rat a drop of water forms, to be replaced by another drop as required by the rats. Not only is labor saved by this piping of the water directly to the cage, but the elimination of spilled water has greatly improved the sanitation.

All animal holding equipment, as well as other special equipment, is constructed almost entirely in the station's own shops.

MAINTENANCE OF BUILDINGS AND EQUIPMENT

In addition to its duties of equipment development the Section is responsible for the provision and maintenance of utilities essential to all parts of the laboratory. These include electric light and power, process and heating steam, compressed air, vacuum, conditioned air, and waste disposal. Unfortunately, these problems are complicated by the age of the facilities and the fact that the installation was not designed as a laboratory. As a result constant maintenance activities are under way to keep the station at top operating efficiency.

The air conditioning of the laboratories for temperature and humidity control is alone a considerable problem, with an installed capacity in excess of 30 tons of refrigeration. To insure that this equipment does not fail as a result of power failure during the not infrequent hurricanes, a diesel generator plant is kept on a standby basis. This unit has a capacity of 42 KVA, sufficient for the absolutely essential requirements of the station.

In addition to maintenance of the physical plant is the job of maintaining much of the scientific apparatus of the station. Innumerable electric motors, scales, balances, ventilators, elevators, lights, bells, signals, cameras, cages, and traps, all require a watchful eye and unending attention.

THE RADIOACTIVE ISOTOPE LABORATORY UNIT AT TECHNICAL DEVELOPMENT SERVICES

JENS A. JENSEN, Sanitary Engineer (R)*

During the past year activities at Technical Development Services have been extended to the field of radioactive isotope tracer technique. This new activity will be particularly useful to the Toxicology Section with its accelerated program on the study of the toxicities of various economic poisons. Although the radioisotope laboratory is a part of the Toxicology Section it may be called on to solve problems for any section of Technical Development Services or other Services of the Communicable Disease Center.

The laboratory consists of six units: (1) housing for biological specimens such as insects, and experimental animals up to the size of dogs and monkeys; (2) a chemistry laboratory where complex compounds can be synthesized from the simpler molecules that contain the radioactive element; (3) a small "hot" laboratory, which is mostly a large hood where very active materials are handled (this hood is equipped with all the utilities needed for chemical and physical manipulation of the isotopes, including gas, hot and cold water, steam, vacuum, air, and electricity); (4) a counting room with Geiger tubes, ionization chambers, and associated electronic equipment (only low levels of activity, contained in samples to be analyzed, are carried to this room); (5) a sample and specimen preparation room where a material whose activity is to be determined can be divided into aliquots, or where insect specimens and small animal tissues may be prepared; and (6) an office.

The walls of the animal and specimen room, the

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chemistry laboratory, and the hot laboratory are lined with aluminum sheathing bonded on one-half-inch plywood panels over which a removable film of plastic has been applied by spraying. This feature is included only for ease of decontamination in case of accident, such as spills of "hot" material, small explosions, breakage of equipment, and soiling by animals that have become radioactive. Table tops are covered with aluminum pans on which "diaper" paper, an absorbent paper with a grease-proof and waterproof backing, is placed. This paper is discarded when accidentally contaminated. The floors are covered with asbestos tile, and it is thus possible to decontaminate limited areas merely by replacing the tiles. Incoming shipments of radioactive materials are kept in the hot laboratory when activities are in the order of a few millicuries or less. Provisions are being made, however, for storage of more active material in steel pipes sunk into the ground to a depth of 10 to 15 feet.

Animals are kept in metabolism cages equipped with feeders, water fountains, and means for automatic separation of feces and urine whenever a determination of their activity is wanted. Although air conditioning has been planned for the animal room, a temporary large window fan effects ventilation satisfactorily.

Two additional hoods are under construction. One will house animals and biological specimens that excrete radioactive material through the respiratory system. Contaminated expired air will be drawn through various types of absorbers before escaping to the atmosphere. The other, a carbon-14 hood, will be used for synthesis of compounds from radioactive carbon whenever long-life carbon is used in the gas phase as carbon monoxide or carbon dioxide. This structure is a table enclosed with sliding glass panels, and is kept under a slight vacuum by an exhaust fan, thus preventing leakage to the laboratory. A large steel-rod grid serves as foundation for an elaborate vacuum system consisting of a megarac pump in series with an oil diffusion pump. Associated gauges, thermocouple and Pirani type, are mounted on the exterior. All chemical reactions will take place in an enclosed system of reaction flasks, traps, lines, and vessels; and chemical contents will be moved in gaseous form by either vacuum or pressure.

The instrument room is equipped with a large-scale, constant-voltage transformer, tables, and cabinets, and two scalers, one a decade type with pulse discriminator, regulated auxiliary power supply, and timer, the other a scaler of 64 with pre-set timer. A lead shield with built-in shelf arrangement serves to eliminate extraneous and stray radiation from being recorded. This feature is particularly important whenever samples with low activity are counted. On hand is a well-rounded selection of Geiger-Müller tubes, end window type, dipping type, open window type, and annular liquid or gas flow type.

Two types of instruments are used for radiation health protection, namely, the Geiger counter type and the ionization chamber type. The former type includes both a Tracerlab monitor and a Victoreen portable monitor. These instruments indicate only the rate at which the isotope emits particles or electromagnetic rays per unit of time; they are, however, very sensitive even to an extremely minute amount of radioactivity.

Ionization chambers, on the other hand, measure the actual rate of ionization produced by particles and rays. They are made from materials similar in nuclear aspects to the tissue of the human body. Ionization damage produced in the body of personnel may therefore be determined by observing the reading of the chambers. Each person is given two small pocket ionization chambers and an X-ray film badge before entering the laboratory. These devices are read once a day and radiation exposure recorded. A large ionization chamber is on hand for determining large radiation doses such as those encountered when isotope shipments are unpacked or when large amounts are transferred or otherwise handled. A supply of 2-inch-thick lead bricks can be interposed between the investigator and the "hot" material in isotope manipulations. Although the bricks give excellent protection from penetrating gamma rays they also cause "Bremsstrhalun-gen" effect. These are electromagnetic rays produced when beta particles collide with the heavy lead nuclei, and they are rather damaging. Very good protection can be had merely by keeping as far away as possible. A plentiful supply of remotely controlled pipetting devices and tongs affords this type of protection.

An assortment of electronic repair parts and test instruments is available for servicing of equipment.

A project on marking various species of flies with radioactive phosphorus has been completed. P^{32} is readily administered in food (milk) and the uptake and retention are excellent. Marked flies can be detected readily with a Geiger counter for a period of 3 weeks. This type of marking provides an excellent, efficient, and highly sensitive method for the study of fly migration, fly resting habits, and fly population determinations. Much information was also gathered on the phosphorus metabolism of diptera. In a current project the iodine analog of DDT has been synthesized from aniline and radioactive iodine. This compound, very similar to DDT, is administered to rats for the purpose of determining in greater detail the metabolic rate of DDT in animals.

The laboratory is supervised by a chemical and sanitary engineer who has been trained at Oak Ridge Institute of Nuclear Studies, and he is aided by a graduate physicist who has had considerable experience in maintenance and calibration of electronic equipment.

EPIDEMIC AND DISASTER AID

FRANK R. SHAW, Sanitary Engineer Director*

Part I.

INTRODUCTION: DISASTER AID OF LONG AGO.

The public health activities of the Public Health Service were the outgrowth of epidemic and disaster aid. The Service originated in 1798 as the Marine Hospital Service for the care of sick and disabled seamen. With the establishment of hospitals, first at Norfolk in 1807 and later at New Orleans, New York, San Francisco and other ports of entry, it developed that the Medical Officers in Charge of these hospitals were called upon more and more by local and State authorities for aid in combating epidemics of smallpox, yellow fever, cholera, and plague.

The early acts of Congress and the establishment of local and State boards of health resulted from concern over epidemics of the aforementioned scourges. Fear of epidemics prompted the authorities of Baltimore to appoint a health officer in 1793, and the disastrous yellow fever epidemic in Philadelphia in the same year resulted in the establishment of a Board of Health for that city in 1794. Other epidemics of yellow fever and outbreaks of cholera were responsible for the formation of other city health boards and State boards of health.

The first related act of Congress, in 1794, was for its own protection in the event of the occurrence of an epidemic at the seat of government. However, in 1799 the Congress took its first step in matters of disaster aid by providing for the establishment of warehouses for the storage of goods taken from ships held in quarantine. This quarantine function became the responsibility of the Secretary of the Treasury. A widespread epidemic of cholera in the United States in 1833 caused Congress to permit the use of revenue cutters in enforcing the quarantine laws of States and cities. The widespread epidemic of yellow fever in the Mississippi Valley in 1878 was the incentive for the passage of the first national quarantine law. This law related to the prevention of the introduction into this country from abroad ot smallpox, cholera, yellow fever, and plague, and resulted in the creation of the Foreign Quarantine Division of the Marine Hospital Service. This

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