design is modular with each unit of the design consisting of a center shielded area for Class B and C wastes and Class A wastes with higher levels of gamma radiation and a surrounding area to be filled with the remainder of the Class A waste. With no earthen cover, the dose due to skyshine needed to be considered. In addition, there is a possibility of radiation streaming through equipment access hatches into portions of the facility where workers will routinely be working. These two radiation exposure scenarios have been analyzed to assess the potential dose rates to workers at the facility and to the public at the fenceline of the facility using Monte Carlo methods. Based upon the resulting analysis, design changes have been recommended along with proposed operational restrictions in order to limit the radiation dose rates to the public and to workers.

WPM-E.8

INFLUENCE OF SOURCE MATERIAL AND SOLIDS-TO-WATER RATIO ON CESIUM LEACHING FROM CEMENT. J. Sessoms, D. Stephenson, W. Johnson, and M. Rudin (Department of Health Physics, University of Nevada, Las Vegas, NV 89154-3037)

Four sources of Portland cement (two type V, one type II/V, and one type III) were analyzed for their ability to retard cesium leaching. Batches were mixed using each source of cement and deionized water to obtain two water-to-solids ratios (0.4 and 0.5). The cement was poured into 5-cm-diameter by 5-cm-high monoliths and spiked with 19 ng of ^{133}Cs along with 9,140 Bq of ^{137}Cs as a tracer. After a 28-d cure at room temperature, the monoliths were suspended in a deionized water bath at room temperature. The cumulative fraction of cesium leached from the monoliths was tracked for over 90 d. Results showed that the highest leach rates were obtained for the type V cements, while the fractions released from the type III cements were approximately 50% lower. Cements mixed at a water-to-solids ratio of 0.5 consistently exhibited leach rates that were higher than 0.4 formulations by a factor of two. Near complete leaching of cesium was observed in the first three months of the study.

PROBABILITY OF CAUSATION

Thursday, 20 June 2002
Room: CC 18/19
8:30 am–Noon

THAM-A.1

REPORT OF THE NCI-CDC WORKING GROUP TO REVISE THE 1985 NIH RADIOEPIDEMIOLOGICAL TABLES: OVERVIEW. C. Land,[1] E. Gilbert,[1] J. Smith,[2] O. Hoffman,[3] I. Apostoaei,[3] and I. Thomas[3] ([1]National Cancer Institute, Division of Cancer Epidemiology and Genetics, Radiation Epidemiology Branch, Bethesda, MD 20892-7238; [2]Centers for Disease Control and Prevention, National Center for Environmental Health, Radiation Studies Branch; [3]SENES Oak Ridge, Inc, Center for Risk Analysis)

The legislative mandate for the 1985 Report of the NIH Ad Hoc Working Group to Develop Radioepidemiological Tables provided for analyses of existing data linking cancer risk to ionizing radiation exposure, to facilitate the adjudication of compensation claims for cancers diagnosed following exposure to ionizing radiation. The 1985 working group did this by estimating "probability of causation" (PC) values, defined as PC = risk due to radiation exposure, baseline risk + risk due to radiation exposure for hypothetical instances of cancer following specific histories of radiation exposure. The report has been used mostly by the Department of Veterans Affairs (VA) as a guide to adjudicating compensation claims for cancers diagnosed in persons who were exposed during military service. The amount of new information about radiation-related cancer risk has increased markedly during the 15 years since publication of the report, and there have been revisions in the system of dose reconstruction used for the major source of epidemiological data for estimating risk, the cohort of atomic bomb survivors studied by the Radiation Effects Research Foundation (RERF) in Hiroshima and Nagasaki, Japan. The VA requested the Secretary of the Department of Health and Human Services (DHHS) to update the Report, as provided for in the original legislative mandate, and joined with the DHHS to support the present effort by a working group of the National Cancer Institute (NCI) and the Centers for Disease Control and Prevention (CDC). Noting that the National Academy of Science/National Research Council (NAS/NRC) Committee on Biological Effects of Ionizing Radiation (BEIR VII, phase 2) is expected to complete within 2 or 3 years a comprehensive survey of the scientific data linking radiation exposure to health effects in human beings, the NCI and CDC have undertaken to provide an interim update of the 1985 report based on statistical analyses by the working group of readily available data on cancer risk following radiation exposure, notably the 1958-87 LSS Tumor Registry data on survivors of the atomic bombings of Hiroshima and Nagasaki made available on computer disk by RERF. It is expected that a further update to the present report will be made following the BEIR VII review. The working group has replaced the tabular format of the 1985 report by an interactive computer program (IREP, for "interactive radio-epidemiological program") that eliminates nearly all of the computational labor of estimating PC values and their uncertainties, and permits a more detailed and comprehensive expression of the various components of the calculation and their uncertainties.

THAM-A.2

THE ROLE OF UNCERTAINTY ANALYSIS IN ESTIMATING THE PROBABILITY OF CAUSATION OF RADIOGENIC CANCER. F.O. Hoffman,[1] A.I. Apostoaei,[1] B. Thomas,[1] C. Land,[2] and E. Gilbert[2] ([1]SENES Oak Ridge, Inc., 102 Donner Drive, Oak Ridge, TN 37830; [2]National Cancer Institute, 6120 Executive Blvd., Rockville, MD 20852)

The Interactive RadioEpidemiological Program (IREP) allows for full consideration of uncertainty in the calculation of the probability of causation (PC) of a potentially radiogenic cancer. Uncertainties in model selection, model assumptions, and input variables are expressed as probability distributions. Monte Carlo simulation (with Latin Hypercube Sampling) is used to propagate all sources of uncertainty into a probability distribution of PC that is conditioned on an individual's exposure and disease. Uncertainties are accounted for in the user-provided estimate of the organ or tissue specific equivalent dose and in the excess relative risk per unit dose. With the exception of thyroid cancer from childhood exposures and lung cancer from exposure to radon, all organ-specific risk estimates are based on LSS cancer incidence data for the atomic-bomb survivors of Hiroshima and Nagasaki. The statistical uncertainty in these dose-response estimates are adjusted for bias induced by errors in the original LSS dosimetry and for uncertainties in the models used to extrapolate estimates of the dose response to a member of the U.S. population. To enable extrapolation to various radiation types other than high-energy gamma radiation, probability distributions are assigned to values of the relative biological effectiveness factors for low energy photons, low-energy electrons, alpha particles, and neutrons. For exposures at low doses and low dose rates, the dose and dose-rate effectiveness factor (DDREF) is also described as a probability distribution, with higher weights given to a linear dose-response for breast and thyroid than for other solid tumors. IREP allows for additional adjustment of uncertainties to be added to the calculation of PC provided that such adjustments can be sufficiently justified. These adjustments could account for advances in the state of knowledge and would permit applications to unique conditions not explicitly considered within the code.

THAM-A.3

RELATIVE BIOLOGICAL EFFECTIVENESS FACTORS FOR DIFFERENT RADIATION TYPES. D.C. Kocher, A.I. Apostoaei, and F.O. Hoffman (SENES Oak Ridge, Inc., 102 Donner Drive, Oak Ridge, TN 37830)

As part of an effort to update the 1985 Radioepidemiological Tables, we have developed relative biological effectiveness (RBE) factors for different ionizing radiations for use in calculating the probability of causation of specific cancers. The radiation types considered include neutrons, alpha particles, x rays, and other photons of energy less than about 0.2 MeV, and low-energy beta particles emitted in tritium decay. RBE factors are defined relative to high-energy gamma rays from ^{60}Co decay as the reference radiation, and they are expressed as probability distributions, taking uncertainties in relevant radiobiological data and other information into account. The probability distributions of RBE factors are based primarily on reviews and evaluations of available data by experts and expert groups. The 95% confidence intervals of the probability distributions for neutrons and alpha particles span a range of more than a factor of 10, and they encompass the point values of radiation weighting factors recommended by the ICRP. For lower-energy photons and beta particles from tritium decay, however, radiobiological data and quality factors calculated by the ICRU do not support an assumption that the RBE factor is 1. The probability distributions for these radiations have central estimates of 2-3.

THAM-A.4

TRANSFER OF RISK BETWEEN POPULATIONS APPLIED TO ESTIMATING PROBABILITY OF CANCER CAUSATION. A.I. Apostoaei,[1] F.O. Hoffman,[1] B. Thomas,[1] C. Land,[2] and E. Gilbert [2]([1]SENES Oak Ridge, Inc., 102 Donner Drive, Oak Ridge, TN 37830; [2]National Cancer Institute, 6120 Executive Blvd., Rockville, MD 20852)

The current update of the 1985 Radioepidemiological Tables is based almost entirely on the dose-response relationships for cancer incidence determined from studies of the Japanese A-bomb survivors. The correct model to estimate the transfer of risk coefficients from the Japanese to the U.S. population is uncertain, but it is believed to produce a risk estimate