

Research: EPA has an ongoing biosolids research program focused on selected pathogens, and is expanding this program during this fiscal year. Future pathogen research will be determined by the results of ongoing studies that will inform the Agency about significant issues and information gaps that require additional work. Presently, the Agency is considering research in at least three general areas: (1) Development of improved pathogen analytical techniques; (2) assessment of exposure and risk for critical pathways and pollutants, and (3) evaluation of sewage sludge processing and land application methods and site restrictions. Results of such research will assist the Agency in determining where improvements may be needed.

Pathogen Activities

In June 2001, EPA and USDA sponsored a workshop on "Emerging Pathogen Issues in Biosolids, Animal Manures, and Other Similar By-Products" (USEPA 2003 in press). The workshop assembled experts in biosolids and animal waste management to review the state-of-the-science, resolve persistent and complex issues, and provide suggestions for research. The workshop considered: viruses, bacteria, protozoa, prions, fungi, and helminth ova; migration of pathogens to groundwater and air from recycling and treatment operations; qualitative identification and detection methods for pathogens; the fate of antibiotics in animal and human wastes; pathogen resistance to antibiotics; and susceptibility of people with immunosuppressed conditions to pathogens.

A discussion of recently initiated EPA work concerning pathogens at five biosolids and three animal manure production and/or application sites is provided in the previous Exposure category.

The Agency has completed and is conducting additional studies on exposure and occurrence of disease which are described in the Risk Assessment and Human Health subsections of this Section VII. In a collaboration with Duke University, EPA has also published a report on the relationship between odor from animal and waste water residuals processing facilities and land application sites and potential health effects (Journal of Agromedicine, Volume 7(1), 2000, ISSN: 1059-924X). The report summarizes the state of knowledge on ambient odor health effects with emphasis on animal manure and biosolids odor emissions. Potential mechanisms for health symptoms, methods for validating health symptoms, presence of odor, and

efficacy of odor management are discussed. The importance of health effects was found to be dependent upon a number of factors, and health impacts may be minimized using odor remediation methods.

The University of Arizona's, National Science Foundation, Water Quality Center (<http://www.wqc.arizona.edu>) has conducted, and is planning to conduct, pathogen studies in biosolids including: (1) Air transmission of pathogens from land application, (2) potential occurrence of *Staphylococcus aureus*, (3) fate and transport of pathogens, and (4) risk assessments for pathogens in land applied biosolids. These studies will evaluate various application sites, terrain, climate, and potentially affected nearby populations. The researchers involved in this study plan to model the transmission of pathogens to estimate exposure for nearby human populations, which may ultimately allow the development of predictive risk assessment protocols. EPA will monitor these studies as they develop over at least the next two years to determine their relevance to the National biosolids program.

EPA's Pathogen Equivalency Committee (PEC): The Agency formed and has supported the PEC since 1985. PEC members provide guidance to applicants, permitting authorities and members of the regulated community on sampling and analysis issues related to meeting the subpart D requirements of part 503 (pathogen and vector attraction reduction). The PEC currently consists of representatives from EPA and the Centers for Disease Control and Prevention (CDC). The members have expertise in bacteriology, virology, parasitology, wastewater engineering, medical and veterinarian sciences, statistics, and sludge regulations. The PEC evaluates and supports development of alternative treatment technologies by consulting with local communities, States, industry and others stakeholders. The PEC provides information on biosolids processes, contaminant occurrences, and exposure, and assists EPA regions, States, and the regulated industry with questions about equivalency for Processes to Significantly Reduce Pathogens (PSRP) and Processes to Further Reduce Pathogens (PFRP) under 40 CFR part 257 and part 503. If the PEC recommends that a process is equivalent to PSRP or PFRP, the operating parameters and any other conditions critical to adequate pathogen reduction are specified.

The Water Environment Research Foundation (WERF), with contributions from EPA, is funding a diverse research

program to support the wastewater treatment industry. An important part of their program has been supporting research on biosolids that has been aimed at reducing uncertainties and hence is significant with respect to the NRC recommendations. Treatment plant residuals and biosolids, including pathogen issues, have consistently ranked among the top five priorities for WERF subscribers over the past decade. WERF biosolids research entails more than 40 basic and applied projects to reduce uncertainties, better manage biosolids, assess public perception of risks, and develop strategies for biosolids treatment and management. Much of WERF's research is focused on the beneficial uses of biosolids. The Research of particular interest includes methods for rapidly detecting pathogens. EPA plans to continue to review and evaluate such research projects as they are completed to determine their relevancy to the national biosolids program.

Other studies supported by WERF are intended to determine biosolids land application rates. Phosphorus overload in animal manure and biosolids is a particular concern. These studies are evaluating phosphorus bioavailability and Class A and Class B pathogens to determine potential impact on groundwater and other environmental media. WERF is convening a biosolids research summit in the summer of 2003. A WERF pre-summit will provide training about mutual gains activities and joint fact finding, and will develop a protocol for guiding the assistance of an information sharing group (comprised of the concerned citizens, as well as stakeholders) in recommending WERF-sponsored research and oversight needs. EPA plans to collaborate with WERF and the USDA to sponsor an international conference on sustainable land application for municipal and industrial effluents, manures, biosolids and other non-hazardous wastes. The conference, scheduled for January 2004, will provide information and perspectives on research gaps and needs. Detailed information on the WERF biosolids research program may be accessed at <http://www.werf.org>.

Planned Pathogen Activities

Quantitative Microbial Risk Assessment (QMRA): EPA and WERF are funding research termed "QMRA", as described in "A Dynamic Model to Assess Microbial Health Risks Associated with Beneficial Uses of Biosolids" (WERF 2003, Cooperative Agreement No. CR-825237). The organizations involved in this research include WERF, the University of