Project Summary

Test Report for the Trial Burn of Dioneb in a Pilot-Scale Incinerator

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This Project Summary synopsizes a brief (16 page) final report on the incineration behavior of a cancelled pesticide, dioneb. Dioneb exists as a large volume (2 to 4 ml gal) of Resource Conservation and Recovery Act (RCRA) waste, type P-020. The pesticide was cancelled in recent years because the U.S. Environmental Protection Agency (EPA) determined its continued use in agriculture represented an imminent health hazard in terms of its cancer-causing properties as well as its effects on human reproductivity. The EPA, in its process of finding disposal methods for this waste, determined that incineration would be the optimum technology except for concerns over the potential nitrogen oxide (NOx) emissions that may result. Consequently, before proceeding with full-scale incineration of all inventories, EPA conducted a brief trial burn of a sample dioneb mixture to quantify NOx levels and also to ascertain that acceptable levels could be achieved for destruction and removal efficiency (DRE), particulate emissions, and other combustion behavior.

The trial burn demonstrated that, indeed, incineration would be an effective, safe, and satisfactory method for disposal. Based on the tests described herein, and subsequent full-scale demonstration testing, EPA then proceeded with contract disposal of dioneb by the commercial incineration industry.

This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, 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

As part of a program by the EPA Office of Research and Development (ORD) to determine which technically viable disposal option is appropriate, the Environmental Systems Division of Acurex Corporation conducted pilot-scale test burns of a mixture of dioneb products at the John Zink Company Research Incineration Facility in Tulsa, Oklahoma. The mixture represented the dioneb products that were to be destroyed. The rationale for doing the pilot-scale test was that specific performance data were needed to address, with confidence, any public or permitting questions that might arise in authorizing the full-scale disposal operation.

The sampling and analysis methods were configured to characterize influent and effluent streams and to quantify the incinerator operating conditions. The specific objectives of the test burns were:
• Confirm that DRE of dinoseb is better than 99.99% at typical waste incinerator operating conditions,
• Determine the portion of nitrogen in the dinoseb mixture converted to NOx in the combustion products,
• Determine the particulate emission characteristics of the dinoseb mixture, and
• Survey the combustion products for hazardous semi-volatile or volatile products of incomplete combustion.

Pilot-scale incineration testing was also needed so that interested parties could assess and project basic incineration parameters associated with destroying the dinoseb products. The test burn plan was completed in December 1987, and the Quality Assurance Project Plan was approved in February 1988. The test burns were successfully performed between February 18 and February 26, 1988.

Facility Description
Tests were performed in a conventional 2 mil Btu/hr liquid injection incinerator at the John Zink Company Research Facility. The system consisted of a horizontal combustion chamber followed by two vertical, water-quenched transfer sections and assorted ducting to downstream pollution control equipment.

Feed Materials Characteristics
The nominal dinoseb mixture fed to the incinerator consisted of 82% Dyanap, 16% Dynamate 3, and 1.6% Dynamate 5. The Dyanap contains about 12% dinoseb salts. The Dynamate 3 and 5 consists of 51% and 54% dinoseb, respectively. All of the dinoseb products were delivered to John Zink's facility in Tulsa, Oklahoma, in 30-gal containers.

According to the manufacturer, Dyanap is a mixture of dinoseb, dinoseb salt, a herbicide called naptalam, other constituents, and water. The common name of Naptalam is sodium alanap or N-1-naphthylphthalamic acid. It represents about 22% of the Dyanap. The Dyanap mixture is a dark red liquid with a phenolic odor and a specific gravity close to water. Dyanap material tends, however, to become very viscous and solidify below 10°C. The other dinoseb formulations, Dynamate 3 and 5 from Drexel, are very stable even at temperatures below 10°C.

For the test burns, the waste mixture was prepared by blending the three dinoseb products (Dyanap, Dynamate 3, Dynamate 5) into an agitated mix tank in a 5:1:0.1 volumetric ratio to produce a waste with a dinoseb or dinoseb salt composition of 16% to 20% by weight. A sample of this mixture was prepared in the laboratory and kept at ambient temperature of about 20°C.

The sample remained homogeneous with no visible signs of immiscibility over a period of more than a month. As long as the mixture is above 20°C, it seems to be easily pumped, agitated, and injected into the incinerator. During testing, ambient temperature was below freezing, so the mixture needed to be heated to remain pumpable.

Operating Conditions
The primary operating parameters for the test burns were the incinerator exit temperature and the dinoseb mixture feedrate. Flue gas was sampled both before and after the particulate scrubber pollution control device at the ports.

The incinerator was fired primarily on natural gas with relatively small amounts of heating provided by the dinoseb mixture. Estimated heating value of the mixture is 2,485 cal/gm (4,473 Btu/lb).

Sampling and Analysis Methods
Sampling and analysis were conducted in accordance with an EPA Category II Quality Assurance Project Plan (QAPP). Methods generally followed those given in Test Methods for Evaluating Solid Waste (SW-846, Third Edition, November 1986). Specific deviations were needed in some cases and are documented in the QAPP.

Dinoseb Destruction and Removal Efficiency
The DRE of the dinoseb mixture in the John Zink incinerator system was evaluated by conducting standard Modified Method 5 (MM5) sampling at the flue gas ducts (Method 0010 of SW-846). Analyses generally followed the protocol, although, during method validation activities, the extraction process was changed to use acetone rather than methylene chloride. In the validation work, dinoseb recovery exceeded 70%.

Results
No dinoseb was detected in any of the flue gas samples. In all cases, dinoseb DRE exceeded 99.999%.

NOx Production
The feed mixture contained 3.1 percent nitrogen on a dry basis. Nitrogen comes from the dinoseb salt, Naptalam, diethanolamine.

The NOx concentrations in the flue gas were analyzed continuously using nondispersive infrared analyzers: detected only NO and the sum detected total NOx. In general, differences in readings were small relative to the uncertainty in measurement.

Various levels of NOx were measured during incineration; these are presented in detail according to location in the incinerator and test conditions in the report. The values, however, ranged from 150 to as high as 1011 parts per million (ppm) in the combustion gases or exhaust stack, as corrected to 0% oxygen levels. Values of NOx were measured with no dinoseb flowing, and the results simply from firing natural gas alone with combustion air, ranging from 150 ppm.

Other Results
Particulate measurements show a common design of a wet scrubber to handle heavy loading of nearly 700 mil per dry standard cubic meter (mg) the stack gas loading after scrubber controlled to less than 35 mg which was well under the performance standard of 180 mg/d.

Products of incomplete combustion (PICs) were sampled and analyzed to detect the PICs detected, however, using volatile or the semi-volatile type found to be of any unusual type of level of concern in the stack gas.

Conclusion
Incineration proved an effective and satisfactory method for disposing of the cancelled pesticide dinoseb.

The full report was submitted to the U.S. Environmental Protection Agency.
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The complete report, entitled "Test Report for the Trial Burn of Dionseb in a Pilot-Scale Incinerator," (Order No. PB 89-198 790/AS; Cost: $13.95, subject to change) will be available only from:

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