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BIOEMISSIONS FROM MEDICAL WASTE TREATMENT TECHNOLOGIES: EVALUATION OF INDICATOR MICROORGANISM RECOVERY

FINAL DRAFT REPORT

Prepared for:

Office of Solid Waste
U.S. Environmental Protection Agency
Washington, DC 20460

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DISCLAIMER

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 15 1996

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

Subject: Background Documents to the Final Report to Congress on Medical Waste Management in the United States

From: David Bussard, Director
Characterization and Assessment Division

To: Bruce Jordan, Director
Emission Standards Division

This memorandum is to notify your office that the Office of Solid Waste is releasing a draft document to OAR Docket #: A-91-61 (New Source Performance Standards for Medical Waste Incinerators). This document is entitled Bioemissions from Medical Waste Treatment Technologies: Evaluation of Indicator Microorganism Recovery. This document is a contractor report prepared by Research Triangle Institute for the Office of Solid Waste.

This document is considered background supporting EPA's Final Report to Congress on Medical Waste Management in the United States (FRC) which has not yet been released from the Agency. The document has been peer reviewed by scientists within the Agency and by scientists at several outside agencies and their comments and concerns have been addressed. The FRC and the accompanying background documents, however, have not yet been through Red Border review. Because the document has not received final Agency clearance, information and data contained in the document does not represent official Agency policy.

I hope you find the information contained in this report useful in developing your final rulemaking.

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READER INFORMATION

This document is a contractor report prepared by Research Triangle Institute for the Office of Solid Waste. This document is considered a background document to EPA's Final Report to Congress on Medical Waste Management in the United States (FRC) which has not yet been released from the Agency.

The studies presented in this document were performed in 1992. Technologies available on the market today from these manufacturers and others in the field may be very different from those in the reports. The purpose of the studies was to identify potential emissions points of microbial agents from available medical waste treatment technologies. Because numerous factors other than microbial inactivation are important when choosing a technology, the reports do not propose to rank these technologies, but merely to present the data gathered during the studies.

The FRC, including this and other background documents, have not yet undergone final Agency administrative review process. Therefore, information and data contained in this document are NOT considered official Agency policy and should NOT be inferred to reflect approval by the Agency at this time.

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ABSTRACT

Microorganisms present in medical waste treatment systems represent a broad spectrum of groups ranging from frank pathogens to innocuous forms present in indoor and outdoor environments. Environmentally stable and innocuous spores of thermophilic *Bacillus stearothermophilus* (BST) and the mesophilic *B. subtilis* var. *niger* (BSN) were chosen for use as indicators in studies of biological emissions from medical waste treatment technologies. Before monitoring for bio-emissions from medical waste treatment, it was necessary to determine: 1) that each indicator microorganism could be effectively recovered from the same sample mixture; 2) that spore viability could be preserved during sampler operations, and; 3) that the loss of collected spores could be minimized during monitoring.

Typical BST colonies are cream-colored and grow at 55°C, while BSN colonies are pigmented orange and will not grow at elevated temperatures. Pure and mixed cultures of BST and BSN spores were plated onto five different agar media and incubated five days at 37°C (BSN) and 55°C (BST). Resultant colony counts for both spore types were greater on Trypticase Soy Agar (TSA) than on Beef Extract Glucose agar (BEGA), Nutrient Agar (NA), Tyrosine agar (TYR), or FDA Bacteriostasis agar. No interference was observed in mixed cultures when plates were incubated at selective temperatures for each target organism. BSN colonies produced black pigmentation on TYR after 72 hrs, while the most intense orange pigment production occurred on BEGA.

Survival of non-injured spores during operation of AGI-30 standard impingers was monitored over a 1-hr period. At 20 mins, mean BSN survival was 26%, and declined to 5% and 11% at 40 and 60 mins, respectively. Mean BST survival was 89% at 20 mins, declining to 75% and 62% at 40 and 60 mins, respectively. Heating all spores to 100°C for 20 mins to simulate medical waste treatment by thermal inactivation destroyed BSN viability, but 81% of heat exposed BST spores survived for 20 mins in operating impingers.

Losses due to spore slippage through the impingers were also evaluated. Mean spore recovery from impingers sampling the exhaust of other impingers, seeded with approximately 3×10^4 CFU each of BST and BSN, was 0.2% for BSN and 0.3% for BST.

Laboratory results indicate the suitability of BST and BSN spores for use in monitoring emissions from medical waste treatment processed. Both can be selectively grown on TSA from mixed cultures and BSN can be confirmed by intense orange or black colony color using additional media. Both species survive in impingers during operation, and minimal slippage of viable spores occurs. It is recommended, that for optimum airborne organism recovery using the AGI-30, that sampler operation not exceed 20 minutes.