NCRP REPORT NO. 100, EXPOSURE OF THE U.S. POPULATION FROM DIAGNOSTIC MEDICAL RADIATION.

Maryland, National Council on Radiation Protection & Measurements. 1989, 103 pp, $14.00

In 1987 the NCRP published Report No. 93 on Ionizing Radiation Exposure of the Population of the United States (1987) that summarized the characteristics and magnitudes from several sources; natural background, occupational, nuclear power cycle, consumer products, miscellaneous environmental sources, and medical diagnosis and therapy. Report No. 100 describes the work of one of five NCRP dose assessment committees and is one of the sources of information in the overall summary effort, Report No. 93.

This report consists of five chapters with 1. Introduction, 2. Concepts, Units and Quantities and 5. Summary being very brief. The substance of the report is contained in 3. Diagnostic Medical and Dental X-ray Examinations and 4. Nuclear Medicine. Both of these chapters are organized to define the sources of data, numbers of procedures primarily between 1970 and 1980, population demographics, differential trends, absorbed dose or exposure, gonadal and genetically significant dose, and effective dose equivalent. There is one appendix that shows a sample calculation of collective effective dose equivalent.

The stated purpose of this report is to review the current status of population exposure to diagnostic medical radiation in the U.S. and review trends in this over the last 20 years. Such exposures are difficult to compare to other sources of radiation exposure to the public because: (a) they are deliberate with expected benefit to the individual, (b) typically nonuniform over the body or confined to a part of the body, (c) intermittent and at relatively high dose rates, (d) have a lower limit mandated by current image technology, and (e) delivered to a highly select population, generally ill and elderly. Even though medical diagnostic radiation is the largest source of manmade radiation exposure to the population, second only to natural background, no attempt is made to calculate detriment since this requires a measure of both risk and benefit. To make an accurate assessment at this time is not possible.

The chapter on medical and dental radiation exposures contains a wealth of data on trends in the number of x-ray machines, film use, and patient exams. I was surprised to learn that the number of dental x-ray machines exceeds medical machines by 50%. From 1970 through 1982, the ratio of inpatient to outpatient x-ray exams in hospitals has remained essentially constant. I wonder if this would hold through the late 1980s in these days of DRGs. Also, the number of hospital exams increased by over a factor of 2 between 1964 and 1980, and only slightly less than 2 corrected for population growth. In terms of annual frequency of exams, the U.S. is midrange in comparison to other developed countries. Probably because the data used in this report are only through 1982 it does not support the claim that newer modalities, such as CT, MRI and ultrasound, are replacing other exams. Conventional radiography still (1982) accounts for over 90% of all imaging procedures. Between 1970 and 1983 one might have expected to observe a decrease in mean skin entrance exposure with the advent of rare earth screens and faster screen-films combinations. No such trend is documented by the data analyzed.

The chapter on Nuclear Medicine is based entirely on hospital statistics since <1% of nuclear medicine imaging is performed outside the hospital. I suspect we will see a shift in this distribution. Between 1972 and 1982 there has been substantial growth in nuclear medicine in most areas except brain. The U.S. annual frequency of 32 exams per 1000 population is substantially higher than other developed countries. As with x-rays the population demographics show an expected skewness toward the older segments of the population. There are some useful tables that summarize absorbed doses in a wide range of exams. However, I thought there was too much emphasis on iodine-131 and suspect that the exam mix and radiopharmaceuticals are a bit outdated. This is a problem throughout the report since the newer developments (since the early 1980s) are not included in the data upon which the report is based.

In general, this is a useful reference on diagnostic radiation exposures. One must keep in mind that the time necessary to collect and analyze these data renders some of the conclusions outdated in areas of rapid change, as we have seen in this decade in both diagnostic radiology and nuclear medicine.

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RADIOCHEMISTRY OF CARBON, NITROGEN AND OXYGEN.

R. M. Lambrecht, M. Sajjad, Office Scientific and Technical Information, United States Department of Energy, 88 pp, $14.95

This book is a report on the radiochemistry of carbon, nitrogen and oxygen. It has been prepared as one of the series of monographs on the radiochemistry of the elements under the sponsorship of the Committee on Nuclear and Radiochemistry within the National Research Council. The book contains two main reviews which spread over 88 pages including 158 references.

The first part covers the production and the preparation of the important precursors of carbon-11, nitrogen-13, oxygen-14 and oxygen-15. It also reports on some radiopharmaceutical and biomedical applications. The production yields for the important nuclear reactions are tabulated. The first chapter (Section A) should have been extended to cover biochemical applications which will include biomedical as well as other applications such as ion transport, kinetics, and metabolism (See references 1–4 below).

Nitrogen-13 nitrate is an important intermediate generated as a major product in the proton bombardment of water. It was also used as a tracer (see references 2, 4 below) to study