New York's Radiation Control System

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HUMAN EXPOSURE to radiation poses a significant health challenge in this atomic era. State governments share with the Federal Government responsibility for insuring that populations are not overexposed to radioactivity and fallout. The monitoring of radioactivity from fallout and the control of industrial sources of radioactivity is well within the technical competence of States.

However, before radioactivity can be kept within safe limits in the environment, it must be measured. A sound monitoring system is the bedrock measure of a control effort. Cost, of course, is important in any monitoring system, and therefore the problem, briefly, is how to get reliable data at the least possible cost.

The New York State Department of Health has developed a program to measure levels of specific radionuclides in air, water, milk, and food. Sampling these environmental vectors is a valid way to measure the exposure of an entire population. But measurements are only a means, not an end. Our purpose in monitoring air, water, and food is to obtain information needed for determining when and where to institute control measures. Our basic guide for deciding when to take countermeasures is the recommendations of the Federal Radiation Council's Radiation Protection Guides (*1*), which were established for normal peacetime operations. These guides establish limits of exposure for certain body organs in relation to population groups, and define three ranges of intake for four of the more important radionuclides: radium 226, strontium 89, strontium 90, and iodine 131.

Sampling the environment for the effects of weapons testing began in 1953, and the first sampling measure was gross beta analysis of surface water supplies. This work has since been extended and refined as more money and personnel have become available.

Currently, the department routinely performs radioactivity analyses of 48 water sources, including 25 water supplies, 5 air sampling stations, 15 milk sampling stations, and 5 fallout stations. Many stations are located near nuclear installations and are a part of the related surveillance program of these facilities. Careful plans were made to prepare for this sampling. Our radiological health personnel began by consulting with department colleagues responsible for the general safety of air, water, and milk. From them, we got information that pinpointed the number and location of major supplies and other relevant factors.

Water, Air, and Milk Surveillance

Water. Nine of every 10 New York residents drink water from public water supplies (*2*). These supplies could contribute to human radiation exposure if levels became high because of fallout or industrial contamination. To monitor these supplies, we gathered information on the location and kinds of water sup-

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plies in the State. We also had to find out where personnel were available to collect samples regularly. Finally, we collected information on which industries were adding radioactive discharges to waters used for public consumption.

Fifteen water sampling stations were established throughout the State. Grab samples from each station are usually collected hourly or daily and analyzed once a week in the department's central laboratory in Albany. Local health department personnel man these stations.

Routine analysis includes gross beta and gamma scan for gamma emitting radionuclides for all supplies and strontium 89 and strontium 90 for selected supplies.

Review of gross beta results over the last 6 years shows measurable and intermittent increases of radioactivity in streams and impounded supplies during an active weapons testing program.

Samples collected downstream of industrial sources seldom show any increase in radioactivity that can be related directly to the industry. However, on a number of occasions upstream samples have been found to be higher in radioactivity than samples collected downstream of a nuclear facility. Before commenting on such results, we review available data including activity released from the industry, dilution, sensitivity of test, and comparable data from other statewide sampling stations. We usually find that fallout contributes relatively more radioactivity to surface water courses than does the industry and that the difference is caused by normal variation within the limits of the test.

Milk. Dairy plants serving the large urban areas around the State were selected for sampling. Samples collected from the Albany area are analyzed daily. Other sites are sampled daily and composited into a weekly sample.

Samples collected from large milk plants represent large milkshed areas. Sampling of these larger plants adequately reflects the levels of radioactivity caused by weapons testing.

Samples from individual farms or small dairies, selected for monitoring near nuclear facilities, more adequately reflect the levels of radioactivity that may be related to the nuclear facility discharges than samples from large milksheds.

The laboratory routinely analyzes milk supplies for strontium 89, strontium 90, iodine 131, cesium 137, barium-lanthanum 140, and zirconium-niobium 95.

Air. Air sampling stations have been set up to cover every area of the State. Sampling sites were selected where personnel would be available to service them.

To date, our environmental sampling program has expanded and the work of maintaining, interpreting, and reporting data has grown. Machine processing of data to improve interpretation and speed the reporting of results was instituted in February 1964.

Since September 1961, when high levels of radioactivity occurred after U.S.S.R. weapons tests, we have reported our sampling results weekly by a radioactivity bulletin. This bulletin gives up-to-date information to some 550 recipients, including full-time local health departments, hospitals, and civil defense directors. It lists all routine results for samples of air, water, and milk collected in the State.

Sampling Around Nuclear Reactors

Nuclear reactors are operated at eight different sites in New York State. Their uses vary—research, training, power sources—but their implicit hazard to surrounding areas is constant. Because of this, State and local health department personnel work with reactor personnel to sample the environment surrounding these sites. They work together in selecting, maintaining, and operating off-site sampling stations. The kind of analysis, frequency, and environmental vectors sampled around a site are determined by the volume and kinds of radioactive wastes released by the reactor.

Thus, monitoring requirements vary at each reactor or plant site. At the Knolls Laboratory, a large facility operated since 1946 for the AEC, in addition to in-plant monitoring, liquid wastes released into the Mohawk River are sampled at downstream sites. Since the water supply of the city of Cohoes is drawn from the Mohawk 10 miles downstream of the Knolls site, a weekly sample is analyzed for radioactivity by both Knolls and the State health department laboratory. A control station operated by Knolls personnel is situated upstream of the Knolls site to take baseline

samples. Monthly and semi-annual reports are submitted to the State health department.

At Brookhaven National Laboratory, a 3,500-acre research facility on Long Island under contract with the AEC, stations around the reactor collect samples of milk and vegetation. These samples are analyzed at weekly or monthly intervals by Brookhaven personnel and quarterly by our department laboratory.

At a third large reactor site, Consolidated Edison Company's pressurized water reactor about 25 miles north of New York City, a continuing survey is being conducted in cooperation with the company (*3*). The intensity of the sampling program is geared to the amount of radioactive wastes released by the plant. Low-release rates are countered with less frequent sampling; high-release rates spark more intensive sampling work. The on-site sampling program is carried out by the industry. We assist in off-site sampling. Because of low-release rates, off-site sampling is limited to spring, summer, and fall.

In addition to these large reactor sites, monitoring will soon be necessary at a large chemical processing plant. The Nuclear Fuel Services, Inc., is building a spent-fuel processing plant on a 3,300-acre site in western New York. The plant will receive, store, and process spent reactor fuel. Scheduled for completion in 1965, the plant will be the first privately operated facility of its kind. Background sampling of water and soil has been started. We have reviewed the design and safety analysis of the proposed plant. The radionuclides of primary importance to be routinely discharged are krypton 85, hydrogen 3, and iodine 131. More than 2,500 analyses of 1,000 samples of water, air, milk, vegetation, fish, soil, and animal thyroid should be undertaken once the plant begins operation. Curie amounts of tritium released to air and water may provide some interesting research studies, including ground water recharge from surface supplies and atmospheric water vapor transport.

Emergency Countermeasures

Nuclear facility designs and special safety procedures make it unlikely that a major accident could occur that would release large quantities of radioactivity to the surrounding environment. Nevertheless, accidents involving less than a total release of a reactor's contents are possible. Because of this possibility, our staff has analyzed the "maximum credible accident," the worst accident likely to occur at a given facility.

In any accident, the quantity and particular radionuclides in inventory determine the severity of an accident. Accidental releases of these radionuclides may be in the form of radioactive gases, particles, or mists into the air or an adjoining watercourse.

Accidental exposure of the population may result from: (*a*) external exposure from a passing cloud; (*b*) external exposure from deposited radioactive materials; (*c*) inhalation of radioactive materials; or (*d*) ingestion of contaminated water, milk, or crops.

Comprehensive surveys of the environment have been completed around the Consolidated Edison reactor (*4*), Brookhaven Laboratory, and a nuclear processing plant (*5*) in Cattaraugus County. These surveys have two purposes: to identify the size and location of environmental vectors and population clusters in the vicinity that would be affected, and to get baseline information needed for the establishment of an adequate operational survey.

To achieve these aims, we (*a*) identified the population at risk and the extent of the survey area; (*b*) pinpointed the characteristics of the area, including population, agricultural activity, climate, hydrologic features, and topography; and (*c*) located concentrations of farms, dairy herds, milk plants, surface water supplies, and other activities that would be affected.

The survey around the Consolidated Edison reactor was confined to a 20-mile radius of the plant. The area surveyed was found to contain a number of public watershed areas, milk-producing facilities, and farmland. A report of this survey appears in a department publication (*4*).

Similar surveys around Brookhaven National Laboratory and the Western New York Nuclear Service Center site (*5*) are also completed. We are gathering data on the levels of radioactivity that would occur in various vectors should Brookhaven's maximum credible accident occur.

Summary

The New York State Department of Health has established a routine radiological monitoring program. Samples of air, water, milk, and precipitation are collected and analyzed in its central laboratory. Stations are located throughout the State. Off-site air, water, and milk monitoring stations are established in cooperation with operators of nuclear facilities. A comprehensive environmental survey within 20 miles of the Indian Point nuclear power reactor, Brookhaven National Laboratory, and a chemical processing plant site provides data on the physical environment. This information is useful in evaluating possible impact of a nuclear reactor accident and establishing an adequate operational survey.

REFERENCES

(*1*) Federal Radiation Council: Background material for the development of radiation protection standards. Report No. 2. U.S. Government Printing Office, Washington, D.C., September 1961.

(*2*) New York State Department of Health: Public water supply data. Bulletin No. 19, 1960.

(*3*) Davies, S., and Thompson, M. H.: Protecting the environment around a nuclear power reactor—a State health department acts. Amer J Public Health 52: 1993–2000 (1962).

(*4*) Division of Environmental Health Services, New York State Department of Health: 1962 report on environmental factors to be considered after an accidental release of radioactivity from the Consolidated Edison thorium reactor.

(*5*) Division of Environmental Health Services, New York State Department of Health: 1962 report on western New York Nuclear Service Center environmental survey.

New Cities in PHS Air Sampling Network

The Public Health Service's National Air Sampling Network, which gathers scientific data on air pollution throughout the country, recently added these cities: Gadsden, Ala., Texarkana, Ark., Bakersfield and Santa Ana, Calif., West Lafayette, Ind., Dubuque, Iowa, Moline and Rock Island, Ill., Ashland, Covington, and Newport, Ky., Wyandotte, Mich., Moorhead, Minn., Concord, N.H., Carteret, Glassboro, and Princeton, N.J., Fayetteville, N.C., Fargo, N. Dak., Steubenville, Ohio, Laredo and Texarkana, Tex., Ogden, Utah, Parkersburg, W. Va., Eau Claire and Superior, Wis., and Ponce, Puerto Rico. There are now about 260 individual air sampling stations, located in every State, the District of Columbia, and Puerto Rico.

The network samples suspended particulates—smoke, dust, and other such solid contaminants which are emitted into the atmosphere from a variety of sources and remain suspended for varying periods of time. The pollutant samples are collected biweekly by a high-volume air sampler which draws air through a glass-fiber filter for 24 hours. The filter is later analyzed at the laboratories of the Public Health Service's Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Thirty-five of the network stations also sample for two gaseous pollutants, sulfur dioxide and nitrogen dioxide.

The data collected provide State and local air pollution officials with basic information for control programs.