



Project Summary

POHCs and PICs Screening Protocol

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During the last decade, the destruction of hazardous waste by incineration has become an increasingly desirable alternative to classical hazardous waste disposal methods. Properly designed and operated incinerators destroy almost all hazardous waste organic compounds while reducing total waste volume. However, the improper design or operation of a hazardous waste incinerator may pose a risk to public health through hazardous emissions. Currently, trial burn protocols for an incinerator are designed to determine preselected Principal Organic Hazardous Constituents (POHCs) and not total organic emissions. Products of incomplete combustion (PICs) may be formed during the incineration of hazardous wastes. PICs may be defined as compounds in the stack gas of an incinerator that are not in the waste feed.

This report presents a proposed analytical protocol for use in screening total emissions from hazardous waste incinerators and combustion sources. A tiered approach to the screening protocol was developed, based on simple prescreening techniques. Driven by the quantity of pollutants found in the prescreening of the samples, more involved and specific analytical techniques were utilized. GC/FID, GC/MS, HPLC/UV, and HPLC/MS were evaluated as candidate screening methods. The proposed protocol was applied to the analysis of incinerator effluent sample extracts. Major pollutants were identified and quantified.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Re-

search 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

During the last decade, the destruction of hazardous waste by incineration has become an increasingly desirable alternative to classical hazardous waste disposal methods such as landfilling, lagooning, and deep well injection. Properly designed and operated incinerators destroy almost all of the hazardous organic compounds of waste streams while reducing total waste volume. However, the improper design or operation of a hazardous waste incinerator may pose a risk to public health through the emission of potentially hazardous chemicals into the atmosphere. The Resource Conservation and Recovery Act (RCRA) requires that the destruction and removal efficiency (DRE) of an incinerator for certain predetermined Principal Organic Hazardous Constituents (POHCs) be equal to or greater than 99.99%.

Normally, during a trial burn of an incinerator for certification, one to six POHCs per waste stream are chosen for study. The success of a trial burn depends on meeting the DRE criteria and other environmental regulations for these designated POHCs. Designated POHCs chosen to be measured in a trial burn of a waste are usually those that are the most difficult to burn or those that have the highest concentrations. Currently, trial burn results for specific designated POHCs are being interpreted to be applicable to other organics in the waste stream that are less difficult to burn. Thus, total incinerator emissions are not routinely determined in trial burns.

Currently, trial burn protocols are designed to determine preselected POHCs in a hazardous waste incineration trial burn. The development of a screening protocol would allow for the analysis of preselected POHCs and for the analysis of all other major constituents of the combustion effluent. Generally, the total composition of a combustion effluent is unknown at the time of a trial burn. Compounds in the combustion effluent may be derived from auxiliary fuel, compounds originally present in the hazardous waste, and compounds formed in the combustion process. A screening protocol must measure all of these elements in a way to identify the major emissions (POHCs and PICs) and certain specific highly toxic compounds that may be present at a lower concentration.

Protocols that are available for conducting a trial burn plan and for the sampling and analysis of specific designated POHCs can be extended and incorporated into a screening protocol. The basic "building blocks" from which a cost-effective screening protocol can be assembled have been developed for hazardous waste incineration programs. The purpose of this research is to develop an analytical protocol for use in screening emissions from hazardous waste incinerators and combustion sources.

Approach to Screening Protocol

In recent years, EPA has moved toward a risk assessment and a risk reduction framework for making regulatory decisions concerning the disposal of hazardous wastes. EPA's Science Advisory Board has commented on the lack of information on total emissions from incineration processes. A general sampling and analysis screening protocol is needed to satisfy requirements for data on total emissions from incineration pro-

cesses. A screening protocol must be able to identify and quantify the major organic compounds in combustion effluents.

This report documents the development of a generalized screening protocol for organic compounds in combustion effluents. The sampling and analysis methods are based on protocols developed and documented in EPA guideline and test method documents. The basic premise is to use existing sampling and analysis techniques whenever possible and practical. The purpose of the developed protocol is to give maximum information while minimizing time and cost incurred in the collection of adequate data. The tiered approach of the proposed protocol provides a foundation for a protocol that can be risk-driven.

Flow diagrams of the organic screening protocol include the extraction and analysis procedures for volatiles, semi-volatiles, and nonvolatiles. The proposed protocol assumes that specific sampling methods and procedures such as VOST, MM5, or SASS trains have been defined and implemented. Risk assessment data can be incorporated into the protocol to help determine if sufficient data have been obtained.

Also included in the report are details of the analytical procedures for different analyses in the screening protocol. Each analytical procedure has been written as a stand-alone document and is based on existing sampling analysis techniques wherever possible. These analytical procedures may be used for many compounds. The analytical procedures include GC/FID and GC/MS for volatile organics, GC/MS for semivolatile organics, analysis for organics, HPLC/UV for nonvolatile organics, Soxhlet extraction for solid sorbent modules, and a screening procedure for total chromatographable organics.

Results and Discussion

The need to characterize hazardous waste incinerator emissions for multiple organic compounds has been steadily increasing for several years. Similar interest is being shown in organic emissions from municipal waste incinerators and sewage sludge incinerators. The strategies described in this report should be useful for building data bases related to other waste combustion processes.

Seven protocols based on methods published in EPA documents were developed and reviewed. The protocols included GC-FID screening for volatile compounds, GC-MS screening for volatile compounds, Soxhlet extraction sample preparation, TCO determination, GC-MS for semivolatile compounds, gravimetric determination, and HPLC-UV screening.

Currently, experimental application of the proposed scheme is very limited. Three extracts of samples obtained from Method 0010 testing of an incinerator under different feed and firing conditions were analyzed by the seven protocols. Thirty-four compounds have been tentatively identified but, more importantly, the protocol methods seem to perform well.

Conclusions

A tiered approach to the screening protocol was developed based on simple prescreening techniques. Driven by the quantity of pollutants found in the prescreening of the samples, more involved and specific analytical techniques were utilized. GC/FID, GC/MS, HPLC/UV and HPLC/MS were evaluated as candidate screening methods. Evaluation of combustion effluent samples by the proposed tiered approach both supports the need for a screening protocol and represents the initial phase in the development of a risk-driven protocol for screening a combustion effluents.

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The complete report, entitled "POHCs and PICs Screening Protocol," (Order No. PB 90-116 930/AS; Cost: \$23.00, subject to change) will be available only from:

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