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PROVISION OF GUIDANCE INFORMATION AND BASIC CRITERIA
FOR RADIATION PROTECTION (U) NATIONAL COUNCIL ON RADIATION
PROTECTION AND MEASUREMENTS BY J T WALKER 27 FEB 84

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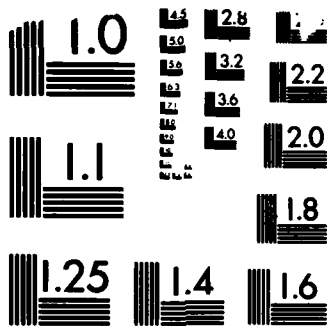
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PROTECTION AND MEASUREMENTS

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report will highlight the activities of the National Council on Radiation Protection and Measurements (NCRP) and, in particular, the efforts of those NCRP scientific committees or sub-groups which were supported during the period between July 1983 and 31 December 1983. The report will briefly outline the overall objectives of the work, as they were defined in the original contract, including a statement about the objectives of each study, and when it is appropriate, a proposed outline of (OVER)		

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the major sections of the draft scientific reports being produced and a statement describing the current status of each project.

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PREFACE

The purpose of this report is to highlight the activities of the National Council on Radiation Protection and Measurements (NCRP) and, in particular, the efforts of those NCRP scientific committees or sub-groups which were supported under Navy contract No. N00014-83-C-0538 during the period between 1 July 1983 and 31 December 1983.

The report will briefly outline the overall objectives of the work, as they were defined in the original contract, including a statement about the objectives of each study, and when it is appropriate, a proposed outline of the major sections of the draft scientific reports being produced and a statement describing the current status of each project.

Introduction

Unlike other research facilities, the NCRP is unique in that support from funding agencies is used primarily to maintain scientific committee or sub-group activities aimed at providing scientific reports concerning radiation protection and measurement.

The NCRP has evolved, over the years, a method of operation which has been effective in accomplishing its objectives. The NCRP seeks to be always on the alert to identify areas in which the promulgation of recommendations can be of value to progress in radiation protection and measurement. Such areas are frequently brought to the attention of the NCRP by its members, by other individuals, or by organizations interested in radiation matters. If the Board of Directors of the NCRP concludes that a study would be appropriate, the problem is either assigned to one of the existing sub-groups or a new sub-group is constituted to examine the problem. The sub-groups -- committees, task groups or study groups -- consist of from five to fifteen individuals with particular expertise in the subject to be treated. These individuals are drawn from the nationwide pool of individuals with training and experience in radiation matters. If preliminary study justifies it, work is begun which typically involves a detailed examination of pertinent information already available, an identification of areas in which information is meager or unavailable, and an assessment of the scientific thinking on the problem at hand. Occasionally it is possible to fill gaps in the available knowledge through individual efforts on the part of sub-group members or by generating interest in the needed information in others working in the problem area. The final result of the sub-group's work is usually a draft of a

proposed NCRP report. This draft is submitted to the members of the NCRP so that the many disciplines and comprehensive experiences represented by the members may be brought to bear on the problem. This review is supplemented by review by government agencies participating in the Council special liaison program. The review process sometimes results in the need for reconsideration by the sub-group and always results in substantial improvement of the proposed report. Finally, after membership approval is obtained, the report is prepared for publication.

This method has made it possible for the NCRP to publish more than seventy five NCRP reports which have often been accepted as the definitive statements on matters of radiation protection and measurement.

Judging by the wide acceptance of NCRP reports, it appears that this method of operation does, indeed, result in a synthesis of the present knowledge relevant to problems of radiation protection and measurement into reports of scientific merit.

As was established in the original proposal entitled "Guidance, Information and Basic Criteria for Radiation Protection", the NCRP was to collect, analyze, develop and disseminate information and recommendations on radiation protection and measurement that represent the consensus of leading scientific opinion on these matters. The overall objective of the work was to provide reports treating the following subjects:

1. Basic radiation protection criteria, including biological aspects of radiation protection criteria, internal emitter standards, human radiation exposure experience and comparative risk.
2. Operational radiation safety including bioassay, training, emergency planning and warning and security systems.
3. Radiation protection measurements, including quality assurance and accuracy in radiation protection measurements, determination of dose equivalent and related quantities and neutron dosimetry and monitoring.

These scientific subgroups involved in this work include the following:

1. SC-1 on Basic Radiation Protection Criteria
2. SC-40 on Biological Aspects of Radiation Protection Criteria
3. SC-46 on Operational Radiation Safety
4. SC-47 Methods for Determination of Dose Equivalent and Related Quantities
5. SC-54 on Bioassay for Assessment of Control of Intake of Radionuclides
6. SC-57 on Internal Emitter Standards
7. SC-59 on Human Radiation Exposure Experience
8. SC-65 on Quality Assurance and Accuracy in Radiation Protection and Measurements
9. Study Group on Comparative Risk

WORK OF SCIENTIFIC COMMITTEES AND RELATED GROUPS

1. Scientific Committee 1 - Basic Radiation Protection Criteria

Scientific Committee 1 is charged with the formulation of NCRP radiation protection standards. Currently, this amounts to the preparation of a new NCRP report to supersede NCRP Report No. 39, Basic Radiation Protection Criteria. This Committee is concerned with annual limits for occupational exposure and for exposure of members of the public, de-minimis concepts, the concept of a lifetime dose limit, quantities and units, radiobiological risk assessment, reasonable risk and the dose (risk) limit system in radiation protection.

Proposed Report Title: Biological Aspects of Radiation Protection Criteria

Proposed Outline: (Major Sections):

1. Summary
2. Introduction
3. Radiation Quality
4. Cytogenetic Effects on Plants, Animal and Human Cells
5. Transformation and Mutation in Mammalian Cells in -Vitro
6. Hereditary Effects -I
7. Hereditary Effects II
8. Experimental Carcinogenesis - External High LET Radiations
9. Internal Emitters
10. Life Shortening in Mice
11. Discussion

Current Status:

The Committee has prepared a complete draft which looks at RBE's for various endpoints at low doses in an attempt to estimate RBE's applicable to man for carcinogenesis at low dose. The report is should soon be ready for entry into the critical review stage.

4. **Scientific Committee 46 - Operational Radiation Safety**

After completion of NCRP Report 71, Operational Radiation Safety - - Training, Scientific Committee 46 was made into an umbrella Committee to oversee task group activities aimed at the provision of additional guidance on practical operational radiation safety matters.

Efforts were proposed in the following areas:

- 1) Warning and Access Control Systems
- 2) Uranium Mining and Milling -- Radiation Safety Program
- 3) ALARA For Occupationally Exposed Individuals in
Clinical Radiology
- 4) ALARA and Reactors
- 5) ALARA and Chemical Processing
- 6) ALARA and Research Facilities
- 7) Instrumentation Calibration Criteria
- 8) Standardization of Film Badges
- 9) Waste Management
- 10) Medical Exams for Workers
- 11) Records
- 12) Personnel Protective Equipment
- 13) Relationships between Field Quantities and Absorbed
Dose in Organs
- 14) QA
- 15) Emergency Planning
- 16) Criteria for Monitoring Intakes

Currently, four task groups have been constituted.

1) Task Group 1 on Warning and Access Control Systems

Task Group 1 is charged with developing a report that will focus on systems aimed at the prevention of high, unexpected radiation exposures and encompass systems ranging from simple signs and ropes to computer-based accelerator vault access control equipment. Included will be a treatment of

criteria for selecting the level of protection required and the minimum requirements for each class of control devices.

Proposed Report Title: Warning and Access Control Systems

Proposed Outline (Major Sections):

1. Introduction
2. Alarm Systems
3. Access Control Systems
4. Protective logic System
5. Criteria for Selection
6. Education on Training
7. Mathematical Description of Reliability
8. Examples of Operational Systems

Current Status:

Task Group 1 had its first meeting on June 21, 1983 and at that time the proposed outline for the report was presented and writing assignments were made. The Task Group is currently in the "middle drafting" stage.

2) Task Group 2 on Uranium Mining and Milling -- Radiation Safety Programs

Task Group 2 is charged with developing a report that will describe the needs and requirements of radiation safety programs at uranium mines and mills and current techniques of radiation control and monitoring.

Proposed Title: Uranium Mining and Milling - Radiation Safety Programs

Proposed Report Outline(Major Sections):

1. Introduction
2. Organization of Radiation Protection Equipment
3. Radiation Hazards
4. Exposure Management
5. Monitoring of Occupational Exposure
6. Effluent Monitoring and Environmental Surveillance
7. Emergency Planning
8. Standards
9. Applications to Underground Mining
10. Applications to Surface Mining
11. Applications to Mills and Processing Facilities
12. Definitions
13. The Uranium -238 Decay Series
14. The Thorium -232 Decay Series

Current Status:

This Task Group had its first meeting on October 5, 1983 and at that time the proposed outline for the report was presented and writing assignments were made. The Task Group is currently in the "beginning drafting" stage.

- 3) Task Group 3 on ALARA For Occupationally Exposed Individuals in Clinical Radiology

Task Group 3 is charged with developing a report that will cover ALARA as it can be applied to diagnostic radiology, nuclear medicine and radiation therapy. It is expected that occupational exposures and the hazards associated with these exposures will be identified and recommendations given on how to reduce the risks of hazards from radiation exposures to levels as low as reasonably achievable for individuals working in the diagnostic radiology area.

Proposed Title: ALARA for Occupationally Exposed Individuals in Clinical Radiology

Proposed Outline(Major Sections):

1. Implementation of ALARA for Occupationally Exposed Individuals in Clinical Radiology
2. Nuclear Medicine
3. Diagnostic Radiology
4. Radiation Therapy
5. Supervision of the ALARA program

Current Status:

Task Group 3 had its first meeting on October 12, 1983. At that meeting, the outline of the report was discussed and writing assignments were made. The Task Group is currently in the "beginning drafting" stage.

4) Task Group on Calibration of Survey Instrumentation

Task Group 4 is charged with drafting a NCRP report dealing with the calibration of field instruments used to monitor radiation and radioactivity. The report should develop the criteria for properly calibrating each type of monitoring instrument as well as detail the criteria and minimum requirements for appropriate calibration facilities. This would include specification of the radiation field to be used in calibrating various instruments and methods for meeting those specifications. Instrumentation which will be included is that which is normally used for radiation protection surveys and air, water and waste stream monitoring. The report will not treat laboratory counting and analysis instrumentation, bioassay instrumentation, nor instrumentation used for radon gas or process monitoring. Calibration criteria will include that necessary for instrumentation used for monitoring photon, electron and neutron radiation (including that generated at high energy accelerator facilities), beta radiation fields and instrumentation which will be used in mixed radiation fields, e.g. beta-gamma or gamma-neutron.

Current Status:

Task Group 4 was recently constituted. The appointment of its members is currently underway.

5. Scientific Committee 47 - Methods For Determination of Dose Equivalent and Related Quantities

Scientific Committee 47 was constituted to undertake development of a report providing guidance on the determination of dose equivalent and related quantities such as the dose equivalent index. The Scientific Committee was to

cover neutron monitoring, thus expanding the treatment of this subject provided in NCRP Report No. 57. The new report was to treat the advantages and disadvantages of various approaches to the determination of dose equivalent quantities. Examples of systems that were to be evaluated include: (1) the use of moderating media and thermal neutron counters to infer dose equivalent for neutrons; (2) the use of passive thermal neutron detectors, along with passive gamma-ray detectors in moderating media to infer dose equivalent in mixed fields; (3) the use of LET-dependent columnar recombination to infer a mean value of LET and from that a mean value of Q; and (4) the use of a proportional counter to measure the LET spectrum and infer dose equivalent directly.

Current Status:

Initiation of the Scientific Committee 47 effort was deferred pending further development of closely related efforts being carried out by the International Commission on Radiological Protection and the International Commission on Radiation Units and Measurements.

6. Scientific Committee 54 Bioassay for Assessment of Control of Intake of Radionuclides

Scientific Committee 54 was charged with developing a report that will address the use of bioassay in assessing and controlling the intake of radionuclides by workers. The Committee is formulating a report treating: bioassay techniques, necessity for a bioassay program, interpretation of results, participation, frequency, action points and action, implementation, and evaluation of results.

Proposed Title: Bioassay For Assessment of Control of Intake of Radionuclides

Proposed Outline(Major Sections):

1. Introduction
2. Necessity for bioassay
3. Participation
4. Bioassay frequency
5. Bioassay techniques
6. Interpretation of bioassay results
7. Action points and action base on bioassay results
8. Perspective on bioassay

Current Status:

The draft report of Scientific Committee 54 was recently submitted to the critical reviewers of the Council. The comments of the reviewers have been received and have been addressed by the Chairman of the committee. A few more items remain to complete the handling of all the comments, and the draft will then be retyped and submitted to the entire Council for review in early 1984.

6. Scientific Committee 57 - Internal Emitter Standards

Scientific Committee 57 was established to examine all aspects of the physics and biology of internally deposited radionuclides leading to the derivation of the interrelationships between intake by man, body and organ burdens, doses to sensitive cells, and the biological risks. The Committee operates as a management committee with thirteen task groups, some of which

are active and some of which have been disbanded as they completed their task. When all aspects of the problem have been examined, it then is the responsibility of Committee 57 to develop recommendations and, working in conjunction with Scientific Committee 1, to recommend limits for population and occupational exposure in situations which result in internally deposited radionuclides. Committee 57 has produced a report entitled, "General Concepts for Dosimetry of Internally Deposited Radionuclides". The report includes major sections treating: (1) primary concepts, reviewing their evolution and stating the position of the NCRP on these concepts, particularly as it may coincide with, or differ from, that of the International Commission on Radiological Protection (ICRP), (2) the output of the system - the forms of expression of internal emitter standards, and the manner in which these standards are properly used, (3) the deposition, metabolism, and anatomic models which form the basis for an internal dose calculation system; including evolution of current ICRP models and identification of areas of needed improvement and limitations on NCRP acceptance of these models. Appendices include detailed information on the central concepts of the new ICRP dose limitation system as they relate to control of internal emitters, the new ICRP methods for calculating doses to tissues from internally deposited radionuclides. The report is currently being revised as a result of Council review.

Several of the task groups of Scientific Committee 57 are now involved in preparing what is called a Phase 2 Report, which will provide the details for implementation of protection activities concerned with internal emitters.

Some of the task groups of Scientific Committee 57, rather than preparing material for the Committee, are charged with preparation of complete reports in their own area of interest. The first of these is Task Group 4 on Radon

and Its Daughter Products. This Task Group has produced a report entitled, "Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States". The report is now in press and a copy of the proofs is enclosed. The report treats sources of radon in the atmosphere, dosimetry of inhaled uranium mine aerosols, dosimetry of inhaled radon daughters in environmental atmosphere, variability of radon daughter dose conversion factors, the adequacy of the working level as an exposure unit, lung cancer in man attributable to radon daughters, studies of radon daughter inhalation using experimental animals, calculated lung cancer risk to individuals from radon daughter exposure and evaluation of occupational and environmental exposures.

Task Group 6 was charged with producing a report discussing the problems of bone. This Group has been very active. The recommendation of the Task Group will probably be significantly different from the recommendations set out in ICRP Publication 30. Their draft report is being revised prior to submission to critical reviewers.

Task Group 7 on Thyroid Risk Estimates completed the drafting work on a report entitled, "Thyroidal Carcinogenesis Following Exposure to Ionizing Radiation." The report develops a practical assessment of the potential of external x- and gamma-radiation, and of some internally deposited radionuclides, to induce thyroid cancer. Major sections of the report include:

1. Introduction
2. Components of the Absolute Risk Equation
3. Human Experience Following External Radiation Exposure
4. Human Experience after Exposure to Iodine-131

5. Animal Data Relating Iodine-131 to External Exposure and Their Applicability to Human Exposure
6. Experience with Iodine-125
7. Classification of Internal Emitters Based on Physical and Biological Characteristics
8. Iodine-129
9. Test of Models in Marshall Islanders Exposed to Mixed Types of Irradiation
10. Conclusions and Recommendations

The Task Group is now revising the report following result of Council review.

Task Group 8 was charged with providing estimates of leukemia risks from internal emitters. It did provide those estimates of leukemia risk to the Management Committee, for inclusion in the Committee report. However, they felt that they had a larger job to do and that was to examine the classification of myelolymphoid disorders, particularly the non-human forms of the disease. There is a strong feeling on the part of the members of the Task Group that much information can be provided relating to the early detection of leukemia in humans by using the animal data as a model. The Task Group has attempted to bring together the veterinary pathologist and the human pathologist in order to examine the pathologic similarities and dissimilarities of the different stages of leukemia, as seen through the eyes of each. This Task Group feels that this will be a very important contribution and the members have all enthusiastically participated in several long slide-reading sessions.

Task Group 12 on Strontium, has been working on a draft report which will bring animal experiments on internally deposited strontium up to date, examine

the alkaline earth models, and develop estimates of the risks associated with internally deposited radiostrontium. It is expected that the draft report will go to critical reviewers in 1984.

Task Group 13 on Neptunium is examining the validity of the parameters and dosimetric models used for neptunium-237 and developing recommendations on metabolic parameters. The work is in the middle draft stage at this time.

7. Scientific Committee 65 - Quality Assurance and Accuracy in Radiation Protection and Measurements

Scientific Committee 65 was established to formulate recommendations on: (1) quality control procedures, (2) the level of accuracy appropriate to the various types of measurements involved in radiation protection and means to achieve it, and (3) traceability requirements for radiation protection instrumentation. The Committee will be concerned with all types of measurement related to radiation protection but will also direct attention to such problems as quality control in the selection, collection and analysis of environmental samples taken for radiation protection purposes.

Proposed Title: Quality Assurance and Accuracy in Radiation Protection and Measurements

Proposed Outline (Major Sections):

1. Introduction
2. Quality goals
3. Quality assurance considerations (elements)
4. Controls accuracy and traceability
5. Illustrations of quality assurance application
6. Conclusions and recommendations

Current Status:

A completed draft is being unified by the Chairman for a review by the Committee in early 1984, with the expectation that the Council review process can start late in 1984.

8. Scientific Committee 59 - Human Radiation Exposures Experience

Scientific Committee 59 supports the work of Scientific Committee 1 by collecting and evaluating new information becoming available from studies of effects attributable to previous human radiation exposure. The Committee is also charged with an examination of the methodology involved in group studies and the identification of additional groups of exposed individuals that might provide information on the effects of irradiation.

Current Status:

This Committee has been relatively inactive pending completion of the efforts concerned with improvement of the dosimetry for the Japanese A-Bomb survivors.

9. Study Group on Comparative Risk

The Study Group on Comparative Risk is also supportive of efforts concerned with basic radiation protection criteria in that it is concerned with comparisons between radiation hazards and those hazards posed by non-radiation activities and materials. One important aspect of this topic is an assessment of the industrial hazard - radiation and non-radiation: (1) on an average basis and (2) in terms of the minimum and maximum hazard level faced by workers. Previous formulations indicate that the use of the average basis places radiation industry in the category of so-called "safe" industries, but a comparison of the range of hazards is yet to be explored.

The Task Group on Comparative Carcinogenicity of Pollutant Chemicals is collecting and analyzing available data on chemical carcinogenicity with emphasis on chemicals which are energy related. The Task Group seeks to review the scientific basis of risk assessment for carcinogenic chemicals in comparison with ionizing radiation.

Proposed Report Title: Comparative Carcinogenicity of Synthetic Fuel
Products

Proposed Outline:

1. Introduction
2. Theories of Cancer
3. Ionizing Radiation
4. Chemicals
5. Data in Hand and Models
6. Risk Assessment
7. Risk Estimates
8. Conclusions and Recommendations

Current Status:

The Task Group is progressing quite well. Their report is in the "middle drafting" stage, i.e. most all sections have been drafted and some sections are in the third or fourth draft.

Conclusion

During the period of the contract, a considerable amount work has been accomplished, as is shown in the report. The funds provided by the Department of the Navy were essential to this progress.

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