

is not always possible. A person's exposure record may be incomplete, missing, or perhaps the individual was not monitored properly or at all during the time of employment. The development of site profiles for all of the major Department of Energy sites is a necessary tool for completing dose reconstructions. These profiles serve several purposes: 1) they provide a brief, general overview of specific DOE sites; 2) they identify the facilities on site with a brief description of the processes and radionuclides of interest; and 3) they provide very important support information for the dose reconstructor to use if the monitoring data are inadequate or not available. These are technical basis documents that include specific information and assumptions that can be used by the dose reconstructor. Each claim is reviewed individually. Depending on the situation, important parameters may include facility monitoring data (by radionuclide, mechanism, year, location within a facility); medical x-ray exposures and techniques used; environmental measurements (by area on site, radiation type, energy range); MDAs for different radionuclides; specific source terms within each facility or process; and specifics of the dosimetry program itself as it has evolved over time. Resources include technical basis documents for the external and internal dosimetry programs, facility descriptions, environmental reports, safety analysis reports, and other reports that have been written to describe the workplace environments within the facilities. For example, the Site Plan for the Savannah River Site provides the above-referenced information for five heavy-water reactors (no longer operational) and other facilities in seven Areas on the site.

\*(Work supported by the National Institute for Occupational Safety and Health under contract no. 200-2002-00593.)

#### TPM-D.2

**DEVELOPMENT OF EXTERNAL DOSIMETRY PARAMETERS FOR SITE PROFILES.\*** J.L. Fix,<sup>1</sup> J.L. Kenoyer,<sup>2</sup> S.E. Merwin,<sup>2</sup> W.G. Tankersley,<sup>3</sup> and T.D. Taulbee<sup>4</sup> (<sup>1</sup>Pacific Northwest National Laboratory, P.O. Box 999, Richland, WA 99352; <sup>2</sup>Dade Moeller & Associates; <sup>3</sup>Oak Ridge Associated Universities; <sup>4</sup>National Institute for Occupational Safety and Health)

An important activity within the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) concerns the evaluation of external dosimetry parameters significant to the measurement and recording of dose from beta, photon, and neutron radiation. A brief examination of actual claim information quickly underscores the variability and complexity of potential circumstances in DOE predecessor facilities important to the evaluation, or

reconstruction as necessary, of the dose to an individual worker. Although there are many similarities among DOE sites, there are also notable differences and some limitations, particularly historically, in external dose parameters that must be considered. Crucial guidance in selected technical parameters was achieved during the 1949 trilateral (i.e., Canada, UK, and U.S.) meeting in Chalk River, Canada. This meeting identified basic dose assessment parameters concerning relative biological effectiveness factors and dose quantities that did provide general comparability in the dose of record. However, interpretation of the respective site-specific dose of record information requires an understanding of the various parameters to measure dose from beta, photon, and neutron radiation, typically in mixed fields, in different facilities, using different technology, and during selected periods of time. Site Profiles are being developed that examine the relative significance of various parameters involved in dose measurement. These profiles provide an effective means for the dose reconstruction staff to evaluate the dose of record for monitored workers.

\*(Work supported by the National Institute for Occupational Safety and Health under contract no. 200-2002-00593.)

#### TPM-D.3

**EVALUATION OF ENVIRONMENTAL MEASUREMENTS AND CALCULATIONS FOR SITE PROFILES.\*** E.M. Rollins (Dade Moeller & Associates, 545 Blackburn Drive, Augusta, GA 30907)

Environmental profiles have been developed for DOE sites for use by dose reconstructors to evaluate the contribution of ambient site background to a energy employee's occupational dose. Site annual environmental reports have been reviewed for data that would be useful in reconstructing ambient radiation levels and airborne radionuclide concentrations. Data in these historical documents included ambient pressurized ion chamber and TLD radiation measurements, air sampling results, and residual soil activity. The historical ion chamber and TLD results with uncertainty estimates, where available, were tabulated and are located in the Technical Basis Document. Environmental dose estimates to workers, including background radiation, ranged from 0.05 cSv to 0.8 cSv y<sup>-1</sup> for the Savannah River Site. Careful review of the air sampling data deemed it to be of limited value due to confounding effects of above ground nuclear testing, limited spatial and radionuclide resolution, and insensitivity of early sampling techniques for radionuclides of interest. Therefore, methods were developed to use well documented source terms developed by previous studies,

coupled with historical meteorology, to estimate, radionuclide-specific airborne concentrations for  $^3\text{H}$ ,  $^{131}\text{I}$ ,  $^{41}\text{Ar}$ ,  $^{238/239/240}\text{Pu}$ , and  $^{234/235/238}\text{U}$ . Air concentration calculations included spatial and release height considerations for source terms from two separations and five reactor areas at the Savannah River Site. The 50th and 95th percentile air concentrations were estimated for these source term areas as well as other populated areas. The utilization of residual soil activities has also been implemented in the Technical Basis Document.

\*(Work supported by the National Institute for Occupational Safety and Health under contract no. 200-2002-00593.)

#### TPM-D.4

**CONSTRUCTION OF A SECURE ONLINE ENVIRONMENT FOR DOSE RECONSTRUCTIONS.\*** J.V. Wierowski,<sup>1</sup> P.W. Wallace,<sup>2</sup> and M.D. Wierowski<sup>1</sup> (<sup>1</sup>MJW Corporation Inc., 338 Harris Hill Road, Suite 208, Williamsville, NY 14221; <sup>2</sup>Oak Ridge Associated Universities)

The performance of dose reconstructions under the Energy Employees Occupational Illness Compensation Program Act involves a team of health physics professionals working together from locations across the country. This unique workforce configuration presents numerous information management challenges, most notably, providing high-speed access to data in a variety of formats in a secure environment. A secure environment is required because all data related to a claim is protected under the Privacy Act. To facilitate efficient processing of each claim, the dose reconstruction staff needs access to the original claim documents, the telephone interview(s), all dosimetry records, and the technical basis document(s) for the relevant site(s). This information is primarily stored in electronic documents. Staff also need access to a variety of databases and to controlled versions of the software tools used for totaling internal and external exposures and determining the probability of causation, and a mechanism for collaborating on an individual claim via on-line discussion. The claims tracking staff requires a project management system to monitor each step involved in the processing of a claim. Due to the volume of claims in the program, the system must allow the project staff to indicate their individual progress. This system must be able to support concurrent users in a Web environment and provide automatic notifications as milestones are reached and/or problems identified. A combination of in-house developed applications, commercial software and Internet technologies such as virtual private networking, have been brought together to create a secure environment. This environment enables

the dose reconstructor to access all data and tools necessary to perform the dose reconstruction and communicate with other team members. The system also helps to automatically track the progress of each claim through the dose reconstruction process.

\*(Work supported by the National Institute for Occupational Safety and Health under contract no. 200-2002-00593.)

#### **RISK ANALYSIS**

**Tuesday, 22 July 2003**

**Pacific 3**

**4:00–5:15 pm**

#### TPM-D.5

**TOTAL RISK OF CANCER FROM INGESTION AND INHALATION OF MULTIPLE RADIONUCLIDES.** A.I. Apostoaei, B.A. Thomas, and F.O. Hoffman (SENES Oak Ridge, Inc., 102 Donner Drive, Oak Ridge, TN 37830)

In cases of ingestion or inhalation of multiple radionuclides (e.g., by a member of the public exposed to releases from a nuclear facility) each organ of the body receives a different radiation dose. The risk of cancer can be calculated only for the organs for which a dose response has been determined. However, there are some remainder organs for which a cancer is potentially radiogenic but for which no individual dose response is available. To assess the overall impact of exposure to multiple radionuclides, an estimate of the total risk is desired. However, the sum of the individual organ risks underestimates the total risk, since not all organs have a predetermined dose response. This paper introduces a method by which the total risk can be estimated and presents results obtained for offsite exposure to releases of radionuclides from the Oak Ridge Reservation. The basic estimates of dose response rely on the Japanese A-bomb survivor data for solid tumors. The objective is an estimate of the excess lifetime risk of cancer incidence. The method presented here is based on the existence of a risk coefficient for all solid tumors combined, and it is similar in concept to using the effective dose for estimating the total risk. A weighting factor is determined for each organ of the body, starting from the number of cancers observed for that cancer type and the total number of cancers for all solid tumors. A weighted dose is then calculated using the weighting factors and the doses for each organ, and the total risk is determined using the weighted dose and the risk coefficients for all solid tumors. The risk of leukemia (often reported separately from risk of solid tumors) is added to the total

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*On the cover: A panda at the San Diego Zoo. Photo courtesy of the San Diego Convention and Visitors Bureau.*

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