Applications and Availability of Whole-Body Counters to the Nuclear Medicine Technologist

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TABLE 1. Location of Low-Level Whole-Body Counters in the United States

State	Institution	Address
Arkansas	University of Arkansas Medical Center	Department of Anatomy Little Rock, Ark.
California	University of California	Laboratory of Nuclear Medicine and Radiation Biology 900 Veteran Avenue Los Angeles, Cal.
	VA Center	Human Radiation Counting Laboratory Wiltshire and Sawtelle Blvds. Los Angeles, Cal.
	Donner Laboratory	University of California Berkeley, Cal.
	University of California School of Veterinary Medicine	AEC Project No. 16 Davis, Cal.
	Helgeson Nuclear Services, Inc.*	872 Abbie Street Pleasanton, Cal.
	NASA Ames Research Center	Moffett Field, Cal.
	Lawrence Radiation Laboratory	Hazards Control Dept. Radiation Safety Section P.O. Box 808 Livermore, Cal.
Colorado	State of Colorado Dept. of Public Health	Division of Occupational Health Radiological Health Section 4210 East 11th Avenue Denver, Colo.
	Dow Chemical Company	Rocky Flats Division Health Physics Dept. P.O. Box 888 Golden, Colo.
Florida	Jackson Memorial Hospital	University of Miami Miami, Fla.
	J. Hillis Miller Medical Center	University of Florida Dept. of Radiology Whole-Body Counter Laboratory Gainesville, Fla.
Idaho	USAEC	Health Services Laboratory Analytical Chemistry Branch P.O. Box 2108 Idaho Falls, Id.
Illinois	Argonne National Laboratory	9700 South Cass Avenue Argonne, Ill.
	Argonne Cancer Research Hospital	University of Chicago 950 East 59th Street Chicago, Ill.
	Packard Instrument Co., Inc.	2200 Warrenville Road Downers Grove, Ill.
	University of Illinois	College of Agriculture Dept. of Animal Science Urbana, Ill.
Indiana	Purdue University	Bionucleonics Department Lafayette, Ind.
	California Nuclear, Inc.	2323 South 9th Street Lafayette, Ind.
Iowa	VA Hospital	Radioisotope Service Iowa City, Ia.
Maryland	National Naval Medical Center	Radiation Exposure Evaluation Laboratory Bethesda, Md.
	National Institutes of Health	Dept. of Nuclear Medicine Bethesda, Md.
Massachusetts	Boston VA Hospital	Radioisotope and Medical Service 150 S. Huntington Avenue Boston, Mass.
	Massachusetts Institute of Technology	Department of Physics Radioactive Center Cambridge, Mass.
	Boston University School of Medicine	Radioisotope Research Section 750 Harrison Avenue Boston, Mass.
	National Center for Radiological Health	NE Radiological Health Laboratory 109 Holton Street Winchester, Mass.
Minnesota	Mayo Clinic	Section of Clinical Pathology Rochester, Minn.
Missouri	University of Missouri	College of Agriculture Low-Level Radiation Laboratory Columbia, Mo.
Nevada	SW Radiological Health Laboratory	944 East Harmon Las Vegas, Nev.

* Mobile unit. † Mobile unit not listed in *IAEA Directory of Whole-Body Radio-active Monitors.*

The responsibility of nuclear safety is a part of each individual's daily routine. Even though precautionary measures are observed, there is always the possibility that radioactive contamination to some hospital personnel can occur. This paper briefly reviews some of these aspects and suggests the potential role of low-level whole-body counters to help eliminate some of the problems.

Whole-body counters are useful instruments in clinical studies requiring the measurement of radionuclides in patients. A few examples are the assess-

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Compiled from IAEA Directory of Whole-Body Radioactive Monitors *(5)*

State	Institution	Address
Nevada	Pan-American World Airways, Inc.	Nuclear Rocket Development Station Jackass Flats, Nev.
New Jersey	U.S. Testing Corporation	1415 Park Avenue Hoboken, N.J.
New Mexico	Los Alamos Scientific Laboratory	University of California P.O. Box 1663 Los Alamos, N.M.
	Kirtland Air Force Base	Special Weapons Center Albuquerque, N.M.
New York	Brookhaven National Laboratory	Medical Department Medical Physics Division Upton, N.Y.
	University of Rochester	School of Medicine and Dentistry Dept. of Radiation Biology and Biophysics and Atomic Energy Project 260 Crittenden Blvd. Rochester, N.Y.
	New York University	Bellevue Medical Center Institute of Industrial Medicine 550 First Avenue New York, N.Y.
	New York University Medical Center	A. J. Lanza Laboratory Long Meadows Road Tuxedo, N.Y.
	USAEC, New York Operations Office	Health and Safety Laboratory 376 Hudson Street New York, N.Y.
	Cornell University	New York State Veterinary College Dept. of Physical Biology Ithaca, N.Y.
	University of Rochester School of Medicine and Dentistry	Department of Pediatrics 260 Crittenden Blvd. Rochester, N.Y.
Ohio	University of Cincinnati College of Medicine	General Hospital Radioisotope Laboratory Cincinnati, O.
	U.S. Public Health Service	Nuclear Medicine Unit National Center for Radiological Health 4676 Columbia Parkway Cincinnati, O.
Ohio	Wright-Patterson Air Force Base	USAF Radiological Health Laboratory Dayton, O.
Pennsylvania	University of Pittsburgh	Graduate School of Public Health Dept. of Occupational Health Pittsburgh, Pa.
	Radiation Management Corp.†	3508 Market Street Philadelphia, Pa.
South Carolina	E. I. DuPont de Nemours & Co.	Savannah River Plant Radiological and Environmental Sciences Division Aiken, S.C.
Tennessee	Union Carbide Corporation	Nuclear Division Radiation Safety Dept. Y–12 Plant Oak Ridge, Tenn.
	Vanderbilt University and Hospital	Radioisotope Center Nashville, Tenn.
	Oak Ridge National Laboratory	Health Physics Division Oak Ridge, Tenn.
	Oak Ridge Associated Universities	Medical Division P.O. Box 117 Oak Ridge, Tenn.
Texas	Aerospace Medical Center	Radiobiology Branch Brooks A.F.B., Tex.
	Permiam Corporation	P.O. Box 3119 Midland, Tex.
	Aerospace Medical Division	Brooks A.F.B. San Antonio, Tex.
Utah	University of Utah	College of Medicine Radiobiology Laboratory Salt Lake City, Ut.
Washington	Battelle Memorial Institute	Pacific Northwest Laboratory Environmental Health and Engineering Department P.O. Box 999 Richland, Wash.
Washington, D.C.	Walter Reed Army Institute of Research	Walter Reed Army Medical Center Department of Biophysics Washington, D.C.

ment of lean-body mass by measurement of naturally occurring ^{40}K, the study of absorption and retention of radioactive drugs administered orally (e.g. iron or iodine) or injected (such as chromium- or radioiodine - labeled thyroxine), and the measurement of radioactivity induced by whole-body neutron activation *(1)*. There is also the need to measure the total-body radioactivity in occupationally exposed persons from the nuclear-related industries, such as the power-generating industry, radiopharmaceutical manufacturers, radiobiology laboratories, and especially nuclear medical facilities. Shleien and LeCroy have shown that several commonly used radiopharmaceuticals can be detected in medical and paramedical personnel *(2)*. A study by Blum and Liuzzi *(3)* has also shown that ^{131}I contamination results in body burdens of personnel working in and near nuclear medicine sections. The application of whole-body counting for measurement (identification and quantitation) of employee contamination by gamma emitters can and should be a part of the radiation safety program of these facilities. For example, in nuclear medicine institutions the persons at risk include nurses, orderlies, laboratory technicians, radiotechnologists, radiotherapists, physicians, and other supporting staff members.

Many hospitals offering nuclear medical or radiotherapy services do not have a whole-body counter because of the high cost of construction and operation of such a facility. Fortunately, there are approximately 50 low-level whole-body counters distributed across the United States that are capable of measuring radioactivity in humans far below the maximum permissible body burdens *(4)*. Thus the main objective of this article is to inform nuclear medicine technologists and administrators of the available whole-body counting facilities and their potential role. Figure 1 shows the general location of the counters, and Table 1 gives the address for each counter. [(Table 1 was prepared from a list published by the IAEA *(5)*.] In addition, there are a number of mobile units that can be moved to any site if need be.

Whole-body counting can provide an excellent opportunity to detect and hence correct errors in techniques or procedures that lead to unknown uptake of radionuclides by the technologist. Even when there is no evidence of abnormal internal or external radioactive contamination, the measurement can serve as a baseline for comparison in the event of a future mishap. A whole-body counting program will also provide valuable data regarding the body burdens of hospital and industrial workers. When compiled over an extended number of years, data such as these are an excellent index of the radiation exposure to workers. Biologic half-times and turnover rates can also be determined from these data.

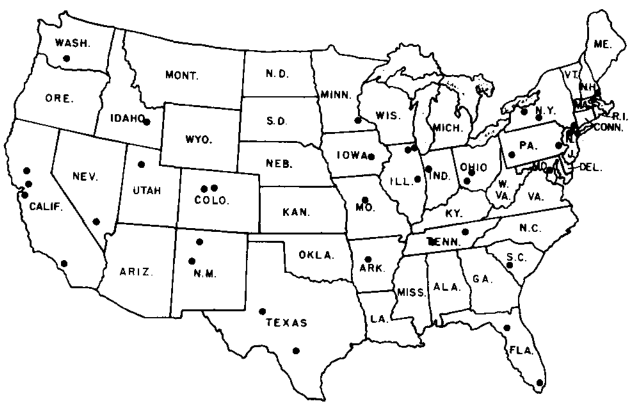

FIG. 1. Location of low-level whole-body counting facilities. Some points represent two or more counters.

Because most maximum permissible body burdens fall far below the sensitivity ranges of standard nuclear medicine instrumentation, each nuclear medicine facility should be prepared to request monitoring assistance from a nearby whole-body counting group should a serious exposure occur.

The risks for contamination of technologists who practice safe techniques are minimal. However, whole-body counting data can help enlighten other personnel and the public that radionuclides are much less likely to be hazardous if handled properly.

References

1. Andrews GA, Gibbs WD, Morris AC, et al: Whole-body counting. *Semin Nucl Med* 3: 367-388, 1973

2. Shleien B, LeCroy E: Results of thyroid and whole-body counting of some medical and paramedical personnel. *J Nucl Med* 12: 523-525, 1971

3. Blum M, Liuzzi A: Thyroid ^{131}I burdens in medical and paramedical personnel. *JAMA* 200: 184-186, 1967

4. *National Bureau of Standards Handbook 69.* Maximum permissible body burdens and maximum permissible concentrations of radionuclides in air and in water from occupational exposure. Washington, National Bureau of Standards, June 5, 1959

5. *Directory of Whole-Body Radioactive Monitors.* Vienna, IAEA, 1970, pp 13-19