

Overview on ICRP's Task Group 115 – Motivation, Agenda, and Future Plans

Meeting of NAS Committee on Assessment of Strategies
for Managing Cancer Risks Associated with Radiation
Exposure During Crewed Space Missions

April 14, 2021

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ICRP and Cosmic Radiation

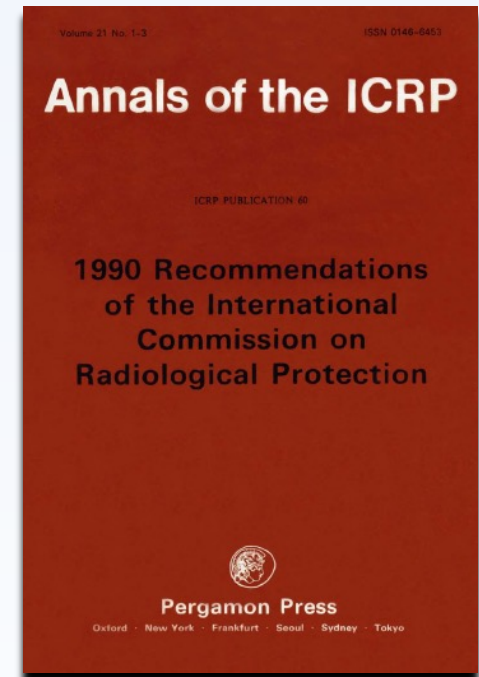
ICRP Publication 60, 1991, Recommendations

(136) "... the Commission recommends that there should be a requirement to include exposures to natural sources as part of occupational exposure only in the following cases":

- (a) ... radon ...
- (b) ... natural radionuclides ...
- (c) **Operation of jet aircraft,**
- (d) **Space flight.**

Case (c) will relate principally to the aircraft crew, but attention should also be paid to groups such as couriers who fly more often than other passengers.

Case (d) relates to very few individuals and will not be discussed further here.

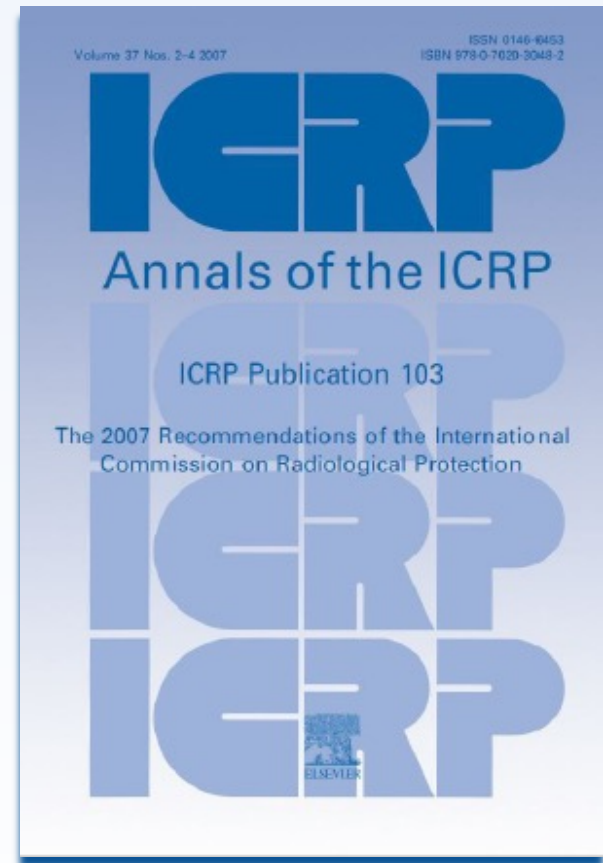


ICRP60 was a milestone, because for the first time natural exposures were explicitly addressed

ICRP Publication 103, 2007, Basic Recommendations

On exposures in space

(190) Exceptional cases of cosmic radiation exposures, such as **exposure in space travel**, where doses may be significant and some type of control warranted, **should be dealt with separately, taking into account the special type of situations that can give rise to this type of exposure.**

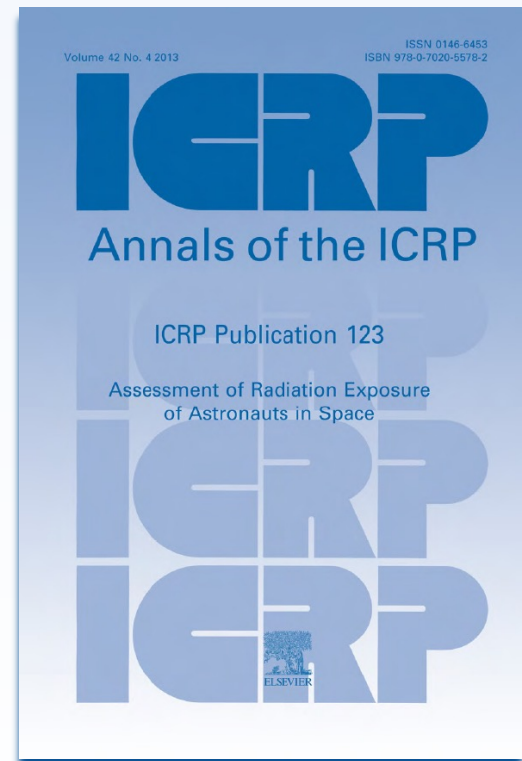


ICRP Publication 123, 2013, Assessment of Radiation Exposure of Astronauts in Space

Authors on behalf of ICRP

G. Dietze, D.T. Bartlett, D.A. Cool, F.A. Cucinotta, X. Jia, I.R. McAulay, M. Pelliccioni, V. Petrov, G. Reitz, T. Sato

- ICRP 123 focusses on astronaut exposure
- The different – **more risk-related** – concept of exposure assessment described in this report is clearly restricted to the special situation in space, and should not be applied to any other exposure situation on Earth or for aircraft crews.
- Due to the specifics of the radiation field in space, not all concepts of quantities defined for radiological protection applications on Earth are appropriate for applications in space missions, especially **when risk assessment is an important task.**



In Feb 2018, the International Systems Maturation Team (ISMT-Radiation) asked ICRP

- To provide expert opinion/guidance on radiation effects to the CNS during spaceflight based upon a review of available evidence base.
- To provide recommendations on inclusion of cardiovascular disease as a health outcome
- To provide recommendations on the occurrence and latency of lens opacification during a long duration exploration-class mission
- To evaluate results from a selection of space agency-provided risk models for designed reference missions
- To provide recommendations on both a common risk assessment framework and recommendations on exposure limits for cancer risks for exploration-class human spaceflight missions.

Formal Establishment of Task Group

Task Group 115 Risk and Dose Assessment for Radiological Protection of Astronauts A Task Group under Committee 1

Terms of Reference

- Will build on the work in Publication 123
- To develop a comprehensive framework for risk and dose assessment for radiological protection of astronauts, including
 - a set of basic objectives
 - a review of the current understanding of effects and risks from space radiation
 - a broadly-applicable risk and dose assessment methodology
 - an assessment of the use of risk as a radiological protection quantity.

TG115 Kick-Off Meeting

November 20, 2019
Adelaide, Australia

In conjunction with the 5th
ICRP Symposium



HOSTED
BY



Australian Government
Australian Radiation Protection
and Nuclear Safety Agency



Task Group 115: Risk and Dose Assessment for Radiological Protection of Astronauts

Members

- **Werner Huhm** (Chair), Helmholtz Zentrum München, Germany
- **Nobuhiko Min**, Nuclear Regulation Authority, Japan
- **Francis A. Cucinotta**, USA
- **Marco Durante**, Germany
- **Isaburo Komiyama**, Japan
- **Kotaro Ogasawara**, Radiation Effects Research Foundation, Japan
- **Isaburo Sato**, Japan Atomic Energy Agency, Japan
- **Edward Semones**, USA
- **Vyacheslav Shurshakov**, Russian Federation
- **Ulrich Straube**, Germany
- **Lewna Tormi**, Canada
- **Alexander Ulanovsky**, International Atomic Energy Agency, Austria
- **Ludovic Vaillant**, CERN, France
- **Zhenhua Xu**, China

*Corresponding members



Previous ICRP Activities

Aspects of radiological protection of astronauts in space have been addressed by ICRP in Publication 123 'Assessment of Radiation Exposure of Astronauts in Space', published in 2013. This publication focused on the challenges in dosimetry related to the radiation fields in space which differ from those on Earth. It covered:

- the radiation environment in space,
- quantities used in radiological protection,
- methods of measurement,
- radiation fields inside spacecraft and on planetary surfaces,
- radiation fields and doses in the human body,
- and a short section on operational radiological protection.

Recent Developments

The various space agencies involved in human spaceflight use:

- a variety of methods to assess dose and risk to their astronauts, and
- a variety of risk and dose protection quantities and restrictions.

In 2018, the following space agencies involved in the International Space Station proposed collaboration with ICRP:

- Canadian Space Agency - CSA,
- European Space Agency - ESA,
- Federal Space Agency of the Russian Federation - FSA,
- Japan Aerospace Exploration Agency - JAXA,
- National Aeronautics and Space Administration - NASA.

This prompted ICRP to establish TG115 with input from international experts in radiation risk and dosimetry.

The Task Group was approved in May 2019 at the meeting of the Main Commission in Houston, USA.

Goals of Collaboration between ICRP and Space Agencies

- to examine effects which may impact crew health and mission success, and
- to develop a common health risk assessment framework and recommendations on exposure limits for exploration-class human spaceflight missions.

Scope of Task Group 115

The current Task Group will build on the work in Publication 123, to develop a comprehensive framework for dose and risk assessment for radiological protection of astronauts, which might also be of relevance for space tourism. This will include:

- a set of basic objectives,
- a review of the current understanding of effects and risks from space radiation,
- a broadly-applicable risk and dose assessment methodology (noting that dose assessment has already been addressed in Publication 123),
- an assessment of the use of risk as a radiological protection quantity.

Planned TG 115 Work as Discussed in July 2019

- Review of relevant literature,
- Characterization of radiation fields,
- Dose assessment methodologies,
- Relevant health effects + reviews (focus on space),
- Risk assessment methodologies,
- Sources of uncertainty,
- Set ranges of reasonable and tolerable dose/risk for space exploration (implementation into ICRP RP system).

Current Membership – www.icrp.org

Werner Rühm (Chair), Helmholtz Zentrum München, Germany

Chunsheng Li (Secretary), Health Canada, CANADA

Nobuhiko Ban (Member), Nuclear Regulation Authority, Japan

Marco Durante (Member), Germany

Tatsuto Komiyama (Member), Japan

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Tatsuhiko Sato (Member), Japan Atomic Energy Agency (JAEA), Japan

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Leena Tomi (Member), Canadian Space Agency , Canada

Alexander Ulanowski (Member), International Atomic Energy Agency, Austria

Ludovic Vaillant (Member), CEPN, France

Zhenhua Xu (Member), China

Short-term Goal

Preparation of report to answer ISMT-Rad request including

- Setting the scene
- Describing the methods used for dose and risk assessment by space agencies involved in ISS (CSA, ESA, JAXA, NASA, RSA)
- Defining two example missions
 - Cislunar mission and lunar surface mission
 - Exposures from galactic cosmic radiation and from a solar particle event
 - Doses and risks calculated following space agency procedures
- Reviewing relevant tissue reactions (anything new since ICRP Publ. 118?)
- Reviewing relevant stochastic effects and associated risk metrics
- Reviewing issues related to RBE and radiation quality factors

Long-term Goal

Work on how the principles of radiological protection are applied for the space environment (this TG or a follow-up TG)

This could include recommendations on use and setting numerical values of

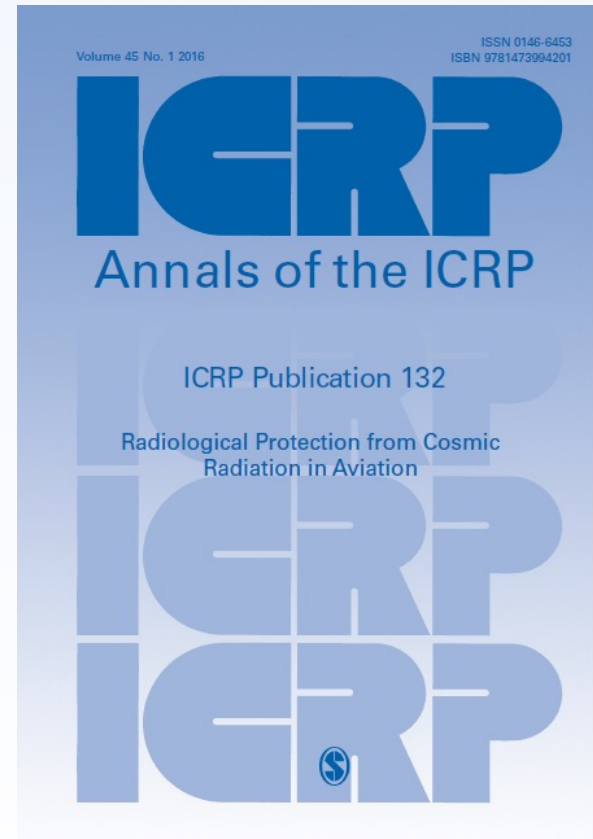
- Limits
- Constraints, and
- Reference levels.

This would mirror *Publication 132*

Radiological Protection from Cosmic Radiation in Aviation

Authors on behalf of ICRP

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ICRP

THANK YOU!