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A REVIEW OF THE CONTROLLED-AIR INCINERATOR

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READY, SET, ... QUIT!
A REVIEW OF THE
CONTROLLED-AIR INCINERATOR

ABSTRACT

The Los Alamos National Laboratory (LANL) Controlled-Air Incinerator (CAI) has had a long and productive past as a research and development tool. It now appears that use of the CAI to treat LANL legacy and other wastes under the Federal Facilities Compliance Act is no longer viable due to numerous programmatic problems.

This paper will review the history of the CAI. Various aspects associated with the CAI and how those aspects resulted in the loss of this Department of Energy asset as a viable waste treatment option will also be discussed. Included are past missions and tests; CAI capabilities, emissions, and permits; Federal Facility Compliance Act and associated Agreement; National Environmental Policy Act coverage; cost; budget impacts; public perception; the U.S. Environmental Protection Agency Combustion Strategy; Independent Technical Review "Red" Team review; waste treatment alternative technologies; the New Mexico Environment Department; and future options and issues.

INTRODUCTION/BACKGROUND

The Controlled-Air Incinerator (CAI) and associated systems located at Los Alamos National Laboratory (LANL) Technical Area 50, building 37 (TA-50-37) were originally a research and development tool used to prove the viability of incineration as a treatment method for various transuranic (TRU) wastes, radioactively contaminated polychlorinated biphenals (PCBs), and low-level mixed (hazardous and radioactive) wastes (LLMW). The original CAI was installed in 1977 and first operated in 1979. Over the next 15 years, 2,607 operating hours were logged¹. Compliant treatment of actual wastes, the ability to handle a wide variety of waste streams, and highly effective off-gas cleanup were demonstrated.

Operations ceased in 1987 so that upgrades to the CAI and its systems, identified during the initial phase of operation, could be performed. These upgrades and modifications were nearing completion. Some notable modifications included².

- Carbon bed upgrades
- Control system upgrades
- Materials of construction
- Continuous emission monitors
- Off-gas filtration improvements
- Various reliability upgrades

However, it is now questioned whether the facility should be used to treat wastes at LANL. In order to defer costs and other decisions, the CAI was "mothballed." Personnel were transferred to other

programs and the remaining staff and budget were only sufficient to maintain the facility at this low maintenance state. There is now direction from the U. S. Department of Energy (DOE) to close the facility and to investigate decommissioning and decontamination of the CAI in order to use the existing building for other purposes.

PAST MISSIONS AND TESTS

Some notable past missions and tests performed at the CAI include¹:

- Treatment of low-level wastes (run 7)
- Investigation into the combustion of pentachlorophenol (PCP) treated wooden ammunition crates (run 9)
- Investigation into the combustion of nuclear power plant wastes (runs 10 and 14)
- Investigation into the combustion of ion-exchange resins (runs 11 and 11A)
- Treatment of PCBs (runs 12, 13 and 15)
- Demilitarization of Navy marker smoke compounds (runs 16A, 16B, 16C, 16D, and 16)
- Demilitarization of Army marker smoke compounds (runs 17A and 17)
- Evaluation of the requirements of the Air Pollution Abatement System for the Dunnage Incinerator in the Johnston Atoll Chemical Agent Disposal System (JACADS, run 18)
- Treatment of Rocky Flats plutonium and americium contaminated PCBs (run P-1)
- Demilitarization of Navy marker flare compounds (runs 19A, 19B, and 19)
- Refractory evaluations (run 20)
- Treatment of TRU wastes (run 22)
- Treatment of scintillation cocktails (run 23)
- Destruction of radiopharmaceuticals (run 23)

This wide range of past missions and tests verify the versatility of the CAI. With the necessary equipment upgrades, the goal of production incineration of LANL-generated TRU wastes as well as mixed wastes could have been achieved.

CAPABILITIES

The CAI can thermally treat numerous wastes types including hazardous wastes, low-level wastes (LLW), TRU wastes, LLMW, and TRU mixed wastes. The CAI is currently configured to treat solids and liquid waste forms but could easily be modified to treat gaseous wastes. The CAI can treat highly halogenated wastes such as Teflon, polyvinyl chlorides (PVCs), and PCBs. The CAI cannot treat wastes with a large fraction of noncombustibles due to its fixed hearth design. There are also limitations on the amount of certain metals that can be fed into the CAI as well as limitation on the H³ and C¹⁴ contents of wastes.

The CAI is capable of treating up to 56.7 kg/h (125 lb/h) of solid wastes or up to 83.9 kg/h (185 lb/h) of liquid wastes depending upon the heat content of the waste. Estimated process availability is over 5,500 h/yr. The CAI has proven its ability to achieve permanent reductions in waste volume, toxicity, and mobility through previous trial burns and prior operations. Hazardous waste destruction and

removal efficiencies of 99.9999% have been demonstrated. Waste volume reductions (including all secondary wastes generated by the incineration process) are on the order of 20:1 for solids and 3.4:1 for liquids. The CAI is also a demonstrated, existing TRU and TRU mixed waste treatment facility for combustible wastes. There is currently no other treatment facility within the DOE complex with this wide range of abilities. Estimated costs for treatment in the CAI are less than \$22/kg (\$10/lb) of waste.

Additionally, the CAI currently has several advantages over existing DOE incinerators at other sites. The Consolidated Incineration Facility (CIF) at Savannah River has stringent limitations on the amount of halides it can receive as well as not being able to treat PCBs at this time. The Toxic Substance Control Act (TSCA) incinerator at Oak Ridge has no high efficiency particulate air (HEPA) filtration and is therefore limited on the amount of radionuclides that can be fed with combustibles. The Waste Experimental Reduction Facility (WERF) Incinerator at Idaho National Engineering Laboratory (INEL) also cannot incinerate PCBs, TRU, or TRU mixed wastes. In summary, the CAI is technically the most versatile incinerator within the DOE complex for the incineration of wastes, with the exception of soil-based wastes.

EMISSIONS

The CAI's wet off-gas treatment system reflects current scientific thought on how to minimize the reformation of dioxins and furans. Coupled with a triple HEPA filtration system (with on-line backup of two of the three stages), the air pollution control equipment is theoretically designed to remove over 99.99999999993% of the particulate matter emitted by the combustion process.

Past dioxin/furan testing completed in 1982-1983³ indicates that the CAI emits little if any dioxins/furans. No additional dioxin/furan testing has been done to date, but upgrades to the CAI should have increased the ability of the CAI to prevent dioxin/furan reformation and enhance the removal of any that may be formed. It is believed that U. S. Environmental Protection Agency (EPA) proposed performance standards for dioxins (0.2 ng toxic equivalency per dry standard cubic meter) would have been met if not surpassed by the CAI.

In order to better quantify the risk that the CAI could possibly pose to human health and the environment, numerous continuous emission monitors (CEMs) were purchased and scheduled for use. Some of the species that were to be monitored included NO, NO_x, SO₂, HCl, H₂O, CO, CO₂, O₂ and total alpha/beta radioactivity. The monitoring planned for the CAI not only would have met stringent EPA and New Mexico Environment Department (NMED) guidelines, but actually would have surpassed them.

Public outreach efforts were also beginning to impact the general public as to the relatively small amount of emissions that would have come from the CAI. This was overcoming the negative public perception as to incinerator emissions.

PERMITS

The CAI is a permitted Resource Conservation and Recovery Act (RCRA) treatment facility. The RCRA permit was issued in 1989 by the New Mexico Environment Department and allows the treatment of numerous hazardous waste types and forms including solids, liquids, semisolid sludges, and gases. The RCRA operating permit is being updated to reflect the current equipment configuration and expires in 1999.

The U.S. Environmental Protection Agency also granted the CAI a TSCA approval for the thermal destruction of liquid PCBs. This approval was issued in 1983 and renewed in 1992. The current TSCA approval allows for the treatment of DOE generated PCBs in addition to LANL generated PCBs.

While the CAI does have permits to treat RCRA and TSCA wastes, many individuals within LANL and the DOE did not fully understand that the CAI held these permits. This caused significant confusion and brought further doubt as to the ability of the CAI as a viable waste treatment option. Basically, it was thought that the CAI was not operational for environmental permitting reasons while the true reason was the completion of equipment upgrades.

THE FEDERAL FACILITY COMPLIANCE AGREEMENT AND ACT

After successfully completing multiple demonstration programs, it was decided by LANL and the DOE to continue the CAI's use as a treatment facility for hazardous and mixed wastes generated at LANL. The need for this facility became apparent with the promulgation of the Land Disposal Restrictions (LDR, 40 CFR §268) pursuant to the Hazardous and Solid Waste Amendments of 1984. The stringent requirements of these restrictions necessitated treatment of large volumes of hazardous and mixed waste before their disposal. Incineration was (and still is) the best demonstrated available technology for a many wastes, and is specifically required in some cases. With regard to mixed wastes, the CAI initially played an integral role in both LANL's Federal Facility Compliance Agreement⁴ (FFC Agreement) and its Site Treatment Plan⁵ (STP). The CAI alone was initially identified as being able to treat up to 16% of all LANL low-level mixed wastes identified under these agreements. The remaining 84% is not suitable for incineration or may not require treatment (TA-50 waste water treatment sludges). Of this 16%, only 3% has been identified as positively meeting off-site treatment criteria at this time. The remaining 13% could be treated in the CAI.

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THE NEPA CONNECTION

Much as been said about the relationship of the CAI to the ongoing LANL Site Wide Environmental Impact Statement (SWEIS). The last LANL SWEIS⁶ was performed in 1979 and covered the CAI

severely curtailed in order to keep other, more critical operations going. The CAI initially was to be "mothballed" until after the SWEIS at which time a decision would then be made as to use the facility for waste treatment. With the implications of the restart costs associated with the delay, it was determined that the CAI would eventually be zeroed out in fiscal year 1997.

PUBLIC PERCEPTION AND ITS' MISCONCEPTION

Greater public outreach is being required of the DOE and LANL. The National Environmental Policy Act also requires significant stakeholder involvement in the Environmental Impact Statement process. The CAI staff had been actively participating in this and other efforts prior to the upsurge of outreach under the LANL SWEIS to make themselves available to any interested stakeholders. Public outreach was also being accomplished through mechanisms such as the Environmental Stewardship Fair held in Santa Fe on February 6 and 7, 1995. Discussions were held with numerous individuals in industry and the general public at a one-on-one level, and over 20 individuals toured the CAI facility during this event. Other past efforts include many interactions with local media, local interest groups, and Indian pueblos.

While the public perception of incineration is currently not favorable (and this was listed numerous times as a reason why the CAI should not be pursued), it has generally been found by the CAI staff that once uninformed or misinformed individuals are presented the facts about the CAI, an informed consent can be obtained. In addition, tolerance of the CAI had been demonstrated in the past with the issuance and the modification of the RCRA operating permit, both of which processes required public participation. Public perception of incineration can be improved if honest and fair presentation of the technology and the alternatives is pursued.

EPA COMBUSTION STRATEGY

In 1994, the EPA released its Strategy for Hazardous Waste Minimization and Combustion⁸. This strategy represents the EPA's ongoing commitment to determine how best to assure the public of safe operation of hazardous waste combustion facilities (incinerators) and how to integrate source reduction and recycling into the national hazardous waste management program. The Strategy addresses the role of hazardous waste combustion over the next five to ten years. It also covers public involvement in the RCRA decision-making process, the need for strong compliance and enforcement, and the role of risk assessment.

Upon analysis, it is apparent that the CAI personifies the EPA's Strategy for Hazardous Waste Minimization and Combustion. The CAI can excel in various areas of the strategy including waste treatment and emissions monitoring. While the CAI follows many of the directions outlined in the Strategy, it does not follow the alternatives to incineration path which is presently a desirable direction many want to take for various reasons.

In addition, maintenance of the CAI's capabilities and RCRA operating permit would have been crucial since under the Strategy, the issuance of new permits is given a low priority. This could greatly complicate the ability of LANL to obtain a new operating permit for this or a new facility if

a future need arose. By pursuing a closure option, the CAI would be extremely difficult to restart at a later date.

SEEING RED OVER THE RED TEAM

In August of 1994, an Independent Technical Review (ITR) of the proposed LANL Area G expansion and the CAI was requested in order to better assess the return on investment associated with continued funding of these two facilities. This Red Team had the chartered objective to evaluate financial, technical, regulatory, and managerial activities: identify barriers to success; and develop alternative paths forward for Area G and the CAI. These alternative paths forward were to be consistent with DOE, Los Alamos, and environmental management program mission statements and other appropriate guidance.

While the Red Team's final report⁹ was extensive, it did not appear to sufficiently address the return on investment question that was the original purpose of chartering the review. Only generalities were made regarding the costs associated with continued funding of the CAI as a waste treatment option. Much of the report was devoted to dissertations on waste minimization and other potential waste treatment options such as mobile treatment skids that could perhaps replace the CAI at a later date.

Despite the diverse capabilities of the CAI, there was also concern raised as to the throughput capacity of the unit by the Red Team. The concern was raised that the CAI was not capable of continuous production throughputs and thus could not be utilized efficiently. While high volume continuous throughputs may be desirable for large, homogeneous waste streams, it is not necessary for small, semi-batch incineration operations such as the CAI. Smaller, continuous throughput runs in the CAI would have treated an extremely wide variety of relatively low volume waste streams at acceptable rates.

While CAI staff were given the opportunity to comment only on the technical accuracy of the Red Team's draft report, the failure of the CAI staff to mount a rapid response to the final draft may have been a tactical mistake. One letter to the editor in the local newspaper¹⁰ was the only public rebuttal of the Red Team's findings.

SKID ROW

Under the Federal Facility Compliance Agreement and various revisions of the Site Treatment Plan, in addition to the CAI there were listed as treatment options various mobile treatment units (MTUs) which could possibly treat various waste streams. The use of a "dirty, old technology" such as incineration may not be flashy enough in the views of some and these MTUs or treatment skids fit well on the "alternatives to incineration bandwagon". This provided a more palatable alternative to the CAI. Development of alternative treatment technologies also fell well into the underlying science and technology base mission of LANL. However due to the extremely early stages of development of many of these alternate technologies and the costs needed to bring them on-line to a production level status, MTUs are also no longer favorable at this time.

THE STATE OF THE STATE

The New Mexico Environment Department is charged with protecting human health and the environment in the state of New Mexico. While this underlying mission is paramount, the politics of New Mexico are also great. NMED has done well to take into account the views of various anti-incineration groups and individuals while dealing with the realities of the CAI. While the CAI would have been a technically good solution to some of LANL's waste problems, the understaffed NMED will have one less problem to address if the CAI is removed.

SHOULD WE PULL THE PLUG?

Closure is currently being pursued under RCRA/TSCA. While there has been some interest in salvage of CAI components, there appears to be no sponsor available for the system as a whole. Decontamination and decommissioning/demolition of the CAI is being seriously investigated and pursued. If this path is followed there would be no possibility of future use if needed or desired.

This brings us to the serious question of should we finally pull the plug? While opportunities may exist and the CAI is a valuable DOE asset, it is still up to the supporting program to make this determination. It may be reactionary, ill conceived, and short sighted to totally eliminate the CAI at this time.

ANY OPTIONS?

Numerous opportunities exist for a treatment unit such as the CAI due to its size and unique construction. Some possible real opportunities include:

- Rapid transition to TRU and TRU mixed waste treatment within the DOE complex
- Rapid TRU mixed waste treatment as required under the current NMED Compliance Order¹¹ and associated Site Treatment Plan
- Test bed opportunities for novel CEMs
- Treatment of DOE generated PCBs
- Demilitarization demonstration and testing
- Dioxin/furan mitigation research
- Low-level waste and LLMW treatment
- Hazardous waste treatment
- Materials of construction testing
- Incinerator risk studies

To reinforce a potential opportunity for CAI use, there is now over 11,435 m³ (55,000 drum equivalents) of TRU legacy wastes currently in storage at LANL. Of this amount, over 2,079 m³ (10,000 drum equivalents) can potentially be treated in the CAI. This represents a significant portion of the existing legacy wastes at LANL. In addition, it is estimated that approximately 208 m³ (1,000 drum equivalents) of TRU wastes will be generated on a yearly basis at LANL.

From the above information, there are numerous opportunities not only to support waste management operations at LANL (which in turn support LANL's primary mission), but also to further science with regards to hazardous (and mixed) waste incineration.

SUMMARY

Many issues contributed to the demise of the CAI as a DOE waste treatment option. Some compounded on each other (like NEPA and costs). Others were the result of poor communications or the unwillingness of others to listen to the facts surrounding the CAI. This occurred regularly at all levels (from the public up through the customer, the DOE).

Many of these problems may have been avoided if the CAI was brought up and placed on-line in a much quicker fashion, instead of attempting to fully developing its capabilities and potentials as a viable waste treatment option prior to operation. While this fast track approach could have been pursued if the CAI was to only be used as a research tool, it would not have been proper for a waste treatment role. A dual path approach encompassing upgrades along with waste treatment may have been successful.

If incineration is to be used as a viable waste treatment tool, it is paramount to pursue technical excellence by assembling state-of-the-art incineration facilities in order to provide the highest degree of protection. This was the approach being taken with the CAI.

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REFERENCES

1. MERLIN COMPANY, "Run Summaries Controlled-Air Incinerator TA-50, Building 37", Los Alamos National Laboratory, Los Alamos, New Mexico (November 1, 1990).
2. G. E. READER, "Summary Of Modifications To The Los Alamos National Laboratory Controlled-Air Incinerator", LA-UR-95-496, Los Alamos National Laboratory, Los Alamos, New Mexico (February 1, 1995).
3. J. S. VAVRUSKA, "Research Incineration Of Polychlorinated Biphenyls At The Los Alamos National Laboratory", Los Alamos National Laboratory, Los Alamos, New Mexico, U.S. Environmental Protection Agency Interagency Agreement AD-89-F-1539-0.
4. "U.S. Environmental Protection Agency Region 6 And U.S. Department Of Energy Los Alamos Area Office Federal Facility Compliance Agreement Regarding Land Disposal Restriction Requirements At The Los Alamos National Laboratory".
5. "Proposed Site Treatment Plan For Mixed Waste", Los Alamos National Laboratory, Los Alamos, New Mexico (March 24, 1995).
6. "Final Environmental Impact Statement Los Alamos Scientific Laboratory Site Los Alamos, New Mexico", DOE/EIS-0018, U.S. Department of Energy (December 1979).
7. "Continued Operation Of The Los Alamos National Scientific Laboratory At Los Alamos, New Mexico; Record Of Decision", 46 FR 18579-01, U.S. Department of Energy (March 25, 1981).
8. U.S. ENVIRONMENTAL PROTECTION AGENCY, "Strategy For Hazardous Waste Minimization And Combustion", EPA A530-R-94-044 (November 1994).
9. Los Alamos National Laboratory Environmental Management Program, "Independent Technical Review of The Controlled Air Incinerator and the Proposed Expansion of Material Disposal Area G at Los Alamos National Laboratory", LA-UR-95-275, Los Alamos National Laboratory, Los Alamos, New Mexico (January 1995).
10. G. E. READER, "Arguments For CAL...", Los Alamos Monitor, Los Alamos, New Mexico (June 18, 1995).
11. The New Mexico Environment Department in the Matter of U.S. Department of Energy and Regents of the University of California Los Alamos, New Mexico, "Federal Facility Compliance Order (Los Alamos National Laboratory)", (October 4, 1995).