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Project Summary

A Study of PCB Destruction Efficiency and Performance for a Coal-Fired Utility Boiler

Frank C. Whitmore and James D. Barden

The report gives results of an evaluation of the adequacy of a large coal-fired utility boiler for disposal of oils containing 50-499 ppm of polychlorinated biphenyls (PCBs) under the conditions set by the PCB Disposal Regulations. TVA's Widows Creek Boiler No. 1 was the unit tested. In these tests, all effluent streams were sampled and analyzed to determine representative values of Destruction Efficiency (DE) for this technology. The average PCB content of the oil used was 215 ppm.

Test results showed that, at the maximum contaminated oil feed rate of 454 L/min (120 gal./hr) utilized, there was no discernible effect on boiler efficiency. Further, analyses showed that PCB levels were below the detection limits that had been established in the laboratory.

This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The regulations that control the disposal of PCBs and PCB-contaminated materials distinguish between required disposal procedures according to PCB concentration. Materials containing more than 500 ppm of PCBs must be disposed of in an incinerator that has been specifically tested for its ability to dispose of PCBs; however, materials that contain less than 50 ppm of PCBs may be used as conventional fuels in boilers. High-heating-value materials (e.g., used transformer oil) containing between 50 and 500 ppm of PCBs can only be burned in high efficiency power boilers (or in PCB incinerators). It had been a matter of some concern that the ability of such high efficiency boilers to produce acceptable destruction efficiencies (DE) had not been determined in representative systems.

Tests on several oil-fired power boilers have shown that a DE of greater than 99.9% (as required by the regulations) can be obtained without degrading boiler performance. There is, however, a significant difference between oil-fired and coal-fired boilers. With oil, the non-combustible component of the fuel is relatively small, so that the particulate components of the combustion gases represent an insignificant contribution. However, with coal, there is a significant non-combustible (ash) content that is often as high as 15%. There is, then, the possibility that PCBs attached to the fly ash can survive passage through the high temperature regions of the boiler resulting in unacceptable DE values The tests performed in this program investigated this possibility in a representative coal-fired system

After background measurements that also allowed the determination of the rate of production of fly ash, three PCB-injection experiments were carried out at TVA's Widows Creek Boiler No. 1. Unit 1's fire box is divided into two regions by water tubes running vertically through it. This results in separation of the flue gases into two streams, referred to as the A and B sides. With two streams, it was possible to feed on one side of the boiler

and use fly ash and flue gas samples from the other side as background. The three experiments were: (1) feed on A side, sample both sides; (2) feed on B side, sample both sides; and (3) feed and sample both sides.

The flue gases, the fly ash, and the PCB-contaminated feed stock were all sampled for each test run. The flue gas was sampled downstream of the electrostatic precipitators. Each experiment lasted long enough to allow two samples to be taken on each plenum.

On the basis that both the flue gases and the fly ash could have contained PCB concentrations just below the quantifiable level, the minimum (worst-case) destruction efficiency can be determined. The average over six experiments (two from each feed configuration) showed a DE of 99.95%. Because the actual concentrations of PCBs were probably significantly below the detection limits, this value appears to represent a minimum value for the DE in the system. This experiment shows that the technology represented by Widows Creek Boiler No. 1 meets the stated requirements of a 99.9% DE for destruction of PCBs in waste oil in the 50-499 ppm range.

Conclusions

Conclusions drawn from these experiments include:

1. A coal-fired power boiler can effectively destroy low level PCB-containing waste without compromising boiler performance.

2. Costs associated with such disposal should be minimal; in fact, such disposal should result in significant savings over other options.

3. Disposal operations can be carried out with minimal risk to personnel or facility.

F. C. Whitmore and J. D. Barden are with Versar, Inc., Springfield, VA 22151.
***David C. Sanchez** is the EPA Project Officer (see below).*
The complete report consists of two volumes, entitled "A Study of PCB Destruction Efficiency and Performance for a Coal-Fired Utility Boiler:"
"Volume 1. Test and Evaluation," (Order No. PB 84 110 147; Cost: $11.50, subject to change)
"Volume 2. Test Protocol," (Order No. PB 84-110 154; Cost: $11.50, subject to change)
The above reports will be available only from:
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The EPA Project Officer can be contacted at:
Industrial Environmental Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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