complete combustion, compared to micronized activated carbon.
- Lack of supplemental fuel (i.e., propane or natural gas) intimately mixed with the activated carbon.
- Lack of a principal "T" in the "3-T's" of combustion – Turbulence – in both MPF and DFS kiln.

The above combined facts and reasons, should explain why complete combustion of activated carbon would be significantly more difficult to achieve in either a (1). Metal Parts Furnace, or (2). Off-site commercial incineration.

These facts were not discussed, but should have, by the Army in its permit modification request. Doubts should be evident and considered by DEQ in its consideration for Best Available Technology (BAT) at UMCDF.

8. COST

A criterion for assessing Best Available Technology is cost.

The Army CMA document regarding BAT [REF: 4] estimates that a CMS system capital cost to be $18.2 million.

Since the complete MicroEnergy CMS equipment would cost only a minor fraction of the Army's estimate, it is hard to understand how such a high cost was derived.

9. NATIONAL ACADEMY OF SCIENCE REPORT

DEQ 09-1155 mentions a report prepared by the National Academy of Sciences citing operational difficulties at JACADS concerning DFS-CMS.

A National Academy of Science report [REF: 5] contains the following comments concerning MSI's Carbon Micronization System (CMS) related to its use at JACADS.

> ***"The micronization of activated carbon …. has been shown to be a highly problematic process option" (p.4).***
>
> ***"Many difficulties were experienced with the carbon micronization technologies at JACADS …" (p. 46).***
>
> ***"The micronization process proved difficult to operate …" (p.60)***

Unfortunately, the report failed to mentioned certain **documented** issues regarding the CMS; including the fact that significant problems did result because the JACADS operator at the time: (1). incorrectly installed the burner system, and (2). incorrectly operated the system, as follows:

- When installing the burner, inferior refractory material was used that literally "melted" during the initial operating stages causing excessive slag buildup in the burner tube [REF:6].
- When operating the system, insufficient combustion air was delivered to the burner due to faulty control and monitoring procedures causing the system to operate in a "reducing-atmosphere" (i.e., insufficient combustion air which can produce very corrosive compounds) mode within the burner flame "envelope", - a major error that any combustion oriented person would confirm [REF:6].

Understandably - there undoubtedly would be "problems" in any complex system that was a "first-of-a-kind" – "never-been-done-before".

However; any identified CMS technical problems at JACADS, have technical solutions.

AND

The demonstrable fact remains that the CMS successfully disposed of all activated carbon at JACADS.

To date no other technology system can make that claim.

Perhaps the most disingenuous comments presented in the National Academy of Sciences report [REF:5-page 60] stated:

> ***"while being transported in pipes from the micronizer to the*** **[DFS kiln]*****, the resulting powder could under some circumstances become an explosive mixture."***
>
> ***"No explosive event happened at JACADS, but the possibility is real and must be considered."***
>
> ***"A prudent course now would be …. to immediately pursue alternative disposal options …"***

By definition, the CMS produces a mixture - that if not properly controlled - could become "explosive". It must create such a mixture in order for it to burn in the combustion system.

National Fire Protection Association publishes governing standards (i.e., NFPA-85) that dictate design criteria that must be incorporated in industrial and utility combustion systems to prevent explosions and promote safe operating practices.

MSI incorporated NFPA-85 into all aspects of its CMS design, which were reviewed and approved by Bechtel National, Inc. (Army's procurement agent).

NFPA-85 is the same standard that every utility and industrial combustion and power plant must also follow.

If the recommendations suggested by the National Academy of Science were followed, then every fossil-fueled power plant world-wide should ***"immediately pursue alternative options"*** for producing energy.

10. CARBON MICRONIZATION SYSTEM (CMS)

Figure 1 illustrates the basic components of the CMS as developed for JACADS.

More images can be viewed at: www.microenergysystems.com

Subsequent to the successful JACADS campaign to dispose of its agent laden carbon, MSI was asked if it would be possible to improve the CMS performance; specifically to: (a). increase throughput capacity, (b). further reduce particle size, and (c). implement modifications to minimize slagging within the burner tube.

Yes is the answer to all items, by some, or all, of the following measures:

- Increase rotational speed of micronization mill impactors.
- Add one, or more, stages to the mill.
- Increase the diameter and possibly height of the mill.
- Changes to the structural material used for the inside walls of the mill.
- Air flow diverters within mill.
- Type and number of impactors on lower stages of mill.
- Stage settings gap adjustments.
- "Fine-tuning" to the inlet feed conveyor to the mill.
- A "spreader" is the critical item at the burner tip that carbon touches just prior to entering the flame "envelope". MSI has developed alternative configurations, and identified other metal allows, that should enhance combustion efficiency and reduce slagging.
- Modification of swirl vane dimensions and angle alignment.
- Update burner tube ceramic liner (technology continually improves in this industry).

As previously indicated; the JACADS CMS was the first-of-a-kind, never been done before, technological development.

Even so, the system did successfully dispose of all the agent laden carbon at JACADS.

In any complex technology development, "lessons-learned" in first-stage efforts can be applied to enhance and improve the next stages of development. This is no different, and is the case for, an improved CMS.

11. QUESTIONS? Contact:

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Annapolis, Maryland 21401
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Email: microenergy@annapolis.net

12. REFERENCES

1. ***Final Performance Test Results – Activated Carbon Micronization and Combustion Test Program***: G-321-E-Category No. 27.0; Document No.CMS-320A-Z-046; June 19, 2000.

2. ***Steam – Its Generation and Use***: Babcock & Wilcox; 40th Edition; 1992.

3. ***An Introduction to Combustion; Concept and Applications*****;** Stephen R. Turns, PhD; McGraw-Hill, 1996; p.465-466.

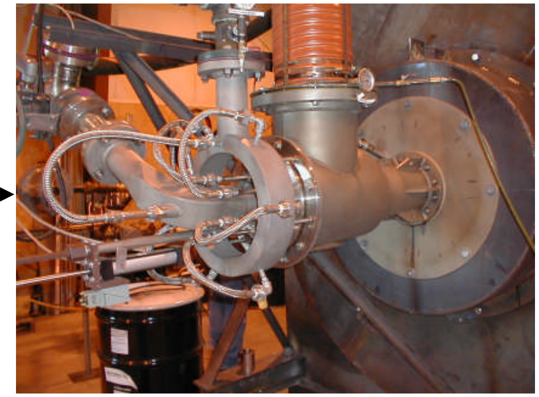
4. ***Umatilla Chemical Agent Disposal Facility Best Available Technology Evaluation for Agent-Contaminated Carbon*****,** Final Draft, August 2009 [p. 5-23].

5. ***Review of Chemical Agent Secondary Waste Disposal and Regulatory Requirements***; National Research Council; 2007.

6. During the period between November 2001 and March 2002, MSI participated in numerous individual and conference calls and email correspondences related to operating problems at JACADS, involving over ten (10) principals from: (a). JACADS Operations, (b). Washington Group International, and (c).ChemDemil Program Management – and a January 9, 2002 meeting at ChemDemil HDQ - Aberdeen, Maryland. Extensive JACADS operating data, photographs and text descriptions were analyzed, discussed, reviewed and conclusions developed. MSI currently maintains all records for this period of assessment.

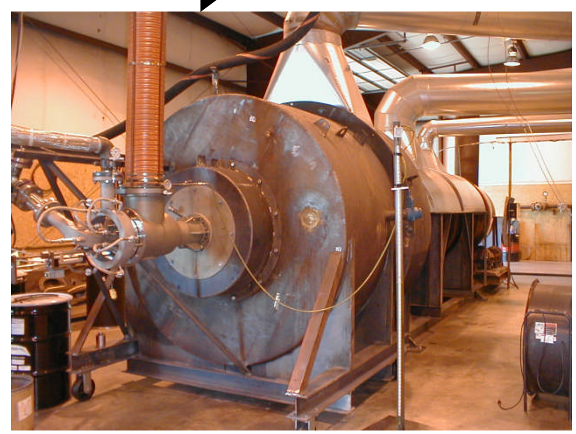
Storage

Micronization



Burner

Control



**Test Kiln at MSI Combustion Test Facility – Oakland, MD.
Dimensions are the same as the JACADS DFS Kiln**

Figure 1: MSI Carbon Micronization System – JACADS

10-0068

TETRA TECH

15 January 2010 138-5722.010

Mr. Casey Beard
Morrow County Courthouse
PO Box 788
Heppner, Oregon 97836

SUBJECT: TECHNICAL REVIEW COMMENTS ON THE BEST AVAILABLE TECHNOLOGY FOR TREATMENT OF SPENT ACTIVATED CARBON AT THE UMCDF

Dear Mr. Beard:

On behalf of Morrow County, Tetra Tech is submitting these public comments on the Best Available Technology (BAT) for Treatment of Spent Activated Carbon at the Umatilla Chemical Agent Disposal Facility (UMCDF). We reviewed the fact sheet and the DEQ memorandum addressing DEQ's preliminary analysis of BAT for spent activated carbon.

First, we have already commented concerning the absence of a sound statistical approach for the sampling of spent carbon, among a host of other problems with the spent carbon characterization plan (PMR UMCDF-09-012-WAP(2)). One concern we have about the BAT determination is a procedural concern. It appears that it is assumed that most (93% or 672,000 lbs) of the spent carbon will be determined to be agent-free or non-agent and thus eligible to go offsite for treatment and disposal. This assumption presupposes that PMR-09-012-WAP will be approved. If the PMR is approved and the agent contaminated carbon can be satisfactorily characterized, then only 48,000 lbs will need on-site treatment. This quantity is assumed in the BAT analysis for looking at the time frames needed by the candidate technologies to treat the agent carbon. If all 720,000 lbs of carbon had to be treated onsite, the timeframes would extend much longer and may favor a different technology. By allowing the assumption that 93% of the carbon is agent free, DEQ seems to be implicitly approving the WAP PMR, and that seems a bit improper and premature at this point since the PMR has not yet been approved (as far as we know, and it certainly was not yet approved when the DEQ BAT analysis went out in November). The DEQ should do the BAT analysis for two cases: first where it is assumed that all 720,000 lbs of spent carbon will have to be treated onsite, and second, as they have already done, assuming only 48,000 lbs needs onsite treatment.

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TETRA TECH

Concerning the BAT determination, the MicroEnergy Systems' fact sheet states that a clarification of misrepresentations made by the National Academy of Sciences about JACADS has been prepared but is not presented. If that information is material to the BAT determination, then DEQ should consider it in their review. Otherwise, the logic presented by the DEQ in the memorandum appears sound in its cost-benefit analysis. The level of operational difficulty experienced at Johnston Atoll is expressed as a reason for not using carbon micronization, but it is not the only reason. Cost appears to play a significant role, and the DEQ states that the expected operational time frame would be 45 days with the MPF compared with 8 days for the DFS-CMS, which, while 5 fold, does not appear to be a significant lifetime difference. In fact, the MPF will be the fastest way to treat the spent carbon when considering the time needed to permit, install, systemize, test, and demonstrate the other technologies.

We trust that you will find these comments useful and informative. If you have any questions please contact me at (509) 942-6060.

Sincerely,
Tetra Tech, Inc.

Michael D. Baker, P.E.
Project Manager
Engineering & Architecture Services
Mike.Baker@TetraTech.com

cc: Judge Terry Tallman, Morrow County Court
Ms. Tamra Mabbott, Umatilla County Planning Director
Central Files/SLP

Best Available Technology (BAT)
For Treatment of Agent-Contaminated Carbon at the UMCDF

	Criteria	Offsite Incineration	Metal Parts Furnace	Deactivation Furnace System With Carbon Micronization	Autoclave	Plasma Energy Pyrolysis System (PEPS)
1	**Types, Quantities, Toxicity of Discharges to the Environment**	• **Meets MACT/RCRA standards** • Demonstrated treatment effectiveness • Small quantities of solid residues (ash) • Brine from pollution abatement system	• **Meets MACT/RCRA standards** • Demonstrated treatment effectiveness, but depends upon approval of carbon analytical method • Small quantities of solid residues (carbon/ash) • Brine from pollution abatement system	• **Meets MACT/RCRA standards** • Demonstrated treatment effectiveness • Small quantities of solid residues (ash) • Brine from pollution abatement system	• Processing of agent-contaminated secondary waste (not carbon) has been demonstrated at bench scale; processing with surrogates has been demonstrated at intermediate scale • Performance test would be required to demonstrate treatment effectiveness and compliance with emission limits • Large quantities of solid waste (intact post-treatment carbon) (Additional treatment might be necessary to ensure treatment effectiveness) • Smaller quantities of off-gases and condensate	• Processing of carbon spiked with metals and surrogates has been demonstrated • Performance test would be required to demonstrate treatment effectiveness and compliance with emission limits • Liquid and solid (slag, baghouse dust) residues
2	**Risks of Discharge from a Catastrophic Event**	• Risks are considered low based on operational history across the industry	• **Risks are considered very low based on operational history and simplicity of operation**	• *National Research Council advised not using DFS/CMS due to risk of dust explosion* • Army indicates risk of explosion could be mitigated through engineering controls	• Risks are considered low based on operational history and simplicity of operation	• Risks are considered low, but some concerns remain regarding over-pressurization
3	**Safety of Operation**	• Site-specific; some incidents of fires/explosions and associated injuries across the industry	• **Demonstrated safe operations** • Familiarity with equipment/process	• *National Research Council advised not using DFS/CMS due to safety concerns*	• Moderate temperatures/pressure • Simple process • In use at TOCDF for other types of secondary wastes	• *High voltage power, very high operating temperatures, molten slag* • New waste handling and ventilation systems would be necessary
4	**Rapidity of Destruction**	• **< 1 day processing time**	• **45 days processing time**	• **7 days processing time**	• **16 days processing time**	• **24 days processing time**
5	**Impacts on Consumption of Natural Resources**	• Natural gas, water, electricity, process chemicals • Transportation (approximately 20 truckloads)	• Natural gas, water, electricity, process chemicals	• Natural gas, water, electricity, process chemicals • Retrofit for micronization system will consume additional materials	• Natural gas, water, electricity • Manufacture/transport of unit will consume additional resources • Large quantities of carbon residue and condensates may require additional transport and treatment	• Natural gas, water, electricity (high-voltage power supply), process chemicals • Transport of unit and facility adaptations will consume additional resources
6	**Time Before Technology is Operational and Impacts to Overall Risks**	• 13 months	• **3 months**	• 10 months	• 10 – 14 months	• 16 – 27 months
7	**Costs**	• $ 0.946 Million.	• **$ 0.133 Million**	• $18.2 Million	• $7.4 Million	• $10.4 Million

BOLD – meets Criteria   NORMAL FONT - marginally meets criteria   *ITALICIZED TEXT* - Does not meet criteria

Response to Comments
Best Available Technology for treatment of spent activated carbon at the UMCDF

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-1	The Metal Parts Furnace (MPF) is an inappropriate selection for destruction of HD ton containers containing any type of heel. Incomplete combustion inherent in the MPF process exposes worker and the public to agent and other hazardous chemicals in unknown quantities. Neutralization with an appropriate follow on process would have eliminated these problems. Moreover, the destruction and removal efficiency (DRE) of the MPF is only 99.99%, further evidence of the inadequacy of the MPF. These facts rule out the MPF as an appropriate technology for treating agent-contaminated carbon. We note and adopt, in support of this argument, the comments make by Micro Energy Systems, Inc., specifically the critical questions: 1) why activated carbon is difficult to burn; and 2) the statistical/probabilistic characterization of activated carbon. (G.A.S.P., et.al, Comment 1)	The MPF has been used successfully to treat other classes of secondary wastes. A number of steps will be taken to ensure effective treatment in the MPF: • A trial burn will be planned and conducted to demonstrate the effectiveness of the MPF in treating agent-contaminated carbon and the performance of the MPF in meeting emission limits • A permit modification will be necessary to establish waste analysis requirements for treated carbon to ensure treatment effectiveness and agent-free status. Please see RTC 6 – RTC 11 for a response to the Micro Energy Systems, Inc. comments.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-2	The DEQ staff report and related documents describing the treatment options for carbon are sorely inadequate and provide insufficient information for the public to comment and for the EQC to make a rational decision because critical information is left out. For example, the DEQ information fails to properly characterize the contaminated carbon or realistically predict what amounts of agent, dioxin, furans, PCBs, mercury and other hazardous constituents will be present in the carbon. The concentrations are particularly important because the smaller the concentration (e.g., less than 10,000 parts per million), the less likely the incinerator can achieve a safe DRE. In addition, it is important to remember that toxic metals such as lead, mercury and arsenic are not destroyed during the incinerations process. (G.A.S.P., et.al, Comment 2)	Treatment effectiveness, including achievement of the DRE, must be demonstrated in a trial burn. Treatment residues must be analyzed to adequately characterize the waste for subsequent treatment and disposal; these waste analysis requirements will be established in a future permit modification.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-3	The DEQ staff report and related documents are also fatally deficient because DEQ fails to articulate (a) the likely risks to the health of workers for each alternative; (b) the likely risks to the public for each alternative; (c) the likely risks to the environment for each alternative. How then are the public and EQC to determine which alternative is BAT? (G.A.S.P., et.al, Comment 3)	Although a quantitative risk assessment was not performed for treatment of agent-contaminated carbon, previous DEQ risk assessments (February 1997 and March 2008) have addressed operations at the UMCDF. These risk assessments demonstrated that facility operations do not pose an unacceptable risk to human health and the environment. In addressing the BAT criteria, the DEQ staff report indicates that any option selected for treatment of agent-contaminated carbon must undergo a trial burn (or equivalent testing for nonincinerator technologies) to demonstrate that treatment standards and emission limits are met. The staff report also identifies operating experience and notes any safety issues associated with specific technologies.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-4	The DEQ refers to the report by the National Research Council (NRC) regarding possible treatments for the contaminated carbon. Referring to the NRC report, DEQ states that, based on operating experience at chemical agent disposal facilities and on sampling results from trial burns, the PFS filters are not expected to be agent-contaminated. What kind of sleight-of-hand is DEQ tying to pull here? The PFS filters were touted as one important reason why there should be no concern about releases and the filters were deemed necessary to meet various air emission standards. The only data reference to support the quoted statement are "results from trial burns." Why should the EQC and public rely on trial burn results when there should be ample data from actual agent operations? Trial burn data does not provide the EQC and public with the best data upon which to make a BAT decision. (G.A.S.P., et.al, Comment 4a)	All components of the facility (incinerators, the wet scrubbers [pollution abatement systems] and dry scrubbers [PFS filters] have performed as expected; the PFS filters provide the last line of defense. The expected lack of agent contamination on the PFS filters indicates that the incinerators are effectively treating the agent. The NRC conclusion regarding the absence of agent contamination on PFS filters was based on operating experience at chemical demilitarization facilities and sampling results from trial burns at these facilities. The DEQ staff report states: "The NRC conclusions are based on operating experience at the chemical agent disposal facilities, where agent monitors in the filter systems have not detected the presence of agent," demonstrating that no agent had migrated through the pollution abatement system. This monitoring information, together with monitoring and sampling results during trial burns, provided assurance that the PFS filters would not contain agent contamination. The DEQ notes, however, that any determination of agent-free status for the PFS filters must be confirmed by UMCDF-specific analytical data. (See DEQ staff report: "DEQ is proposing that, <u>upon confirmation of agent-free status</u>, this waste stream may be managed as routine hazardous waste….[emphasis added].) The specific analytical requirements will be established through the permit modification process. Please see the UMCDF proposal for analytical requirements, permit modification request (PMR) UMCDF-09-012-WAP (PMR 09-012) (DEQ No. 09-1094).

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-5	The DEQ refers to the report by the National Research Council (NRC) regarding possible treatments for the contaminated carbon. Referring to the NRC report, DEQ states that, for the sulfur-impregnated carbon (SIC), agent contamination is not expected and (upon confirmation of agent-free status) the carbon may be treated as routine hazardous waste and transported offsite, for treatment of mercury as needed, and then disposal. The PFS filters were intended to provide a safety net , offering protection from the dangers of dioxin, furan, and PCB emissions, etc. Toxic metals and agent are not the only risk posed by the disposal of contaminated carbon. No analysis is provided for these dangerous substances. (G.A.S.P., et.al, Comment 4b)	The commenter is correct that the DEQ staff report did not identify all analytes for which sampling of SIC will be required. The specific analytical requirements will be established through the permit modification process. Please see the UMCDF proposal for analytical requirements, PMR 09-012 (DEQ No. 09-1094). In addition to sampling for agent, the UMCDF has proposed sampling for TCLP metals (which includes mercury) and organics. The final determination of analytes will be made in a DEQ decision on the PMR, following public comment.
RTC-6	The MPF combustion process is much slower than that of the deactivation furnace/carbon micronization process. If the proposed probabilistic sampling procedure (used to confirm agent-free status of most of the UMCDF carbon) is not approved, the time period required to dispose of all carbon would render the use of the MPF unviable. (MicroEnergy Systems)	In the event all carbon at UMCDF requires onsite treatment, a reevaluation of BAT technologies may be warranted. The Department notes that this scenario is not considered likely.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-7	Because the agent is so lethal and dangerous to public health and the environment, it is reasonable to question the validity and logic of (a) using random statistical probability to classify most of UMCDF's spent carbon as "agent-free"; and (b) designating a less efficient MPF combustion system as BAT. (MicroEnergy Systems)	The specific sampling requirements will be established through the permit modification process. Please see the UMCDF proposal for sampling requirements for spent carbon, PMR 09-012 (DEQ No. 09-1094). The final determination of sampling requirements will be made in a DEQ decision on that PMR, following public comment. Regarding the efficiency of the MPF, the BAT recommendation is based upon the seven BAT criteria; these criteria include rapidity of destruction and types, quantities and toxicity of discharges to the environment, both related to system efficiency. The resulting BAT recommendation selects the best technology following an evaluation of all the criteria.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-8	Even assuming only 48,000 pounds of carbon requires onsite treatment, the MPF is problematic. Carbon is difficult to burn because it has a low volatile content and large carbon particle sizes. The DFS/CMS process overcame these difficulties by: co-firing micronized carbon and propane together, thus supplementing the low volatile content; and micronizing the carbon into extremely small particles, greatly reducing the time required for complete combustion. Complete combustion requires optimization of time, temperature, and turbulence. Both the MPF and a commercial rotary kiln incinerator lack the design and operating characteristics to optimize time and turbulence. In addition, for both the MPF and a commercial incinerator, the lack of intimate mixing of fuel and carbon would inhibit complete combustion. Finally, the combustion process must have adequate air to complete combustion. In the MPF, spent carbon would be stacked in filter trays, one upon the other. This stacked arrangement would likely "starve" the middle and lower trays of sufficient air needed for complete combustion. (MicroEnergy Systems)	Any technology selected must achieve an acceptable destruction removal efficiency (DRE) (99.99% for treatment of agent in the MPF, as demonstrated in a trial burn). This demonstration will ensure that complete combustion is achieved. Although optimization of the combustion process is desirable, the BAT determination process includes consideration of all seven criteria, including rapidity of destruction, discharges to the environment, safety, the time required to permit and install the technology, the processing time, and the cost.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-9	The National Research Council report cited in DEQ 09-1155 presents misrepresentations about problems encountered by the carbon micronization system used to destroy spent carbon at Johnston Atoll Chemical Agent Disposal System (JACADS). A number of issues with the JACADS CMS were attributed to operator errors. In addition, any complex, first-of-a-kind system would have some problems. However, any identified CMS technical problems have technical solutions. Subsequent to the successful JACADS campaign, additional measures were identified that would increase CMS capacity, further reduce particle size, and implement modifications to minimize slagging within the burner. The demonstrable fact remains that the CMS successfully disposed of all activated carbon at JACADS. The risk of explosion identified in the NRC report is the same risk posed by every fossil-fueled power plant. The JACADS CMS design met all standards established by the National Fire Protection Association (NFPA-85) for industrial and utility combustion systems to prevent explosions and promote safe operating practices. (MicroEnergy Systems)	The DEQ acknowledges the successful disposition of all activated carbon at JACADS, as well as the Army's position that the CMS could be safely operated with appropriate engineering controls. In addition, the DEQ acknowledges that commercial combustion systems present the same risk of explosion, but notes that these operations lack the additional risk of chemical agent. The NRC recommendation against the use of the CMS for treatment of chemical agent carbon filters remains a substantial consideration in evaluating options.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-10	The BAT evaluation (Table 5-2) provided by the permittees mistakenly states, for "rapidity of destruction": "Agent destruction efficiency >99.99% and within a fraction of a second." This is impossible based on the combustion principle which states that the time for a solid fuel particle to burn out is proportional to the square of the diameter of the particle. With the large carbon particle sizes, the time to burn would be greater than a fraction of a second. (MicroEnergy Systems)	The DEQ agrees that the table entry is not clear. Upon vaporization of the agent, the destruction would occur within a fraction of a second. The length of the volatilization process will be determined through requirements imposed during a future permit modification process and through the trial burn.
RTC-11	The basis for the Army's estimate of cost ($18.2 million) for operation of the CMS system is not clear. Since the complete MicroEnergy CMS equipment would cost only a minor fraction of the Army's estimate, it is hard to understand how such a high cost was derived. (MicroEnergy Systems)	The costs include those associated with the preconstruction phase (contracts, facility footprint and design, engineering evaluation of hazards, siting, and closure impacts), the permitting process, construction, procedure and training development, and readiness review.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-12	The BAT determination assumes most (93% or 672,000 pounds) of the spent carbon will be agent-free. This assumption presupposes that PMR 09-012 (carbon analytical method, needed to demonstrated agent-free status of carbon) will be approved. The assumption that 93% of the inventory will be confirmed to be agent-free is important because the evaluation of technologies includes factors of rapidity of destruction and cost, both of which depend upon the quantities of carbon to be treated. The assumption also seems to be an implicit approval of the WAP PMR, which is a bit improper and premature. The DEQ BAT analysis should present two cases: 1) assume all spent carbon must be treated onsite; and 2) as has been presented, assume only 48,000 pound must be treated onsite. (Morrow County)	The assumption that most of the spent carbon is agent-free is based upon monitoring (at locations before the pollution abatement system filter system (PFS) filters, within the filter banks, and at the stack) indicating no releases, as well as efficient destruction demonstrations during the trial burns. The DEQ acknowledges that an approved carbon analytical method is necessary to determine agent concentrations (or agent-free status) of spent carbon. Although PMR 09-012 has not been approved, the analytical method has been reviewed by EPA and by the DEQ laboratory. These reviews indicate that the analytical method is technically sound for spent activated carbon, but not for the subclass of sulfur-impregnated carbon. The DEQ has taken this information into consideration in developing a recommendation to the EQC for BAT. The DEQ has not assumed that PMR 09-012 will be approved, but does acknowledge that an approved carbon method will be necessary. In the event substantially more carbon at the UMCDF requires onsite treatment, a reevaluation of BAT technologies may be warranted. The Department notes that this scenario is not considered likely.

Response to Comment (RTC) No.	COMMENT (Complete/Summarized Text) (Name of Commenter in Parentheses)	RESPONSE
RTC-13	The MicroEnergy Systems' fact sheet states that a clarification of misrepresentations about CMS safety and performance at JACADS has been prepared, but is not presented. If that information is material to the BAT determination, then DEQ should consider it in their review. Otherwise, the logic presented by the DEQ in the staff report appears sound in its cost-benefit analysis. Other factors (cost, start-up time) are identified that should also be considered in evaluating the CMS as the best available technology. (Morrow County)	The information related to CMS safety and performance at JACADS was presented in an attachment to the MicroEnergy Systems letter. This information was considered by the DEQ in making a final recommendation. (The specific comments made by MicroEnergy Systems are identified in RTC-6 through RTC-11 above.)