

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICS
CAMBRIDGE 39, MASSACHUSETTS
28 October 1952

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Dr. John D. Stoeckle
Panel Director
Committee on Medical Sciences
Research and Development Board
Washington 25, D. C.

Dear Dr. Stoeckle:

This is in response to your memorandum of 20 October 1952 requesting recommendations for concurrence or comments on the 81 page mimeographed draft of a manual on Medical Aspects of Occupational Radiological Hazards.

In the time available I have carefully read portions of the draft, and have scanned the rest of it. Joel Bulkley and Sam Levin of this Institute have read the draft carefully and have given me their detailed reactions in the form of marginal notes and oral comments. It is clear that whoever wrote this draft has put a great deal of time and effort on the job. Parts of it are very well done. In other places there are serious errors of fact (for example page 10 where hydroxyl ions are referred to when hydroxyl radicals is meant; page 6 where the use of the rep unit is incorrectly denied for neutron measurement).

In view of the large amount of time and effort which has already gone into preparing this manual it seems to me only fair that it should receive a sympathetic and detailed review by the consultants to whom it is referred. In my case, and I think in the case of the others, this is impossible to do in five days with no previous warning so that adequate time may be available for the review. I feel very strongly that in matters of this sort the Armed Forces should give at least a month's notice if they are to obtain the benefit of a sympathetic and thorough review.

I am unable to determine for whom this manual is intended. Neither the introduction nor the content of the manual makes this clear. I feel that as a result of having no target, the manual does not hit any of the available targets. I will try to explain this thought in a little more detail.

28 October 1952

If the manual were written with a view to providing practical working information, then it can be said that it never goes sufficiently into detail to permit the actual performance of a specific objective. For example the information on page 66 is insufficient to permit one to design a radio-chemical laboratory, and no references to additional literature are given in the text. Among potential targets or readers there is the other extreme of the specialist, who for want of a better adjective might be thought of here as the "theoretical man" in contrast to the "practical man". This theoretical man might be interested in such fundamental things as the mechanism of biological action (page 10), or the mechanism of the Geiger-Muller discharge (page 20). But neither of these discussions will give him enough information, and no references for further reading are cited.

Midway between these two extreme targets would be the general reader, and by default I assume that those who wrote the manual may have had the general reader in mind. I do not really know who in the Armed Forces corresponds to the general reader, but I can say that if I were a student I would definitely need to have an adequate bibliography for further reading keyed into the text. I feel that one of the greatest weaknesses of the present manual is the fact that the bibliography at the end is not keyed into the text.

I would urge that the target be defined before the draft is reviewed further. If the final intention is to reach some specific type of "general reader" then several such readers should be used as guinea pigs in testing out the next draft. It is difficult for an informed reader to guess how useful a given piece of text will be to another reader who has not been previously acquainted with the subject matter.

For the present I can only report non-concurrence. This is because the objectives of the manual are not visible to me and therefore I cannot judge how closely the text comes to fulfilling its objectives. I would urge especially that a good bibliography be keyed into the text. I would feel that a month's warning should be given before a detailed and sympathetic review is requested on long drafts such as this one.

If the future course of this draft makes it worth while I could ask Messrs. Bulkley and Levin to compile their list of marginal comments and corrections, but at the present time this does not seem to be indicated.

Sincerely yours,

R. D. Evans

Robley D. Evans
Professor of Physics

RDE:mms

CC: Dr. J. C. Aub
Dr. Franklin McLean

Circulate July 1952
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Oer

COMMENTS OF J. B. BULKLEY AND S. LEVIN
ON COPY

"MEDICAL ASPECTS OF OCCUPATIONAL RADIOLOGICAL HAZARDS"

- Page 4, line 6: "When power ..." Does not consider residual induced radiation, i.e., cyclotron.
- Page 6, line 12: Neutrons are considered in the definition of rep.
- Page 7, table 1: This is Chalk River table. Use NBS Handbook 47 figures, i.e., β exposure whole body should be 1.5 instead of 0.5 reps.
- Page 10, 2nd line from bottom: Refer to Prof. Evans' comment in letter of 28 October 1952.
- Page 17, line 2: The 1 mm absorber is usually cadmium or silver to provide for wavelength independence in response.
- Page 17, pag. 1: It might be useful to point out that wrist badges and/or finger badges are worn in conjunction with body type.
- Page 18, par. 1: Repetition.
- Page 18, table:

<u>Emulsion</u>	<u>Useful Sensitive Range (r)</u>
Dupont 552-b	2.0 - 30.0
Add	
Dupont 558 (Dupont 508	0.03 - 3.0
(Adlux 1290	2.0 - 600
- Page 19, line 16: Delete "and".
- Page 22, par. 1: $mr/hr = \frac{0.84 \text{ (milligrams of Ra)}}{(\text{meters})^2}$
- Page 44, line 3: Cl^{36} has 0.64 Mev beta.
- Page 44, par.2: Add Na^{22} as cyclotron-produced, delete Co^{56} , Co^{57} , and Co^{58} as they are not good examples since the three isotopes are produced by the same bombardment and cannot be separated.

COPY

Page 49, 3rd line from bottom: Aluminum - for β -shielding?

Page 50, par. 2: Last sentence: What is meant by this?
1. Is it greater biological effectiveness of lower energy "sky shine" radiation or
2. Is it intensity of radiation from "sky shine" greater than radiation through shield.

Page 52, par. 3: Add: Negative pressure should be maintained in the exhaust ducts.

Page 52, last par: Not true according to present thinking on toxicity of C^{14} (See summary of C^{14} conference, Argonne National Laboratory, Jan. 15-16, 1952). Stated there that "one hundred and fifty mc of C^{14} in an acute accidental inhalation would probably not exceed the permissible dose."

Page 64, par. 2: Does anybody really use this method of controlled accessible storage?

Page 65, last par. : An inhalation and ingestion hazard.

Page 71: This table should be gone over thoroughly. For example cyclotrons, beta-for residual radiation. Synchrotrons-major radiation hazard is x-rays. Luminous paints-major hazard is α from ingestion. Thorium also α from ingestion.



RESEARCH AND DEVELOPMENT BOARD
WASHINGTON 25, D. C.

Rec'd 28 Oct 52
RAN file

27 October 1952

MEMORANDUM FOR EXECUTIVE DIRECTOR, COMMITTEE ON MEDICAL SCIENCES

SUBJECT: Manual on Medical Aspects of Occupational Radiological Hazards

1. In a rather general review of the proposed manual, examining it from the point of view of a training document, a number of problems seem rather pertinent to one who is completely uninformed on the technical aspects of the subject. These are discussed briefly below:

a. The first impressive fact is the complete absence of pictorial or visual aids and diagrams. Although there are no indications that such aids must permeate the entire volume there seem to be a number of situations where they could be incorporated and clarify quickly some of the text, especially when dealing with detection instruments and decontamination and protection programs where devices are utilized.

b. There could be a slight reorganization of the order of some of the Chapters; for example, Chapters 7 and 8 could precede Chapter 6.

c. There is an indication in the earlier Chapters that a great deal of information is taken for granted on the part of the reader and general statements are made all too frequently and glibly. One cannot help but believe that many of the rather complex concepts should be simplified in terms of language and less be taken for granted on the part of the reader if the material is to be readily perceived and understood. In line with this general problem it would seem helpful if occasional references are interspersed throughout the text, by means of footnotes, citing specific research reports as a ready reference for the individual who wants more than a procedure or recommended technique.

d. The early Chapters seem to warrant somewhat improved paragraphing. In a number of situations there are two or three or four different ideas contained in a single paragraph and it is believed that this does not lend itself to utility in a training manual. In addition, there are sections under Chapter 8 that obviously would do better if incorporated into Chapter 9 since they relate to problems of protection in their general consideration of the topics concerned.

e. Although the volume talks in general terms about occupational radiological hazards some information ought to be furnished about the more specific occupations or jobs and their relations to some of the specific types of hazards rather than the general approach which is evident throughout the volume.

2. I trust this will prove of some value in view of the relatively superficial scrutiny of the text contained in the manual.

Aaron B. Nadel

AARON B. NADEL
Executive Director
Committee on Human Resources

Rec'd 27 Oct 52

Mr. [unclear] 0 45

THE UNIVERSITY OF CHICAGO
CHICAGO 37 - ILLINOIS
UNITED STATES AIR FORCE
SCHOOL OF AVIATION MEDICINE
RADIATION LABORATORY
930 EAST FIFTY-EIGHTH STREET

Receiving Room:
927 EAST FIFTY-SEVENTH STREET
Telephone:
HYDB PARK 3-2928-29

25 October 1952

to
John D. Stoeckle, 1st Lt., MC, USAF
Committee on Medical Sciences
Research and Development Board
The Pentagon
Washington 25, D. C.

Dear Lt. Stoeckle:

I have your memorandum of 20 October, with attachments, concerning the draft of a Manual on Medical Aspects of Occupational Radiological Hazards. This has been carefully reviewed by Robert D. Boche, on my behalf, and I have discussed the whole matter this morning with Dr. Coggeshall.

First, I have been unable to understand the purpose of the manual, even with the help of its Introduction (pp. 1-2). A Handbook of Atomic Weapons for Medical Officers was released in June 1951, as prepared by the Armed Forces Medical Policy Council for Departments of the Army, the Navy, and the Air Force and published under the auspices of the Armed Forces Special Weapons Project. The new manuscript apparently proposes a manual to reach the same individuals, with somewhat different slant, but it does not seem sufficiently different to me to warrant a new publication. Perhaps if the purpose of the new manual were made more clear it would be easier to comment on its organization and subject matter.

Second, there are still numerous errors and points requiring clarification in the manuscript as it stands. You have listed a number of these, and Dr. Boche has supplied an additional list. I would say that, once the purpose is adequately defined, a considerable amount of rewriting would be required to make the manuscript publishable.

Third, I am unable to understand why the Armed Forces Medical Policy Council concerns itself with such a project as this. Partly because of this Dr. Coggeshall requests that the question of concurrence on the manual be referred to the civilian group, including members of the Committee on Medical Sciences, which will meet in Washington next Wednesday, 29 October, before any statement is made to the Chairman, Research and Development Board. I shall hope at that time to be prepared to discuss the manuscript, and I shall need your help in presenting it to the civilian group, which will determine what further action is required.

Sincerely,

Franklin C. McLean
Franklin C. McLean, M. D.

cc: Dr. Lowell T. Coggeshall
Dr. Robley D. Evans
Dr. Joseph C. Aub

file

17 October 1952

MEMORANDUM FOR DR. MUSSELLS

SUBJECT: Manual on Medical Aspects of Occupational Radiological Hazards

My comments on the above manual, Medical Aspects of Occupational Radiological Hazards, are as follows:

1. Page 7, Table I.

COMMENT: The RBE of fast and slow neutrons is given as 10 and 5. These values are of lower order from new experimental data.

2. Page 7, paragraph 1 which precedes the Table I. "The following table indicates the presently accepted percentage maximum permissible exposure in rps per week."

COMMENT: In actual practice exposure is expressed in terms of r (roentgens) as this manual does in later paragraphs. Using the same units throughout the text would be helpful for reading and would conform to the current literature.

3. Page 7, paragraph 2. "For the purpose of health monitoring, whole body exposure should be assumed when radiation is received by any portion of the body other than the extremities."

COMMENT: This assumption is not warranted on the basis of experimental and clinical data.

4. Page 9 "MEDICAL EXAMINATIONS AND RECORDS." "This examination should include a detailed history of past occupational and therapeutic radiation exposures, familial tendencies, urinalysis, blood count, serology, and chest x-ray. The blood examination should consist of red, total white, differential and platelet counts, and hemoglobin determination performed at the same time on at least three successive days for comparison with future tests as indicated."

COMMENT: 1. "Familial tendencies" is not defined. I know of no information which indicates that there are any familial tendencies to radiation illness which is implied in the above paragraph.

2. Platelet counts are an unnecessary and unrealistic burden on laboratory facilities because they are difficult to perform accurately and have little value in reflecting early radiation changes on the hematopoietic system.

3. The additional information obtained from a red blood cell count in comparison to a hemoglobin determination is open to question when the red blood cell count is utilized either for follow up or initial examination. The reasons are the same as noted in 2 above.

4. Three successive hemoglobin determinations do not increase their accuracy, usefulness or validity. The reason for this suggestion is not clear.

5. Page 11, paragraph 2: "The total amount of radiation administered, coupled with the schedule of administration of the radiation, or the dose rate, alter markedly the observed biological effects. Any given effect observed after a one hour radiation exposure will be reduced appreciably, perhaps even as much as 50%, if this same radiation dosage is extended or given in divided doses over a 24 hour period."

COMMENT: I do not know of the evidence that indicates that the variation of "any given effect" will vary by 50% under the above circumstances. This evidence may exist but I do not think that this generalization is warranted.

6. Page 14. "DIAGNOSIS." "The various presumptive and supportive evidences are discussed in detail in many publications, and in the acute phase involve mainly interruption of the physiology of the hematopoietic and lymphocytic system of the body."

COMMENT: This sentence is grammatically inaccurate and factually incomplete. The acute phases of radiation illness involve more than the "hematopoietic and lymphatic" system, also the GI tract, etc.

7. Pages 14 and 15. "TREATMENT." "The administration of antibiotics, both orally to control intestinal invasion of infective organisms, and parenterally to control selectively the vulnerable sites of involvement is important."

COMMENT: This is a misstatement of fact. It presupposes that orally administered antibiotics do not reach "selectively the vulnerable sites" whereas parentally administered ones do. This is not true unless it possibly compares serum concentrations to the same dosage administered by the two means. Further it is not clear what is meant by "the vulnerable sites of involvement."

8. Page 15. "The administration of blood derivatives, drugs and chemicals to support blood regeneration and overcome vascular fragility and permeability, chemicals to control and restore fluid and electrolyte balance . . . will play perhaps a major part in determining the success of treatment."

COMMENT: This implies that blood derivatives, drugs and chemicals exist which will overcome vascular fragility and permeability. I do not know of these. Platelets will correct the bleeding defect. Their effect is not as stated above, nor is their mechanism of action known at the present. Further, "chemicals" per se do not control and restore fluid and electrolyte balance. "Chemicals" and water may do both.

9. Page 17, paragraph 2. "Radium is a convenient source for the gamma ray calibration."

COMMENT: Institutions are also using Cobalt 60 for this purpose.

10. Page 17, paragraph 2. "Uranium metal may be used for the beta calibration."

COMMENT: Institutions also use Strontium 89 and Phosphorus 32.

11. Page 17, paragraph 3. "They (film badges) are relatively insensitive to temperature and humidity and will operate successfully where electrical instruments fail."

COMMENT: It should also be added for the purposes of exposition and accurate qualification that film badges have a limited shelf life for storage.

12. Page 20, paragraph 2. "It is this decomposition or breakdown of molecules which generally limits the useful life of a Geiger-Mueller tube."

COMMENT: Current GM tubes are filled with halogen gases for quenching the current, and the deterioration of the tubes is not limited by the factor mentioned here.

13. Page 31, paragraph k.

COMMENT: This paragraph is not clear unless one presupposes that the exposure to multiple sources is simultaneous, i.e., all the sources are in one room and all in operation. This statement ignores the factor of time of exposure.

14. Page 36.
- COMMENT: It would be helpful to know that sources of the tables from the references listed in the bibliography.
15. Page 38.
- COMMENT: The section on BETA PARTICLES has no indication of the energy of these particles. The statements are not meaningful without this.
16. Page 47. "Phosphorus 32 for differentiation of benign and malignant tumors . . ."
- COMMENT: This statement presupposes a wide number of tumors where this observation has been made. The number of tumors has been very limited.
17. Page 49, paragraph 2. "Iodine 131 is excreted more rapidly in myxedematous patients than in normal or hyperthyroid."
- COMMENT: This statement implies that the kidney of the hyperthyroid and myxedematous subjects are responsible for the difference in excretion rates. Actually this excretion is a reflection of the uptake iodine by the thyroid gland. Further, the rate of excretion in myxedema often is slower requiring 72 hours for the elimination of a percentage of the administered dose of I 131.
18. Page 49, paragraph 2. "Radioactive sulfur has to be administered in the form of methionine, cystine, or similar compounds for studying the turnover of sulfur since elemental sulfur or sulfate cannot be utilized by the body in building organic compounds ..."
- COMMENT: This statement is partially correct. It is usually stated, however, and more in accord with the facts, that radioactive sulfur is used to label the amino acids mentioned in order to study their intermediary metabolism.
19. Page 50, paragraph 2. "For large quantities of radioisotopes it is usually necessary to provide shielding above and below the storage area. For example . . ."
- COMMENT: This paragraph ignores the fact that some radioisotopes which are beta emitters, no matter how large the quantity, would not produce secondary reflected radiation from air molecules.

20. Page 59, paragraph 3. "The design and color code of a conventional symbol is under consideration at the present."

COMMENT: These have been adopted.

21. Page 66, paragraph 2. "These procedures should be flexible since an activity may be working with a serious hazard such as plutonium, long-lived alpha emitters, etc. . . ."

COMMENT: Plutonium is a long-lived alpha emitter.

22. Page 72.

COMMENT: The tubes listed on this page are without meaning without further description.

I will not make any recommendation for concurrence or non-concurrence regarding this manual until I have heard from Drs. Aub, Evans and McLean. I think they are more representative of expert and panel opinion on this.

JOHN D. STORCKLE
1st Lt., MC, USAF
Panel Director
Committee on Medical Sciences



RESEARCH AND DEVELOPMENT BOARD
WASHINGTON 25, D. C.

20 October 1952

MEMORANDUM FOR EXECUTIVE DIRECTOR COMMITTEE ON HUMAN RESOURCES AND
COMMITTEE ON ATOMIC ENERGY

SUBJECT: Manual on Medical Aspects of Occupational Radiological Hazards

- ATTACHMENTS: (1) Copy ltr from Armed Forces Medical Policy Council, dtd
14 Oct 52, Subject, as above
- (2) Draft of manual on Medical Aspects of Occupational
Radiological Hazards.

1. According to the attachment the Research and Development Board's concurrences has been requested for the above mentioned manual. The Committee on Medical Sciences has been asked to coordinate the draft of the Chairman's reply with the Committee on Human Resources and the Committee on Atomic Energy.

2. The Committee on Medical Sciences is reviewing the draft of the manual solely from the medical point of view and it is requested that your committee staffs review the manual from the point of view of their field of interest.

3. Would you kindly let us have your comments on this draft at your earliest convenience.

Lloyd Russell

F. LLOYD RUSSELL, M.D.
Executive Director
Committee on Medical Sciences

20 October 1952

MEMORANDUM FOR DR. JOSEPH C. AFB
DR. ROBLEY D. EVANS
DR. FRANKLIN C. MELRAN

SUBJECT: Concurrence or Comments on the Proposed Manual on Medical Aspects of Occupational Radiological Hazards

- ATTACHMENTS: (1) Memorandum from The Armed Forces Medical Policy Council to the Chairman, NHB, dtd 14 Oct 52, Subject: Manual on Medical Aspects of Occupational Radiological Hazards.
- (2) Draft of the Manual on the Medical Aspects of Occupational Radiological Hazards.
- (3) Memorandum to Dr. Marshall from Lt Stockle, dtd 17 October 1952, Subject: As above.

Attachments (1) and (2) have been forwarded to this office from the Chairman of the Research and Development Board for recommendations for concurrence or comments. I would like to know what your comments are on the proposed manual and if you wish them forwarded to the Chairman with recommendations for concurrence or non-concurrence. If non-concurrence the reasons must be stated. I am inclosing my own comments, attachment (3), in which I have tried to stick to factual errors or errors in interpretation even though the exposition, purpose and organization of the manual are unsatisfactory in my mind. I know you are busy but even then I would appreciate an early reply, within a week.

Sincerely,

JOHN D. STOCKLE
1st Lt., MC, USAR
Panel Director
Committee on Medical Sciences

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OFFICE OF THE SECRETARY OF DEFENSE
ARMED FORCES MEDICAL POLICY COUNCIL
WASHINGTON 25, D. C.

14 October 1952

MEMORANDUM FOR: The Secretary of the Army
The Secretary of the Navy
The Secretary of the Air Force
The Chairman, Munitions Board, OSD
The Chairman, Research and Development Board, OSD
The Joint Chiefs of Staff

SUBJECT: Manual on Medical Aspects of Occupational Radiological Hazards

The attached draft of a training manual on Medical Aspects of Occupational Radiological Hazards has been prepared by an Ad Hoc Committee composed of representatives of the three military medical services, chaired by a staff officer of the Armed Forces Medical Policy Council.

A draft of this proposed manual has been reviewed and concurred in, with comments, by the following military department agencies:

Department of the Army

1. Medical Consultants Division, S.G.O.
2. Radiological Consultants Division, S.G.O.
3. Medical Plans and Operations Division, S.G.O.
4. Preventive Medicine Division, S.G.O.
6. Office, Chief of Engineers
7. Office, Chief of Signal Corps
8. Office of The Quartermaster General
9. Office, Chief of Ordnance
10. Office, Chief of Army Field Forces
11. Office of the Chief, Army Chemical Center
12. Office of the Chief Chemical Officer
13. Medical Research and Development Board, S.G.O.
14. Radiological Consultant, Carl B. Braestrup, S.G.O.

Department of the Navy

1. Commandant of the Marine Corps
2. Chief of Naval Operations
3. Chief of Naval Personnel
4. Chief, Bureau of Aeronautics
5. Chief, Bureau of Ordnance
6. Chief, Bureau of Supplies and Accounts
7. Chief, Bureau of Ships
8. Chief, Bureau of Yards and Docks
9. Chief of Naval Research
10. Judge Advocate General
11. Chief, Bureau of Medicine and Surgery

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Department of the Air Force

1. Office of the Surgeon General
2. Assistant for Ground Safety, DCS/P
3. Director of Training, DCS/P
4. Aeromedical and Human Resources Division, Directorate of Research and Development DCS/D
5. Publications Review Branch, AAG

Comments from the above agencies were reviewed by the Committee and pertinent changes made in the content of the manual.

It is proposed that this manual will be a joint publication to be available to the services on a reimbursable basis.

The publication of this manual has the approval of the Armed Forces Medical Policy Council, Office of the Secretary of Defense.

Your concurrence or comments are desired.

/s/ J. Q. Cowley for
Sheldon S. Brownten
Colonel, USAF (MC)
Executive Officer
Armed Forces Medical Policy Council

Incl. 1
Draft of
Subject Manual