RADIOACTIVITY FACT SHEET

Issue: Can radioactive material concentrate in biosolids and incinerator ash and pose a threat to the health and safety of workers or the public?

Answer: Based on studies and available information the levels of radioactive materials detected in biosolids and incinerator ash indicate that at most POTWs, radiation exposure to workers or the public is very low and is not of concern.

What is radioactivity?
Radioactivity is the property possessed by some elements (such as uranium) or isotopes (such as carbon-14) of spontaneously emitting energetic particles (such alpha particles, beta particles, or gamma rays) by the disintegration of their atomic nuclei.

Why is radioactivity a concern?
Radioactive materials include natural and man-made radioisotopes. These radioisotopes emit energetic particles that can affect human health. On an average 80 percent of human exposure to radiation comes from natural sources such as radon, radium, and potassium-40. The other 20 percent comes from man-made sources, primarily x-rays.

Why is radioactivity of interest to wastewater treatment operations?
Radioactive materials are a component of the natural environment and are also concentrated or produced through human activities. Generally, the presence of radioactive materials is a concern only when concentrations become sufficiently elevated above normal background levels. The release or use of radioactive materials could result in elevated levels entering the treatment plant resulting in concentration levels that could and potentially pose a health risk and impact the ability of a POTW to use or dispose of the biosolids or ash.

What are the likely sources of radioactive materials entering the POTW?
There are three general sources of radioactivity in our environment that may enter wastewater treatment systems:

1. Naturally-occurring radioactive materials (NORM) are natural sources of radiation, and include geologic formations and soils that contain uranium, radium, radon, and other nuclides that are radioactive. NORM can be either dissolved in or attached to suspended solids in the water.
2. Technologically-enhanced naturally-occurring radioactive materials (TENORM) may be introduced into the sewer system from ground and surface water, plants and food, and industrial dischargers.
3. Man-made sources include materials produced for, and as a result of the operation of nuclear reactors and fuel cycle facilities; and produced from accelerators, industrial activities, scientific research, and medical applications. Other man-made sources can result from nuclear accidents, or fallout from weapons testing.

Are these sources regulated?
Yes. The primary division of regulation is based on the origin of the radioactive material. Man-made radioactive materials are regulated differently from NORM and TENORM. The lead agency for the regulation of NORM and TENORM is the EPA. Man-made materials are regulated by the Nuclear Regulatory Commission (NRC) under the authority of the Atomic Energy Act (AEA).

Can radioactivity be found in biosolids or ash?
Yes. National survey results indicated that biosolids and ash samples primarily contained NORM such as radium. With the exception of NORM, most other samples were at or near the limit of detection. Based on the survey results, the levels are generally comparable to what is found in other media such as soil and fertilizer.

Are the levels of radioactive materials potentially present in biosolids or ash considered harmful to the worker or public? No. According to dose modeling evaluations, the levels of radioactive material detected in biosolids and ash indicated that at most POTWs radiation exposure to workers or the general public through biosolids use is very low and consequently, is not likely to be a concern.

Are there any instances of elevated radioactive materials in biosolids or ash?
Yes. Elevated levels of radioactive materials were found in biosolids and ash samples at a few treatment plants. These elevated levels were considered isolated, site-specific instances. Available information indicate that there have not been any known occurrences of such elevated concentrations (those sufficiently elevated above background levels to potentially pose a health risk) of radioactive materials in biosolids and ash since the 1980s. No widespread public health concern has been identified because no excessive concentrations of radioactivity have been observed in biosolids or ash.

When should a POTW test its biosolids or ash for radioactive materials?
First, the facility or POTW should contact their State Radiation Control Agency and the EPA regional radiation program managers to help determine if significant sources of NORM or TENORM are present in their service area. Potential licensed sources of man-made radioactive materials using radioactive materials that may be discharged to the sewer system should also be indentified and contacted to determine if they are discharging radioactive materials or if any accidental releases have occurred.

If potential or actual radioactive sources are identified what actions should a POTW take?
The facility should determine if monitoring or sampling of the biosolids or ash is required based on the identified or potential sources in the service area. The following questions should be used to assess if sampling or monitoring is necessary:

1. Have elevated levels of uranium and radium occurred in soils, bedrock, or groundwater in their service area?
2. Are there drinking water treatment plants located in the service area that may discharge residuals into the sewer system from treatment of source water to comply with EPA drinking water levels for radium, and uranium or for alpha and beta emitting radionuclides**?**
3. Are there industrial facilities (such as ceramics, electronics, minerals or metal fabrication, paper and pulp, metal foundry and engine manufacture, munitions and armament manufacturing, luminous watch and clock manufacture, cement or concrete, optics, electric lighting, gypsum board manufacture, welding, paint and pigment, or fertilizer manufacture) located in the service area that discharge significant quantities of untreated process wastewater into the sewer system? All of these industries have been associated with the use of TENORM materials or production of TENORM wastes.
4. Are there many or significant NRC or state licensees, Department of Energy facilities, or Department of Defense facilities such as medical, medical laboratories, research and development colleges and universities, nuclear laundries, decommissioning facilities for byproducts material facilities, UF_6 production plants, hot cell operations, uranium enrichment plants, or uranium fuel fabrication plants located in the service area that discharge significant quantities of untreated process wastewater into the sewer system?

If a POTW determines that monitoring or sampling is necessary, what type of program should be developed?
An initial gamma scan and gross alpha and gross beta screening determination should be performed. This screening tool is inexpensive and can be useful if further analysis is required. If NORM or TENORM is suspected in the biosolids or ash, a gross alpha and beta screen can be performed. If atomic energy radioactive material is suspected, gamma spectroscopy should be performed. All analysis should be performed on a dry weight basis. To obtain a quick result for radon a short-term test (2 days to 90 days) should be performed. Some detectors that could be used include: "charcoal canisters", "alpha track," "electret ion chamber," "continuous monitors," and "charcoal liquid scintillation detectors." A long-term test (more than 90 days) is more reliable and provides a reading that is more likely to yield the year round average radon level. EPA has developed a **POTW Sludge Sampling and Analysis Guidance Document** "http://www.epa.gov/npdes/pubs/owm012.pdf" that provides sampling information.

How do I evaluate the results from the monitoring or sampling?
The POTW should perform screening calculations and assess the potential exposure to workers at the POTW and potential exposure at the land application sites. (See **ISCORS Technical Report 2004**, Chapter 6 on ***How Can A POTW Operator Interpret Levels of Radioactivity Detected in the Plant?*** – "http://www.iscors.org/pdf/FinalRecommendations.pdf" – for guidance on conducting screening calculations). The screening process will help identify and address any potential radiological exposures associated with biosolids or ash management practices and will provide guidance for determining whether further actions are needed to ensure public and worker health and safety. The POTW should compare estimated doses to existing regulatory standards when performing the screening process. The screening calculations are based on a dose equivalent of one (1) millirem/year per source or practice. If findings from the screening calculations show an annual dose from all radionuclides detected in the biosolids or ash sample is 10 millirem or less, no further steps are warranted. If the annual dose of the samples evaluated is greater than 10 millirem per year, the POTW should perform additional sampling to further evaluate the results.

What if the annual dose from my screening is greater than 10mrem per year?
If screening calculations suggest that potential doses are greater than 10 mrem per year, the POTW may want to conduct a more thorough evaluation of the levels detected in the biosolids, ash, or indoor air, based on site-specific conditions. The evaluation may involve additional sampling or monitoring, use of modeling scenarios developed by current available dose modeling projects and substitution of actual site-specific input data, creation of more directly applicable modeling scenarios than those used in current available dose modeling projects, or actual physical surveys of potentially affected areas of the POTW or other biosolids or ash management locations. The results of the management locations should be reported to the state radiation control program to determine appropriate standards for comparison.

Where can I get more information?
More information about radioactivity in biosolids can be found at: http://www.iscors.org/subcomms/sewage.html – Look for the documents listed under "**Library**". EPA's Map of Radon Zones can be found at: http://www.epa.gov/iaq/radon/zonemap.html.