Waste Testing and Quality Assurance

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Foreword

This publication, *Waste Testing and Quality Assurance,* contains papers presented at the Symposium on Solid Waste Testing and Quality Assurance, which was held in Washington, DC, 15-18 July 1986. The symposium was sponsored by ASTM Committee D-34 on Waste Disposal, the United States Environmental Protection Agency, and The American Public Works Association. David Friedman, EPA, served as symposium chairman and was the editor of this publication.

Contents

Overview

This volume, which highlights the latest developments in the areas of waste and environmental media sampling, property and hazard testing, and chemical and biological analysis, will focus on developments in the fields of leachability estimation, analytical method development and evaluation, and quality assurance. The papers included in this volume emphasize testing methodology and quality assurance practices that are being developed or applied to implementing the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous waste management programs.

Leachability Estimation

Land disposal is a widely employed method of managing both hazardous and nonhazardous wastes. For many wastes it may be the only practical option. A major concern with land disposal is the potential for the waste to release its toxic constituents and the consequent contamination of groundwater. The STP includes several papers dealing with leachate quality prediction.

During and prior to disposal, various measures can be taken to minimize the potential leachability of wastes destined for land disposal. In addition to site design to minimize contact between the waste and leaching media present at the site, a commonly employed waste treatment technique to minimize leachability is solidification, or fixation as it is also known. Such processes work by converting the waste into an impermeable monolithic mass. However, the acceptance of such processes depends on an ability to ensure that the waste will retain its monolithic nature during long-term disposal. In their paper "Methods for Evaluating Solidified Waste," Hannak et al. present an overview of studies that are being conducted in the United States and Canada to evaluate short-term laboratory testing methods appropriate to determining the long-term stability and leaching potential of solidified wastes. In addition to leachability, the authors examine tests for measuring a waste's resistance to the environmental stress imposed by the climactic vagaries of freezing and thawing and wet and dry conditions.

In 1980, the Environmental Protection Agency (EPA) promulgated the Extraction Procedure (EPA Method 1310) to be used for determining whether a waste should be classified as a hazardous waste due to its potential to leach certain toxic species under specified codisposal mismanagement conditions. In 1986, EPA proposed to replace the Extraction Procedure with the Toxicity Characteristic Leaching Procedure (EPA Method 1311). The procedure involves an 18-h extraction of a sample with either an acetic acid or a sodium acetate solution and subsequent analysis of the extract for a variety of elemental and organic constituents. This new procedure offers a number of advantages over Method 1310. These include an applicability to evaluating the leachability of both elemental and organic species, including volatile organic compounds, a reduction in the potential for operator error, and a reduction in the extraction time.

To validate the procedure, three waste samples were sent to 24 different laboratories for extraction and analysis. Eighteen of the laboratories participated in the organic analysis and all 24 participated in the metals analysis. The results and statistical analysis of the collaborative test, which forms the basis for EPA's decision to propose the new waste testing procedure, are presented by Blackburn et al. in their paper titled "Collaborative Study of the Toxicity Characteristic Leaching Procedure (TCLP).

As they did in 1979 for Method 1310, the Electric Power Research Institute sponsored a multiple laboratory collaborative study to evaluate the variability and reproducibility of Method 1311. In his paper "Round Robin Study of Leaching Methods as Applied to Solid Wastes from Coal-Fired Power Plants," Murarka presents the results of both the 1979 study and this latest effort which demonstrates that the reproducibility of Method 1311 is equal to or better than that of Method 1310. The study also examines the causes of the variance when conducting evaluations of waste leachability and discusses the relative importance of the various factors.

Analytical and Testing Methods

On a molecular basis, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) is one of the most toxic environmental contaminants known to result from our industrial society. Although 2,3,7,8-TCDD is the most toxic of the 75 chlorinated dibenzo-p-dioxins, many of the others are known to possess high toxicity to humans and animals. The "dioxins," and the chlorinated dibenozofurans which have a similar genesis, are thus of very great environmental concern. They are formed during the commercial synthesis of a number of industrial chemicals as well as in a variety of processes involving halogen-containing precursors, heat, and an organic source (for example, municipal waste combustion).

Method 8280 was published by EPA in 1983 for use in determining the presence and concentration of chlorinated "dioxins" and "furans" in environmental matrices. The method has undergone a period of continual development, improvement, and evaluation in order to accommodate the variety of complex matrices encountered in waste testing and environmental monitoring. In their paper "Development and Validation of RCRA Method 8280 for Dioxins and Furans," Billets, et al. compare the performance of the 1983 version of Method 8280 and the improved method resulting from the work performed by EPA's Environmental Monitoring and Systems Laboratory at Las Vegas, NV.

Inductively coupled plasma emission spectroscopy offers a sensitive method for simultaneously determining the presence and concentration of a large number of elements in environmental samples. As part of its efforts to lower testing costs, EPA developed a standard ICP protocol (Method 6010) and initiated interlaboratory collaborative testing of the protocol. Hinners et al., in "Interlaboratory Evaluation of ICP-AES Method 6010," describe the results of the evaluation and the quality control procedures that need to be followed to obtain accurate results.

The increasing demands faced by laboratories serving the waste management community require innovative approaches to saving time and expense in testing. Illustrative of such novel approaches is the work described by Callio to adapt the hydride generation approach used when analyzing for arsenic and selenium by atomic absorption spectroscopy to the multielement inductively coupled plasma (ICP) spectroscopy method. The paper "Hydride Generation Methods for Determination of Arsenic, Antimony, and Selenium" outlines a sample preparation procedure and instrumental parameters for the simultaneous determination of arsenic, antimony, and selenium using ICP spectroscopy.

Heavy elements, such as lead and mercury, create notorious environmental problems because of their propensity to undergo environmental transformations. These transformed species often present significantly different transport, toxicity, and persistence properties than the form of initial deposition. Accurately assessing the risks associated with heavy element contamination therefore requires knowledge, not only of the concentration of the element present, but also the form that it is present in. Olson et al., in "Methods for the Analysis of Organometallic Compounds in Wastes," describe how combinations of chromatographic molecular separation coupled with element-selective detectors can yield reliable determinations of the organometallic species present in waste matrices.

Used petroleum oils serve as a valuable energy source due to their high BTU content. Improper burning of such oils, however, can present significant environmental hazards. One such hazard is the release of halogenated toxic organic compounds to the air when contaminated oil is used as a fuel. To prevent health risks resulting from the burning of used oils containing spent halogenated solvents and other halogenated organics, in 1985 EPA promulgated regulations establishing standards for waste oil burned as fuel in nonindustrial boilers. The rule presumes that oils with a total halogen content exceeding 1000 mg/L have been mixed with hazardous spent halogenated solvents and are not suitable for use in nonindustrial boilers. This ruling presents problems for those involved in the collection, recycling, and reuse of waste oils. Transporters, reprocessors, and burners of waste oil must test each batch of waste oil to insure that it meets EPA specification. These tests should ideally be done at the point of collection or reuse to avoid the time and expense of laboratory analysis. In their paper "Development of a Portable Testing Procedure for Monitoring Halogenated Solvents in Waste Fuels," Tarrer et al. describe one such test that is being developed to meet this need. Their work is illustrative of the novel, low-cost approaches to testing that have to be developed to meet the needs of the waste management program.

When faced with the problem of analyzing wastes and other environmentally important samples, the analyst is often faced with the task of selecting which of a number of competing methods to use. While the methods vary in terms of their strengths and weaknesses (for example, time for an analysis, sensitivity, precision), detailed comparative information is often not available for use in making the selection. In an effort to select appropriate methods for determining selenium in various sample matrices, Iskander et al. evaluated different approaches to sample preparation and analysis. Their paper, "Comparative Study of Preparative and Analytical Techniques for the Determination of Selenium in Water, Sediment, and Vegetation Matrices," will serve to assist other analysts faced with determining this potentially toxic and difficult-to-analyze environmental contaminant.

Quality Assurance

The primary goal of a quality assurance program is to ensure that the data gathered to answer a question is of known quality. Unless the quality of the data is known, then the decision maker will not be in a position to determine if the accuracy and precision of the data is sufficient to answer the question. The RCRA regulations require that owners of hazardous waste land disposal facilities monitor the groundwater beneath the site. Groundwater monitoring serves a number of purposes. These include: early detection of leakage, determination of the zone of contamination at leaking sites, and assessment of the risk posed by groundwater contamination.

In 1985, the EPA established the Hazardous Waste Ground Water Task Force to evaluate how well facilities were complying with the groundwater monitoring regulations. The paper by Kangas et al., "Quality Assurance on the Groundwater Monitoring Task Force Facility Assessment Program," provides an overview of the quality assurance activities performed by the Task Force during evaluation of six facilities. It provides examples of quality assurance procedures found appropriate for facility monitoring. Evaluation of analytical data and laboratory performance through integration of information from performance evaluation samples, laboratory audits, and laboratory analytical control charts is emphasized.

One critical component of any waste characterization or facility monitoring program is the competence of the laboratory that will be analyzing the field samples. One approach to ensure that laboratories possess at least a minimum level of competency is through the operation of a laboratory certification program. The Office of Quality Assurance within the New Jersey Department of Environmental Protection develops laboratory standards for the Department's environmental regulations and administers a laboratory certification program. Their RCRA laboratory certification program is designed to evaluate laboratory competence in the areas of hazard classification using waste characteristics, inorganic analysis, organic analysis, and miscellaneous SW-846 testing procedures. The paper, "RCRA Laboratory Certification" by Hirst et al. describes the New Jersey system and issues associated with the establishment of certification programs.

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