Conference of Radiological Health Specialists

Basic Surveillance Programs

BLUCHER A. POOLE, B.S.C.E., ROSCOE H. GOEKE, M.S., and DONALD A. PECSOK, M.S.

SURVEILLANCE represents the sensory component of an environmental health program, providing the basic information needed in assessing the hazards to health in the environment. Evaluation of this information may either provide assurance that proper control of environmental pollutants is being maintained or that more stringent control measures are required. Radiation surveillance efforts are directed to this major objective to assure an adequate and effective radiation control program.

The effectiveness of surveillance programs in meeting these purposes should be continually examined. In appraising surveillance, the general purposes and capabilities of current Federal and State programs are first reviewed, and, as another approach in portraying the adequacy of these programs, certain observations are made on the need for further development of surveillance methodology and techniques. Finally, the effectiveness of surveillance programs must be evaluated on their adequacy to cope with the magnitude of the public health threat as measured by actual or potential radiological contamination. The degree of success which health agencies have attained must be judged independently for any locality. The surveillance program in Indiana, we believe, exemplifies an adequate effort at the State and local level.

Status of Radiation Surveillance Programs

During the past decade the Public Health Service in cooperation with State health agencies has developed nationwide surveillance network systems encompassing measurement of radiocontaminants in air, water, milk, and total diet. The major purposes of these systems are to provide dose assessment information, applicable to the total population, for research purposes and for indications of trends. In some instances, the systems have also served as an alert to instigate more comprehensive monitoring at the State and local level.

An example of the nationwide systems is the radiation surveillance network which the Public Health Service established in coordination with the Atomic Energy Commission in 1956, working in cooperation with a number of States. At present, the network comprises 72 stations located throughout the United States where samples of airborne dust and precipitation are collected for radiological analyses.

Experience has demonstrated that highly localized contamination can result from any of the various sources contributing radiation to the environment. It can be readily appreciated, therefore, that the nationwide systems cannot satisfy the surveillance requirements of State agencies. As a consequence, most States have established environmental monitoring programs with various degrees of completeness. Nearly all States possess the basic laboratory equipment to analyze for gross alpha or beta activity of environmental samples. This basic equipment

Mr. Poole is director of environmental sanitation, Indiana State Board of Health. Mr. Goeke is deputy chief, and Mr. Pecsok is assistant chief for public health action, State Assistance Branch, Division of Radiological Health, Public Health Service.

can be used, with standard wet chemical techniques, in evaluating specific radionuclides such as strontium 90, iodine 131, and radium 226. Because of the time consumed in analyzing for such radionuclides as iodine 131 and cesium 137 by chemical separation and beta counting, a number of States have invested in more elaborate equipment such as gamma scintillation detectors with multichannel analyzers. More than 30 States now have such equipment. Fourteen States have established milk monitoring networks, routinely collecting samples and performing analyses for iodine 131 and strontium 90.

Surveillance Technology

Corollary to the need for developing an adequate laboratory capability is the need to develop and adopt standardized methodology and techniques. With a number of Federal agencies, atomic energy installations, and State and local agencies collecting surveillance information, it is important to have data that are accurate and compatible. This will permit maximum use and consistent interpretation of the data. The Public Health Service, in its traditional role as adviser and coordinator to State activities, is vigorously pursuing a program which will assist the States in adopting uniform surveillance technology practice. The Service's Division of Radiological Health has initiated a quality control program including provision of calibration standards, split sample analyses, and technical assistance which can do much to improve or confirm the accuracy of results among the various laboratories. State health departments are urged to use this service.

Additional efforts are needed in standardizing analytical methods applicable to radiation surveillance. A great number of techniques have already been developed for various radionuclide analyses, and it becomes increasingly important that as new ones appear, the various techniques be thoroughly compared to indicate the advantages and disadvantages of each. This will permit an approach on a national basis to attaining standardized analytical methodology.

Further development and coordination of sampling procedures are also needed if results are to be meaningful and comparable. Sampling methodology to assess radiation hazard, for example, requires a composite sample representing the average contaminant intake for a significantly large population group. On the other hand, grab-type samples may suffice to define a localized area of contamination. The selection of environmental media to sample, how to sample, and the frequency of sampling will depend on the objectives of the surveillance program.

Surveillance Requirements

Definite progress has been made in developing an environmental surveillance capability among the States. The degree of success of surveillance efforts must be measured, however, in terms of the adequacy and pertinence of the resultant information. In essence, information should adequately reflect environmental conditions so that optimal decisions concerning public health action can be made. Unless the surveillance data are meaningful in evaluating the significance of health hazards or of control action, the surveillance efforts are not serving the intended objective.

To determine the extent and type of surveillance efforts required, we must examine the magnitude of the local radiological health problems. The situation will vary with the number of nuclear facilities and other contaminating sources, extent and reliability of industry control efforts, and expected intensity of fallout from nuclear test detonations. Studies of these factors will, in general, indicate what and where environmental samples should be obtained as well as the extent of radioanalysis required. Based on the likely or observed fluctuation in radionuclide content for these samples, a minimal surveillance program associated with low levels of exposure can be established. Intensification of this basic program will be necessary when levels of contamination are suspect or rise significantly. For example, it may be necessary to increase the frequency of sampling to forecast more adequately whether or not control measures are required. Expansion of surveillance may also be necessary to delineate more accurately, geographically and by routes of contamination, the nature of public health risk.

To illustrate an adequate surveillance program at the State level, the surveillance capabilities established by the Indiana State Board of Health are described. The system exemplifies a minimal program which can be expanded for more intensive monitoring if necessary.

Indiana Surveillance Program

The Indiana surveillance program was initiated in 1956 with the acquisition of a proportional counter for gross alpha and beta analysis. Initially, only stream samples, collected at routine intervals, were analyzed. With the resumption of nuclear testing in September 1961, a milk sampling network was established in Indiana, the first samples being collected in October of that year. At that time, gamma detection and analysis equipment, encompassing a 512-channel analyzer, a 4-inch by 4-inch sodium iodide crystal, and associated shielding, were procured. Consolidation of two other laboratories in the board of health building released two rooms for the radiological health laboratory, consisting of a standard wet chemistry room and an instrument room.

Equipment includes a low background beta detector, three proportional counters including one with automatic sample-changing capabilities, and the multichannel analyzer and detector. This equipment was obtained during a period of 5 years and represents a total investment of approximately $40,000. The laboratory staff consists of a radiochemist and a chemist.

Indiana's milk sampling program includes routine samples collected from each of five milkshed areas at least monthly for analyses of iodine 131, barium 140, cesium 137, strontium 89, and strontium 90. Samples are picked up by representatives of the dairy division, State board of health. It is possible to obtain results of the analysis of the iodine, barium, and cesium on the day following sample collection. At times of iodine 131 increases, additional samples have been collected for analysis. Monthly stream samples are collected at each of 22 sampling stations, and fish, algae, and sediment are sampled quarterly at selected stations.

In preparation for possible occurrence of high radioiodine levels in milk, a plan of action has been formulated in cooperation with representatives of the dairy industry. Basically, the plan calls for placing dairy cattle on stored feed if iodine 131 in the environment rises to significant levels. The Federal Radiation Council guidelines established for iodine 131 in the environment are one of the criteria to consider in proposing protective measures. Other considerations may include status of nuclear testing, potential reduction in iodine 131 intake, weather conditions affecting fallout, and the time remaining in the normal grazing season. Obviously decisions must be based on a thorough surveillance program. For example when results exceed 100 picocuries per liter in any of the five major milksheds, samples are to be collected several times per week from the same stations.

If radioiodine levels are reached which, if maintained, will exceed the Federal Radiation Council guidelines during the next 2 months, the plan calls for greatly accelerated surveillance. Since the FRC guidelines are based on a yearly intake, the accumulated results during the preceding 10 months will affect the levels at which increased surveillance is necessary. The accelerated program consists of sampling, as often as daily, from each of 27 control farms located throughout the State. These farms will always have cattle on pasture during the normal grazing season. Results will be used to determine when and where protective measures should be initiated and terminated. As an on-the-spot check, 27 farms using stored feed near the control farms will be spot sampled when the protective measures plan is in effect. Thus, the 27 paired farms will provide basic data as to the effectiveness of the measure. In addition, samples will be collected from bulk milk trucks and pasteurizing plants to provide dose assessment information.

Such an energetic sampling program may lead to numerous problems with respect to collection, delivery, analyses, and data handling. With short counting times, the gamma analyzer can measure up to 100 one-liter milk samples in a 24-hour period with reasonable accuracy. Samples will be collected and delivered on planned routes by State and local health personnel. Daily contour maps showing levels of iodine 131 from the 27 control farms will be utilized to indicate cumulative exposures.

Since it has always been a basic principle to work with the milk processing plants rather than the individual suppliers, Indiana is relying on the processors to notify milk producers supplying their plants of requisite control action. The processors are responsible for supplying samples from bulk tanks for the laboratory to analyze, sample collection being arranged by the State board of health and local milk inspectors. Additional assurance of compliance will be aided by the collection of spot samples throughout the State.

Although the State deals primarily with the processing plants, an educational program has been outlined in cooperation with the county agricultural agents throughout the State. This program is intended to inform individual milk producers of their responsibility in providing safe milk and in preparing for such eventualities as placing cattle on feed that has been aged for several weeks. Several pamphlets have been prepared outlining the basic reasoning behind use of aged feed and giving the farmers information on providing the necessary feed mixtures.

Expansion of the laboratory work is planned in the near future. Indiana and most of the other States have adopted the Drinking Water Standards promulgated by the Public Health Service. The 1962 revision of these standards includes for the first time limits for concentrations of the radionuclides radium 226 and strontium 90 and for gross beta activity. These standards place a new responsibility on those agencies concerned with the quality of public water supplies. It is expected that all ground water supplies will have to be checked for the presence of radium 226 and sufficient information obtained throughout the State to determine typical strontium 90 levels in surface waters. As much as possible, the water supplies will be monitored by utilizing gross alpha and beta counting. When this method indicates the presence of sufficient quantities of alpha or beta emitters, it will be necessary to resort to specific radionuclide determinations for radium and strontium.

In addition to this future expansion for drinking water analyses, it is desirable to perform radioanalyses of foods other than milk to assess more accurately population exposure to radionuclide contamination.

Conclusions

Adequate State surveillance programs are needed to yield the information necessary for decisions and control actions on radioactive contamination in the environment. Many States are now developing surveillance capabilities and sampling networks. There is a need to compare results among States on a common basis to avoid duplication of work and to detect nationwide trends. The Public Health Service is in a position to offer guidance on methodology and standardization for the various surveillance programs.