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The Slinger can literally sling biosolids 80-100 feet through the air. Scientists at the University of Arizona in Tucson have produced evidence that Staphylococcus aureus is not present in biosolids that are properly treated using conventional methods.

Biosolids Safe for Land Application, UA Researchers Find

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For at least two decades, wastewater treatment plants have produced what they refer to as Class A and Class B biosolids, the organic residues that result from specific treatment of sewage.

Biosolids are frequently applied directly to cropland, pastures or timberland, where they decompose, furnishing nitrogen, phosphorus and potash to growing plants. This method offers a more ecologically sound and practical alternative to domestic waste disposal than landfills or incineration, that may result in water or air pollution.

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Over the past 18 months questions have arisen over whether Staphylococcus aureus, a human

disease pathogen present in raw sewage, remains in treated biosolids, with the potential for causing illness. S. aureus has an infamous reputation, and causes a wide variety of human skir and wound infections, food poisoning, septicemia, toxic shock syndrome, pneumonia, meningiti and other infections.

But in a recent study, scientists at the University of Arizona in Tucson have produced evidence that S. aureus is not present in biosolids. Their report will appear in the October print issue of the journal Environmental Science and Technology (ES&T Vol. 37:October). An electronic version of the report was released on the Environmental Science and Technology Web site on July 26.

Air samples also were test

Chemically and biologically different from raw sewage, biosolids must meet "Part 503" of the federal EPA standards with regard to pathogen and heavy metal content, handling and application precautions, and otl regulations.

"Sixty percent of all biosolids are land-applied in the United States, but this amount covers less than 0.1 percent of agricultural land," says Ian Pepper, a professor in the UA department of soil and water science and director of the UA National Science Foundation Water Quality Center (WQC, see sidebar).

The center has gained national recognition, with the EPA using WQC studies on land applicatio of biosolids as a response to a 2002 National Academy Science report on land application.

In July 2002, following an 18-month study, the National Academy of Sciences (NAS) issued a report stating there is "no documented, scientific evidence that the Part 503 rule has failed to protect public health regarding land application of biosolids." At the same time, NAS noted that "additional scientific work is needed to reduce persistent uncertainty about the potential for adverse health effects from exposure to biosolids."

Since no scientific data were available to document whether biosolids specifically contain S. aureus, Pepper and colleagues Patricia Rusin, Sheri Maxwell, John Brooks and Charles Gerba studied biosolid and bioaerosol samples from 15 separate sites across the United States.

"As the saying goes, 'Absence of evidence isn't evidence of absence,'" Pepper says. "Our study focused on finding the scientific evidence regarding the presence or absence of S. aureus in

biosolids and bioaerosols."

The sample sites ranged from the East Coast to the Southwest, and all were full-scale treatmer plants. No pilot plants were included in the study. The researchers took samples of raw sewage and untreated primary sewage sludge in sterile bottles and transported them on ice to their laboratory. They also collected biosolid samples at the production site and transported the samples on ice in sterile containers overnight to the laboratory. Each sample was assayed for S aureus the day it was received.

Pepper and the others also collected the bioaerosol samples from four sites in the southwestern United States using commercial land applicators.

"We evaluated the potential for bioaerosols from biosolids with a higher solids content using applicators called 'slingers,' which literally sling biosolids 80-100 feet through the air," Pepper says.

This spray tanker travels at 3 mph while it unloa 4,250 gallons of biosoli

"For liquid biosolids (which have a lower solids content) the material was sprayed from a tanker. In either case we had aerosol samplers hooked up to pumps so that known volumes of air were sucked into a collection fluid, which is later analyzed using cultural assays."

The scientists analyzed all bioaerosol samples for S. aureus within 24 hours of collection. In all, the team analyzed three raw untreated sewage samples and two undigested primary sewage sludge samples, 23 different biosolid samples, and 27 aerosols obtained during biosolid land application (biosolid aerosols).

"We detected S. aureus in samples of raw sewage and undigested primary sewage sludge," the scientists state in their report. "However, we did not detect S. aureus in Class A or Class B biosolids after aerobic or anaerobic digestion, lime stabilization, heat-dry pelleting and/or composting." These are conventional methods that treatment plants use to remove disease-causing organisms from raw sewage.

"You can find S. aureus in sewage and you should be able to, because one in three people hav in their systems," Pepper says. "Yet it should be noted that none of the biosolid or biosolid aero samples in our study were positive for S. aureus. The most likely explanation is that wastewater treatment kills S. aureus along with other pathogenic microbes."

Pepper notes that allegations regarding the safety of biosolids are often not based on good science.

"Overall we need more scientific studies to resolve potential issues of concern," Pepper says. "C study was science-based and indicates that biosolids are an unlikely source of S. aureus."

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SIDEBAR: The Water Quality Center

The National Science Foundation Water Quality Center at the University of Arizona investigates physical, chemical and microbial processes that affect the quality of surface and subsurface waters, including potable supplies.

Housed in the UA College of Agriculture and Life Sciences Environmental Research Laboratory Tucson, the center includes an interdisciplinary group of biologists, chemists, physicists, hydrologists and engineers who work together to resolve water quality problems. Undergraduat and graduate students also participate in conducting research and publishing and presenting papers.

Funding for the center comes from companies and agencies interested in specific water quality issues, and from the National Science Foundation.

Research areas focus on water security; the fate and remediation of commercial and industrial contamination; agrochemical products and practices that influence water quality; municipal was treatment and reuse; mining; and potable water quality.

For more information see http://wqc.arizona.edu