United States General Accounting Office

GAO

Testimony

Before the Committee on Governmental Affairs,
United States Senate, and the Environment,
Energy, and Natural Resources Subcommittee,
Committee on Government Operations,
House of Representatives

For Release on Delivery
Expected at
9:30 a.m. EDT
Tuesday
June 21, 1994

NUCLEAR REGULATION:

Action Needed to Control Radioactive Contamination at Sewage Treatment Plants

Statement of Jim Wells
Associate Director, Energy and Science Issues
Resources, Community, and Economic
Development Division

060299/151960

Messrs. Chairmen and Members of the Committee and the Subcommittee:

We are pleased to be here today to discuss the results of the work that we performed for you on the radioactive contamination of sludge and ash (incinerated sludge) at sewage treatment plants. Radioactive materials are sometimes discharged into municipal sewer systems by facilities such as hospitals, decontamination laundries, research facilities, and manufacturers that are licensed by the Nuclear Regulatory Commission (NRC). NRC is responsible for regulating these licensees to ensure the safe use and control of radioactive materials and limit the public's exposure to radiation.

Our testimony is based on our report, which is being released today, entitled Nuclear Regulation: Action Needed to Control Radioactive Contamination at Sewage Treatment Plants (GAO/RCED-94-133). For today's hearings, you asked us to discuss (1) what is known about the extent of the radioactive contamination at treatment plants resulting from discharges by NRC's licensees, (2) what NRC and others are doing to limit and monitor the radioactive material that ends up in the sludge and ash at treatment plants, and (3) NRC's actions to determine whether treatment plant workers and the public are being exposed to radioactively contaminated sludge and ash.

In summary, our report raises concerns that NRC's regulations may not be adequate to control low-level radioactive materials discharged into municipal sewer systems, possibly putting treatment plant workers, plant property, and the general public at risk. Over the last 10 years, at least nine cases of radioactive contamination of sewage sludge have occurred at treatment plants. One of the most recent was the inadvertent discovery by NRC in 1991 of radioactive contamination (cobalt-60) at the Southerly Sewage Treatment Plant in Cleveland, Ohio. NRC has concluded, after some testing, that the site does have elevated levels of radiation but poses no health or safety risks to treatment plant workers or to the public. According to Southerly officials, the facility has already spent over $1.5 million for on-site cleanup activities and a security fence. Estimates for off-site disposal range as high as $3 billion.

The full extent of contamination at other treatment plants nationwide is unknown because (1) NRC has inspected only 15 of the approximately 1,100 NRC licensees that may discharge radioactive material to treatment plants to determine if a concentration problem exists, (2) NRC does not know how many of the estimated 2,000 "agreement state"[1] licensees may have been inspected, and (3) neither NRC nor the Environmental Protection Agency (EPA) requires treatment plants to test for the presence of radioactive materials in sewage sludge. NRC has revised its regulations so that, as of

---

[1]Agreement states are states that, through agreements with NRC, have assumed the role of NRC in monitoring and regulating the radioactive materials covered under the agreements.

January of this year, all licensees have to reduce the concentration level of radioactive material they can discharge to treatment plants, and certain types of licensees' discharges were eliminated. However, because of its uncertainty about how radioactive materials concentrate during the sewage treatment process, NRC does not know how effective this action will be. NRC is sponsoring a study to determine the impact of its revised regulation and also issued an advance notice of proposed rulemaking in February 1994 seeking information to determine if it needs to further amend its regulations. Messrs. Chairmen, we question why NRC did not develop this information earlier, since our review showed that NRC was aware of the problem as early as 1984.

Exposure to treatment plant sludge, ash, and related by-products can occur in a variety of ways. For example, some of these substances are used for agricultural and residential purposes, such as fertilizer for lawns or gardens. NRC believes that no imminent health risk exists for the treatment plant workers or the general public. NRC and EPA studies conducted to determine the health impacts on workers and the public of radioactive materials in sewage sludge and ash have been inconclusive.

Before discussing these issues, we would like to provide some background information on NRC's activities.

BACKGROUND

NRC issues licenses under the Atomic Energy Act of 1954, as amended, to individuals and entities such as hospitals, research facilities, decontamination laundries, and manufacturers of smoke detectors and other devices and materials. Under NRC's regulations, these licensees are permitted to dispose of small quantities of radioactive materials in their sewer lines, which are connected to sewage treatment plants. NRC regulates approximately 8,000 licensees in 21 states.[2] NRC also provides the regulatory basis for 29 agreement states to regulate approximately 16,000 licensees.

NRC and EPA have a regulatory interest in the radioactive materials discharged into sewage treatment plants and the subsequent use and disposal of sewage sludge, ash, and related by-products. NRC is responsible for the low-level radioactive materials discharged by its licensees and for protecting both the workers employed by its licensees and the general public from exposure to these materials. EPA regulates certain aspects of the sewage treatment plants' operations, such as discharges to the

---

[2]NRC-regulated states are Alaska, Connecticut, Delaware, Hawaii, Idaho, Indiana, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Jersey, Ohio, Oklahoma, Pennsylvania, South Dakota, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

plants and the disposal of sewage sludge and ash. States and localities may impose additional regulations.

RADIOACTIVE CONTAMINATION REPORTED AT SEVERAL TREATMENT PLANTS

One of the most recent and significant cases of radioactive contamination at treatment facilities occurred at the Southerly Sewage Treatment Plant in Ohio. In the last 10 years, at least nine cases of radioactive contamination at treatment plants resulting from discharges by NRC's and agreement states' licensees into municipal sewage systems has been reported.

In April 1991, while conducting an aerial radiological survey of a licensee's site (Chemetron Corporation), NRC inadvertently discovered elevated levels of radiological contamination (cobalt-60) at the Northeast Ohio Regional Sewer District's Southerly Plant, which serves the greater Cleveland area. According to NRC's documentation, the most likely source of the radioactive material was an NRC licensee that discharged waste into the sewer lines that are connected to the treatment plant. Of 492 soil samples taken at the Southerly plant, 133 samples, or 27 percent, exceeded NRC's acceptable level for radiation in soil. The cobalt-60 concentrations ranged from less than 0.1 to about 31,200 picocuries per gram[2] (pCi/g) for soil samples--a single sample was measured at 3 million pCi/g. NRC's criterion for unrestricted use (no need for future regulatory control by NRC) is 8 pCi/g for cobalt-60.

NRC concluded that the site poses no imminent health or safety risks to treatment plant workers or to the public because of a variety of factors, such as limited public access to the property. An NRC official told us that the site may need to be monitored for as long as 50 years if on-site disposal of the contaminated soil is permitted. According to a Southerly official, the facility had already spent over $1.5 million as of May 1994 for activities related to on-site cleanup and for a security fence. And, according to Southerly officials, if NRC or the State of Ohio does not approve on-site disposal of the contaminated soil, the cost of off-site disposal could be as high as $3 billion.

Other Reported Cases of Radioactive Contamination

Radioactive contamination was also discovered at eight sewage treatment facilities located in Tonawanda, New York; Grand Island, New York; Oak Ridge, Tennessee; Royersford, Pennsylvania; Erwin, Tennessee; Washington, D.C.; Portland, Oregon; and Ann Arbor, Michigan. To determine whether the levels of radiation found at these sites posed a health or safety risk to the public, NRC

---

[2]A picocurie is one-trillionth of a curie, which is a measure of the rate of radioactive decay.

sponsored a study involving five of these eight treatment plants. The 1992 study concluded that the levels "may not be trivial" and were high enough to justify further study.[3] The levels of radioactive materials discovered at these plants and the costs to resolve the problem varied significantly.

THE FULL EXTENT OF RADIOACTIVE CONTAMINATION AT TREATMENT PLANTS NATIONWIDE IS UNKNOWN

The full extent of the radioactive contamination of sewage sludge, ash, and related by-products nationwide is unknown. Neither NRC nor EPA has conducted or required testing to determine the extent of the radioactive contamination occurring at treatment plants that receive radioactive discharges. NRC estimated that before January 1, 1994, 1,100 of the 8,000 NRC-regulated licensees and 2,000 of the 16,000 agreement state licensees had the potential to discharge into sewers radioactive materials that could concentrate at treatment plants.

NRC periodically inspects its licensees to ensure compliance with the requirements for discharges of radioactive materials. As part of the inspection, NRC reviews the licensee's records to ensure that the discharges are in accordance with the authorized limits. However, these inspections generally do not include a survey of the sewer lines connecting the licensee to a treatment plant or of the treatment plant itself. Of the 1,100 licensees, we found that only 15 NRC inspections included a survey of the sewer lines connecting the licensee to its treatment plant to determine if a concentration problem exists.

Agreement states, not NRC, are responsible for inspecting their states' licensees. An NRC official did not know at the time of our review how many of the 2,000 such licensees that discharge radioactive materials to treatment plants may have been inspected by the states for concentrations of radionuclides.

To determine whether treatment plant officials were aware of the problem of radioactive materials' concentrating in sludge and ash, we contacted a treatment plant in each of the 21 NRC-regulated states. We found that only 5 were aware of the problem and only 5 have tested for radiation. None are testing on a regular basis, and some had not tested recently.

---

[3]Evaluation of Exposure Pathways to Man From Disposal of Radioactive Materials Into Sanitary Sewer Systems, Pacific Northwest Laboratory, May 1992.

NRC MAY NOT ADEQUATELY REGULATE RADIOACTIVE MATERIALS AT TREATMENT FACILITIES

Messrs. Chairmen, the problem of radioactive contamination of sludge and ash in the nine reported cases was the result, in large part, of NRC's former regulation. In 1991, NRC revised its regulation that controls licensees' discharges to sewer systems. The revised regulation, which became effective for all licensees on January 1, 1994, eliminated certain types of licensees' discharges and reduced the concentration levels of the radioactive material they can discharge into a sewer system. Also, it will no longer allow insoluble discharges, such as the form of cobalt-60 that was found at the Southerly plant, because this type of discharge can concentrate in sludge and ash.

Under NRC's former regulation, NRC permitted its licensees to discharge radioactive materials into treatment plants within certain specified limits, provided that the materials were "readily soluble or dispersible in water." NRC assumed that the radioactive materials discharged into a sewer system would remain in solution or would readily disperse in the large volumes of water discharged by the treatment plants and would become almost undetectable. NRC further assumed that the radioactive materials would pass through the treatment facilities' systems to streams and rivers and not settle out in the sludge. However, at some licensees' sites the materials discharged that were initially thought to be readily dispersible precipitated out of the wastewater and concentrated. For example, in the Southerly case the cobalt-60 in oxide form, originally expected to disperse, concentrated during the sludge treatment process and accumulated in higher concentrations after it was incinerated.

Impact of New Regulation Is Unknown

Because NRC is uncertain about how radioactive materials concentrate during the sewage treatment process, the full impact that the revised regulation will have on preventing the problem is unknown. Recognizing that the current regulation could fall short of addressing the problem, NRC in September 1993 contracted for a year-long study to examine the impact of the current regulation on preventing the recurrence of significant incidents of concentration. The contractor is to examine the physical and/or chemical processes leading to the concentration of radionuclides released to treatment plants under the older regulation in order to determine if the new regulation will prevent its recurrence. The contractor is also to suggest strategies for changes in NRC's sewer disposal regulations if the new regulation is found to be insufficient. One option that NRC suggested would be to prohibit the release of radionuclides into sewer systems. NRC has also issued an advanced notice of proposed rulemaking seeking information to determine whether it needs to further amend its regulation.

Why Agencies Have Not Required Testing

NRC has the authority to promulgate rules and issue such orders as it may deem necessary to protect the public health and safety from regulated radioactive materials. According to NRC's Deputy General Counsel for Licensing and Regulation, this authority may be applied to unlicensed persons or entities, such as a treatment plant, if necessary to protect the health or safety of the public. However, generally NRC would not issue an order to require testing at a treatment plant unless some previous evidence of a problem existed. It appears that NRC does not view the reported nine cases of treatment plant contamination as enough evidence to justify nationwide testing of those treatment plants receiving radioactive discharges from NRC's licensees.

EPA is the agency most knowledgeable and closely associated with treatment plants. However, EPA's Principal Deputy General Counsel informed us that EPA does not have the authority to directly regulate the concentration of radioactive materials subject to the Atomic Energy Act that may be found in treatment plants' sewage sludge and ash. The official also informed us that EPA does have the authority under the Atomic Energy Act of 1954, as amended, and the Reorganization Plan No. 3 of 1970 to establish generally applicable environmental standards for the protection of the general environment from radioactive materials. However, EPA has not determined whether this authority would allow it to conduct testing at those treatment plants most likely to be affected by discharges from NRC's licensees. Although EPA officials have not concluded that the radioactive contamination at treatment plants poses a serious health or safety problem, they told us that they would be willing to work with NRC to assess the extent to which it is a problem.

TREATMENT PLANT WORKERS AND PUBLIC MAY BE EXPOSED TO RADIOACTIVE SLUDGE AND ASH, BUT HEALTH IMPACT UNKNOWN

Sewage sludge, ash, and related by-products from treatment plant operations are used and disposed of in a variety of ways that may possibly expose treatment plant workers and the public to radiation. Some of the sludge and ash by-products are used for agricultural and residential purposes, as fertilizer for lawns and gardens, for instance. Sludge and ash can also be disposed of on-site at the treatment plant or off-site at a landfill. For example, discussions with officials from the 21 treatment plants we surveyed indicated that many disposed of sludge and ash off-site, in some cases using more than one disposal method. Thirteen treatment plants used a public landfill to dispose of their sludge and ash. Seven treatment plants disposed of at least some of their sludge for agricultural purposes. Two treatment plants sold sludge to landscapers, nurseries, or retail stores as compost. One treatment plant used ash as a surface material on baseball diamonds

because it absorbs water well. Another treatment plant is exploring the idea of using ash to make bricks or to pave streets.

The health implications for treatment plant workers and the public that come in contact with sewage sludge, ash, or related by-products are unknown because studies conducted to determine the impact of radioactive material in sewage sludge have been inconclusive. For example, NRC's 1992 study concluded that the levels at some treatment plants, while not an immediate health and safety risk, were not trivial and required further study. A 1986 EPA survey of the radioactivity in sewage sludge, on the other hand, merely documented instances of radioactive contamination in treatment plants' sludge and did not come to any conclusion.[4] Furthermore, on the basis of a 1986 review by NRC's Region I of eight licensees that discharged to sewage treatment plants, the chief of the region's Nuclear Materials Safety and Safeguards Branch recommended that NRC conduct a nationwide review of the concentrations of radioactive materials at treatment plants. His concern was that the public could be exposed to radioactive materials through sewage sludge applied to farmlands or to private lands and gardens.

CONCLUSION AND RECOMMENDATIONS

Messrs. Chairmen, despite the fact that over the last 10 years at least nine cases of radioactive contamination have been discovered at treatment plants, NRC has been slow to act to determine the extent of the problem nationwide and its potential impact on the health and safety of treatment plant workers and the general public. Because they are exposed to sewage sludge, ash, and related by-products in a wide variety of ways, NRC needs to ensure that those who are exposed are not receiving harmful levels of radiation. Although NRC believes that no imminent health risk exists for the treatment plant workers and the general public, on the basis of its 1992 report on radioactive materials' concentrating at five sewage treatment plants, both NRC and EPA officials agreed that further study is needed. If it is determined that additional measures are needed, NRC needs to examine the possible strategies for changing its current sewage disposal requirements.

In the interim, we recommended in our report that NRC determine the extent to which radioactive contamination of sewage sludge, ash, and related by-products is occurring. We also recommended that NRC notify treatment plants that receive discharges from NRC's and the agreement states' licensees of the potential for radioactive contamination and of the possibility that they may need to monitor sludge and ash for radiation. Finally, we

---

[4]Radioactivity of Municipal Sludge, Environmental Protection Agency, Apr. 1986.

recommended that NRC establish acceptable limits for radioactivity in sludge, ash, and related by-products to ensure the health and safety of treatment plant workers and the public. These recommendations are made with the intent to help NRC provide treatment plant workers and the public with a greater sense of confidence that they are being adequately protected from radioactive materials.

- - - - -

Messrs. Chairmen, this concludes my statement. I would be pleased to respond to any questions that you or Members of the Committee and Subcommittee may have.

(302125)

Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are $2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:

U.S. General Accounting Office
P.O. Box 6015
Gaithersburg, MD 20884-6015

or visit:

Room 1000
700 4th St. NW (corner of 4th and G Sts. NW)
U.S. General Accounting Office
Washington, DC

Orders may also be placed by calling (202) 512-6000 or by using fax number (301) 258-4066.

PRINTED ON RECYCLED PAPER

United States
General Accounting Office
Washington, D.C. 20548-0001

Bulk Mail
Postage & Fees Paid
GAO
Permit No. G100

Official Business
Penalty for Private Use $300

Address Correction Requested