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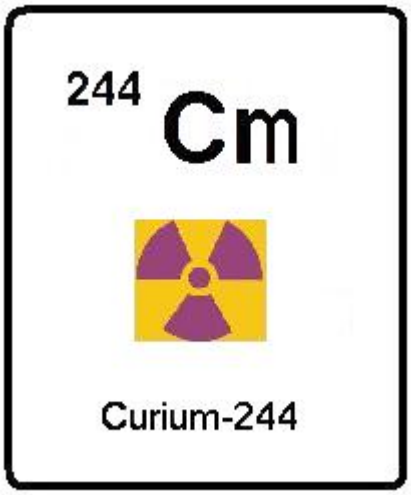
technical BRIEF

BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

Rapid Radiochemical Methods for Analysis of Environmental Samples Contaminated with Curium-244 (^{244}Cm) for Use during Environmental Remediation and Recovery

INTRODUCTION

In the event of a radiological or nuclear contamination event, the response community is in need of tools and methodologies to rapidly assess the nature and the extent of contamination. To characterize radiologically contaminated outdoor areas and to inform risk assessment, large numbers of environmental samples will be collected and analyzed over a short period of time. To address the challenge of quickly providing analytical results to the field, the Environmental Protection Agency (EPA) developed robust analytical methods. These methods allow response officials to rapidly and accurately characterize contaminated areas and the effectiveness of remediation efforts during the intermediate and late phases of environmental clean-up. Improvement in sample processing and analysis leads to increased laboratory capacity to handle the analysis of a large number of samples following an intentional or unintentional release of a radiological/nuclear contaminant.



In 2005, the Integrated Consortium of Laboratory Networks (ICLN) was formed by ten federal agencies with laboratory networks across the government. The agencies recognized the need to ensure adequate laboratory infrastructure to support response and recovery actions following a major radiological/nuclear incident. The ICLN provides a national infrastructure with coordinated and operational laboratory network systems that provide timely, high-quality, and interpretable results for early detection and effective response consequence management. In 2006, HSRP established a relationship with EPA's Office of Radiation and Indoor Air (ORIA) in response to laboratory capacity needs in support of EPA's Environmental Response Laboratory Network (ERLN) and the ICLN. The HSRP and ORIA coordinate radiological reference laboratory priorities and activities in conjunction with EPA's Partner Process. As part of the collaboration, HSRP worked with ORIA to publish two rapid radioanalytical methods for analysis of Curium-244 (^{244}Cm) in environmental matrices.

U.S. EPA's Homeland Security Research Program (HSRP) develops products based on scientific research and technology evaluations. Our products and expertise are widely used in preventing, preparing for, and recovering from public health and environmental emergencies that arise from terrorist attacks or natural disasters. Our research and products address biological, radiological, or chemical contaminants that could affect indoor areas, outdoor areas, or water infrastructure. HSRP provides these products, technical assistance, and expertise to support EPA's roles and responsibilities under the National Response Framework, statutory requirements, and Presidential Directives.

U.S. Environmental Protection Agency
Office of Research and Development, Homeland Security Research Program

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RAPID RADIOCHEMICAL ANALYTICAL METHODS DEVELOPMENT

The anticipated demand for analysis of pure alpha emitters such as ^{244}Cm in contaminated environmental samples resulting from a radiological dispersal device (RDD) scenario will present significant challenges to responding laboratories. Such a scenario will result in sample throughput demands orders of magnitude greater than levels that laboratories currently experience. This will quickly overwhelm their ability to provide the radioanalytical results needed to support decision-making.

Selected Analytical Methods for Environmental Remediation and Recovery (SAM) 2012, EPA/600/R-12/555, lists methods for select radionuclides to be used to evaluate the nature and extent of contamination and the effectiveness of decontamination. The curium methods listed in SAM are well-established, well-proven methods used for screening, compliance monitoring, and site-cleanup activities, but were not developed for cases where quickness and high throughput were concerns. Four of the methods currently listed in SAM to analyze curium samples were designed for the analysis of Americium-241 (^{241}Am). These methods only provide inferential instruction on how to analyze for curium isotopes. The one method that does provide instruction on analyzing for curium was designed for refractory (hard to dissolve) samples. It requires the use of equipment (platinum crucibles) that, for many laboratories, is prohibitively expensive and would be unavailable or available only in very limited quantities. Thus, sample throughput to analyze for curium would be extremely limited.

Development and use of rapid methods for curium by the ERLN-member federal, state, local, and commercial radiological laboratories, fulfills the need for consistent and accurate analysis when faced with a large number of samples over a short period of time. Using these methods will improve confidence in the data, permit sharing of the sample load between laboratories, improve data comparability, simplify the task of outsourcing analytical support to the commercial laboratory sector, and improve the follow-up activities of validating results, evaluating data, and making risk-management decisions. These rapid methods will also accelerate existing analytical throughput times so that each laboratory can process a larger number of samples per day.

This is the first issue of rapid methods for ^{244}Cm in water, air particulate filters, soil, and swipe samples. The methods are single-laboratory validated in accordance with EPA and industry guidance documents. Single laboratory validation testing shows that the methods can achieve required objectives that are based on conservative risk or dose values for the intermediate and late phases of an emergency response. The methods also have been tested to determine the time within which a batch of samples can be analyzed. For the matrices of interest, analysis results for a batch of samples contaminated with ^{244}Cm can be provided to the field within: 7.75 hours for water samples; 10 hours for air particulate filters; 9.75 hours for soil samples; and 11.25 hours for swipe samples. Table 1, provides information for each matrix type.

Table 1: Curium-244 Environmental Methods*

Matrix	Analytical Action Level (AAL)	Minimum Detectable Concentration (MDC)**	Estimated Time to Obtain Sample Analysis Results
Water	15 pCi/L	1.5 pCi/L	7.75 hours
Air Filters	11 pCi/filter	0.25 pCi/filter	10 hours
Soils	5.1 pCi/g	0.66 pCi/g	9.75 hours
Swipes	0.39 pCi/swipe	0.065 pCi/swipe	11.25 hours

* Information in table taken from the methods listed below.
**pCi = picocurie

These new methods will accelerate the analytical turnaround time necessary leading to quicker sample processing. They also provide quantitative results that meet measurement quality objectives. The methods are designed to be used during the intermediate and late phases of the emergency response to a nuclear or radiological incident of national significance, such as the detonation of an improvised nuclear device or a radiological dispersal device. It should be noted that these methods were not developed for compliance monitoring and they should not be considered as having EPA approval for that or any other regulatory program.

LINKS TO CURIUM-244 METHODS

- *Rapid Radiochemical Method for Curium-244 in Water for Environmental Remediation Following Radiological Incidents*, EPA 402-R16-xxx, Revision 0, MONTH 2016

- *Rapid Radiochemical Method for ^{244}Cm in Air Particulate Filters, Swipes and Soil*, EPA 402-R16-xxx, Revision 0, MONTH 2016

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