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Author(s): Keith F. Eckerman

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Responsible NRC Individual and NRC Office or Division:
R. B. Minogue, Director, Office of Nuclear Regulatory Research,
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INTERIM REPORT

OAK RIDGE NATIONAL LABORATORY

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ORNL

FOREIGN TRIP REPORT

ORNL/FTR-1369

DATE: September 20, 1982

SUBJECT: Report of Foreign Travel of Keith F. Eckerman, Group Leader,
Technology Assessments Section, Health and Safety Research
Division

TO: Herman Postma

FROM: Keith F. Eckerman

PURPOSE: To participate in a meeting, as a member, of an IAEA Special
Group on the Q-System, Central Electricity Generating Board
(CEGB), London, England, August 31 - September 2, 1982.

SITES

VISITED: 8/31-9/2/1982 Central Electricity Generating Board
London, England

ABSTRACT: The traveler attended a meeting of the Special Working Group
on the Q-System convened by the International Atomic Energy
Agency (IAEA). The IAEA is revising its regulations governing
transport of radioactive materials. The Q-System is the expo-
sure pathway/dosimetry system under which the revised numeri-
cal values will be developed for the regulation. This revi-
sion will embody the recent radiation protection guidance of
the International Commission on Radiological Protection
(ICRP), in particular, the secondary limits of ICRP Committee
2 of which the traveler is a member. This meeting was con-
vened to review and make necessary changes in the Q-System to
ensure technical soundness.

Introduction

The International Atomic Energy Agency (IAEA) is developing a revision to their 1973 Safety Series 6, "IAEA Regulations for the Safe Transport of Radioactive Materials." The regulations are intended to apply to international shipments and may also serve as guidance for intranational shipping regulations. At a meeting in March 1982, an IAEA advisory group decided to adopt the "Q-System" as the exposure pathway-dosimetric system to be used to derive the numerical limits. It was also decided, however, that IAEA Member States should have the opportunity to comment on the "Q-System"; comments were filed in July. A special working group was convened to review the comments and make the necessary changes to the "Q-System" to ensure its technical soundness. The meeting of the special working group was held at the facilities of the Central Electricity Generating Board, Sudbury House, 15 Newgate St., London, August 31 through September 2, 1982.

The meeting opened at 9:30 am Tuesday, August 31, with Mr. John Anderson, Secretary of the CEGB, welcoming the group. He noted that CEGB was pleased to be able to host the meeting and indicated their interest in the group's effort to reach an acceptable approach to regulating the shipping of radioactive materials. He noted further that public acceptance was an item of concern to all. Mr. Robert F. Baker, IAEA Secretary to the special working group, expressed the gratitude of the IAEA to the countries which had made experts available and to the CEGB for hosting the meeting. A list of participants by country is attached. The meeting was then turned over to the working group chairman, Mr. R. Rawl of the U.S. Department of Transportation.

The "Q-System" had been documented in detail by MacDonald and Goldfinch (Radiation Protection Dosimetry 1, 1981a, Radiation Protection Dosimetry 1, 1981b) and Goldfinch and MacDonald (Radiation Protection Dosimetry 2, 1982) of the United Kingdom. Numerical values derived from this system would replace the 1973 IAEA type A package content limits for special form materials (nondispersible when subjected to certain specific tests) and content limits for other forms of material; the A_1/A_2 quantities. Under the "Q-System", these limits are replaced by values derived for specific modes of exposure. The special form limit generally is taken as the most restrictive value of the Q_A or Q_F and Q_B (see the following list) while the A_2 quantity is the most restrictive of Q_A through Q_E . The exposure modes considered are:

<u>Quantity</u>	<u>Exposure mode</u>	
Q_A	Direct gamma-ray	} nondispersive
Q_B	Direct beta-ray	
Q_C	Inhalation	} dispersive
Q_D	Skin contamination	
Q_E	Submersion	
Q_F	Special limit for alpha emitters.	

Goldfinch and MacDonald had prepared a working paper (Working Paper 1) giving their response to the member state comments. This working paper served as an outline for the discussions.

1. Dose Limit and Identity of Exposed Individual

The "Q-System" employs a 5 rem effective dose equivalent limit with any organ limited to 50 rem. These limits correspond to the dose limits for occupational workers recommended by the ICRP. Several member states questioned the applicability of this limit to the problem in hand and in particular noted that transport workers are not radiation workers. After some discussion, it was agreed that the "Q-System" was considering a "once in a lifetime" dose as a design reference level, and that emergency control procedures and other factors would make it most unlikely that members of the general public would receive doses of the order of the reference level. It was agreed that an effective dose equivalent of 5 rem should be taken as the design reference level, but it was noted, however, that this decision cannot be directly related to applicable ICRP guidance. Furthermore, it was noted that the 50 rem dose equivalent limit to any organ (the nonstochastic limit of ICRP) is not applicable to "once in a lifetime" considerations. However, as this limit is in force in the secondary limits (the annual limit on intake) of ICRP Publication 30 it was agreed to retain the organ dose equivalent limit.

2. Distance-time Relationship

The "Q-System" employs a distance-time exposure relationship of 1/2 hour at 1 meter from the source when considering the direct external exposure pathway (gamma and beta radiation). The 1973 regulations considered the individual to be exposed for 3 hours at 3 meters and did not address beta exposure. It is of interest to note that for gamma radiation the 1973 distance-time relationship with its dose limit of 3 rem corresponds to the same dose rate as the new relationship, i.e., 1/2 hour at 1 meter for 5 rem. The consideration of beta exposure, is of course, highly sensitive to the assumed distance from the source due to air shielding. While other distance-time relationships could be considered, it was recognized that the proposed values were generally reasonable and practical. The point was made that planned recovery operations, i.e., returning the source to a shielded condition, should be carried out by radiation workers and thus is not part of the "Q-System" considerations.

3. Shielding Factors for Beta Particles

In evaluating the external beta dose, the source is assumed to be out of its shipping package but shielded by its own container. A late comment from Japan questions the numerical values of the shielding factors. The Japan and United Kingdom representatives met with the traveler to resolve this question. It was agreed that the approach taken in the "Q-System" was very conservative, particularly noting that no consideration was given to the degraded beta spectra when considering the air transport to 1 meter. A more detailed examination of the relevant data will be undertaken to develop realistic shielding factors.

4. Mass-loading of the Hands

Both the Federal Republic of Germany and the United States noted the need to consider the mass limitation on the amount of activity that could be picked up on the hands. For very low-specific activity radionuclides, it would be impossible to mass-load the hands to the indicated activity levels. There was general agreement on this point and a mass-loading of 10 mg/cm^2 was selected.

5. Special Case for Tritium

Tritium was addressed in the "Q-System" as a special case in that the supporting analysis assumed that package integrity was lost through a fire during shipment. Detailed discussion and critical review of this aspect was offered by the Canadian representatives. While the "fire" consideration results in dispersion of the package contents, it also disperses the workers, in fact, the Canadian effort indicated that workers, not leaving the area would be asphyxiated before the tritium was released. It was agreed to treat tritium as a special case with Q_1/Q_2 being taken as 1000 Ci.

6. Special Forms Limit for Alpha Emitters

The package limit for special forms (sealed sources) of alpha emitters in the 1973 regulations was 1000 times the limit for the dispersive forms. (The factor of 1000 is arbitrary.) The United States had commented that, since the limits for the dispersive forms have generally decreased (largely due to the revised dosimetry in the ICRP Publication 30), continued use of the arbitrary factor of 1000 would severely impact shipment of neutron generator sources. It was noted that the last 10 years of good shipping experience would support increasing this factor and a value of 10,000 was agreed upon. This would maintain about the same source strength for sealed sources that is currently in effect.

7. Neutron/Gamma Exposures

It was agreed that, for neutron generators, if the activity level was established by the gamma radiation level, the neutron level need not be considered. The only exception is ^{252}Cf . The increase in the special form factor for alpha emitters necessitates that the potential neutron exposure be reevaluated as it may well limit the package content. The United Kingdom representatives intend to reconsider the ^{252}Cf special form value.

The above summarizes some of the major topics discussed but by no means represents the total discussions. Considerable attention was directed to other details, e.g., how parent-daughter relationships were to be treated. Additional discussions were related to identifying various areas where the decisions of the special working group might impact other aspects of the developing transport regulation. The meeting closed on Thursday, September 2, at 5:00 pm.

Summary

The purpose of the special working group meeting was to address specific concerns raised by member states on the "Q-System." By the close of the meeting, all identified concerns had been discussed and modifications to the system had been suggested. The meeting was highly productive due to the effort of the chairman to adhere to the agenda. It was quite clear that the participants felt that the special working group had contributed significantly to improvements in the "Q-System."

APPENDIX

Itinerary

8/29-30/82 Travel from Oak Ridge, Tennessee to London, England

8/31-9/3/82 Meeting of IAEA/NRC Special Working Group, Central
Electricity Generating Board, London, England

9/4/82 Travel from London, England to Oak Ridge, Tennessee

Persons Contacted

See attachment.

Literature Acquired

None.

Department of Nuclear Energy and Safety
Division of Nuclear Safety

Issue No. 1
1982-08-17

NOTIFICATION OF AN AGENCY-SPONSORED MEETING

Title of meeting: Special Working Group to revise the activity limits in the Agency's Regulations for the Safe Transport of Radioactive Materials

Dates of meeting: 31 August - 3 September 1982 Opening: 9.00 a.m.

Place of meeting: Sudbury House, 15 Newgate Street, London ECl, England

Scientific Secretary: Mr. R.F. Barker

PARTICIPANTS	ADDRESS ABROAD	ADDRESS IN LONDON	PERIOD
BELGIUM			
Mr. L. Baekelandt	Radiological Protection Office Ministry of Public Health B-1010 Brussels	Kenilworth Hotel Great Russell Street	31 August - 3 September
CANADA			
Mr. G.J. Dicke	Ontario Hydro Radioactivity Management and Environmental Protection Dept. 595 Bay Street (A7-D13) Toronto, Ontario	Barbican City Hotel Central Street	31 August - 3 September
Mr. G.C. Jack	Atomic Energy Control Board P.O. Box 1046 Ottawa K1P 5S9	Strand Palace Hotel The Strand	31 August - 3 September

PARTICIPANTS	ADDRESS ABROAD	ADDRESS IN LONDON	PERIOD
JAPAN			
Dr. K. Kuwashima	Nuclear Transport Services Company Ltd. 1-1-3 Shibadai-mon Minato-ku Tokyo	Avoca House Hotel 43 Belsize Park	31 August - 3 September
Dr. Jun Akaishi	Division of Health Physics Tokai Research Establishment, JAERI 2-4 Shirakatashirane, Tokai-mura Naka-gun Ibaragi-ken		
SWEDEN			
Mr. B. Pettersson	Swedish Nuclear Power Inspectorate Box 27 106 S-102 52 Stockholm	Kingsley Hotel Bloomsbury Way	31 August - 3 September
Ms. B. Svaha	National Institute of Radiation Protection Box 60 204 S-104 01 Stockholm	Kingsley Hotel Bloomsbury Way	31 August - 3 September
UNITED KINGDOM			
Mr. E.P. Goldfinch	Central Electricity Generating Board Courtenay House 18 Warwick Lane London EC4P 4EB	Bonnington Hotel Southampton Row	31 August - 3 September
Mr. D.J. Blackman	Department of Transport 2 Marsham Street London SW1P 3EB	None - travelling each day (Reading to Waterloo)	31 August - 3 September
Mr. H. MacDonald	CEGB, Berkeley Nuclear Laboratories Berkeley, Glocs GL13 9PB	Bonnington Hotel Southampton Row	31 August - 3 September
Mr. K. Shaw	National Radiological Protection Board Chilton, Didcot Oxon OX11 0RQ	-	31 August - 3 September

PARTICIPANTS	ADDRESS ABROAD	ADDRESS IN LONDON	PERIOD
UNITED STATES OF AMERICA			
Mr. R. Rawl	Office of Hazardous Materials Regulation U.S. Department of Transportation Washington DC 20590	Hotel Crichton 36 Bedford Place	31 August - 3 September
Mr. D.R. Hopkins	Office of Research U.S. Nuclear Regulatory Commission Washington DC 20555	Hotel Crichton 36 Bedford Place	31 August - 3 September
Mr. K. Eckermann	Health Safety Research Division Oak Ridge National Laboratories Oak Ridge Tennessee 37830	Hotel Crichton 36 Bedford Place	31 August - 3 September
INTERNATIONAL MARITIME ORGANIZATION			
Capt. H. Wardeimann	Marine Safety Division 101-104 Piccadilly London W1V 0AE		31 August
FRANCE			
Mr. C. Ringot	Commissariat à l'énergie atomique Boite Postale 6 F-92260 Fontenay-aux-Roses		31 August

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- 1-2. Assistant Secretary for International Affairs, DOE, Washington, D.C.
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7. J. A. Lenhard, DOE/ORO
8. J. S. Denton, DOE/ORO
9. Herman Postma
10. D. R. Hopkins, Division of Risk Analysis, U.S. Nuclear Regulatory Commission, Washington, D.C.
- 11-12. Director of International Programs, U.S. Nuclear Regulatory Commission, Washington, D.C.
- 13-14. Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, D.C.
- 15-16. Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830
17. R. Rawl, Office of Hazardous Materials Regulation, U.S. Department of Transportation, Washington, D.C. 20590
18. B. A. Berven
19. R. O. Chester
20. K. F. Eckerman
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