INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

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Resolution of Public Consultation Comments for

ICRP *Publication 146* Radiological Protection of People and the Environment in the Event of a Large Nuclear Accident

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Background

ICRP is grateful for the time and effort taken to review and comment on draft reports during their public consultation period. Active public consultations are a valuable part of developing high-quality publications. Comments are welcome from individuals and organisations, and all are considered in revising the draft prior to publication.

To ensure transparency, comments are submitted through the ICRP website and visible by visiting www.icrp.org.

Public Consultation

The draft report was available for public consultation from 18 June 2019 to 25 October 2019. Altogether 308 sets of comments were received from individuals and organisations covering a wide range of aspects dealt with in the report. Consequently, the Commission undertook a significant redrafting to improve the readability and understanding and to amend some of the recommendations.

The full list of individuals and organisations that provided comments during the public consultation process is shown in Appendix A.

Several comments suggested that the recommendations of the Commission be more consistent with those already proposed by other international organisations. There were also many that requested more detail throughout the document, particularly on the phasing of an accident and the progression of societal and economic consequences over time.

More specific comments focused primarily on: the introduction of the 10 mSv per year reference level value for the implementation of optimisation of protection during the recovery phase; the protection of responders; clarification concerning the process of co-expertise; the termination of protective actions; the management of commercial activities in the affected areas; and, the issue of potential thyroid cancers following a nuclear accident.

Finally, although many reviewers welcomed the annexes to the Chernobyl and Fukushima report, they asked that they be treated more coherently with the main text.

Resolution of comments

The suggestion for greater harmonisation with recommendations and requirements of other international organisations, notably regarding the timeline for managing a nuclear accident, were addressed in several ways. To clarify and simplify the reading of the report, it was

decided to change the titles of Chapter 3 and 4 to adopt the distinction between the early, intermediate, and long-term phases traditionally adopted by the Commission (ICRP, 1984), instead of the distinction between 'emergency' and 'recovery' used in earlier drafts. In addition, to make the link with the relevant international recommendations and to avoid repeating the latter many references have been introduced in the body of the text and in the annexes referring to the most important relevant reports.

An effort has been made to provide further explanation, based on knowledge and experience, to help the reader more deeply understand accident and post-accident situations. In Chapter 2, for example, adjustments were made to better explain the diverse consequences – radiological and non-radiological – of a large nuclear accident as well as the principles for protection of people and the environment to be applied in such circumstances, along with the underlying ethical values. Materials are also provided in Chapters 3 and 4 to further describe possible prevailing circumstances in the three phases of the accident, the protective actions to be implemented, and the roles of various stakeholders.

The two annexes related to the accidents of Chernobyl and Fukushima have been almost totally redrafted to be fully in line with the main text.

In preparing this publication, the Commission has tried to adopt a common language understandable by all, in particular by non-specialists and those people directly affected. The following sections indicate how the Commission has responded to the specific points mentioned above.

Reference levels for the long-term phase

Beyond the question of the rationale to introduce this new value of 10 mSv, many commenters asked for a clearer explanation of the use of reference levels in relation to the implementation of the principle of optimisation of protection in the long-term phase.

In *Publication 111* (ICRP, 2019) the Commission recommended that '*The reference level for the optimisation of protection of people living in contaminated areas should be selected in the lower part of the 1–20 mSv/year band recommended in* Publication 103 *(ICRP, 2007) for the management of this category of exposure situations. Past experience has demonstrated that a typical value used for constraining the optimisation process in long-term post-accident situations is 1 mSv/year.'*

This formulation gave rise to many comments, even criticisms, long before Task Group 93 began its work, in particular regarding the vagueness of the expression *'in the lower part of the 1 to 20 mSv per year band'*. For the sake of clarification, the Commission therefore adopted the following wording in the draft report: *'Levels should be within or below the Commission's recommended 1–20-mSv band taking into account the actual distribution of doses in the population and the tolerability of risk for the long-lasting existing exposure situations, and would not generally need to exceed 10 mSv per year. The objective of optimisation of protection is a progressive reduction in exposure to levels on the order of 1 mSv per year.'*

However, the introduction of the value of 10 mSv per year to logically delimit the lower part of the band raised many more comments. What was the rationale for introducing a new value? Why 10 mSv per year and not a lower value? In addition, several comments rightly underline the importance of preserving the maximum flexibility in selecting reference values, which basically serve as a guide for the implementation of the principle of optimisation and therefore must fit the prevailing circumstances.

Considering the comments, in *Publication 146* the Commission adopted the following formulation: *'For the long-term phase, the reference level should be selected in the lower half of the recommended band of 1–20 mSv per year for existing exposure situations, taking into account the actual distribution of doses in the population and the societal, environmental and economic factors influencing the exposure situation. The objective of optimisation of protection is a progressive reduction in exposure to levels towards the lower end of the band or below if possible.'*

This formulation specifies the range of the band of 1-20 mSv per year in which the reference levels should be selected (in the lower half) and the objective of the optimisation process which is 'to reduce exposures to levels that are close or similar to situations considered as normal' as clearly specified in *Publication 103* (ICRP, 2007, Para. 288).

Management of Responders

An aim of the recommendations is to ensure appropriate protection and suitable working conditions for the responders, likely to be the most exposed individuals. With this in mind, a distinction is made between activities on-site (in the damaged installation) and off-site (in the affected areas), and the three phases of the accident (early, intermediate and long-term).

The notion of responder was introduced to encompass people diverse in terms of their background, status, and degree of preparation and training on radiological protection. Compared to the emergency worker as mentioned in the International or European Basic Safety Standards (BSS), the protection approach is similar apart from the issue of dose criteria. Both BSSs require that the exposure of emergency workers remains below the value of the occupational dose limit whenever possible. In addition, according to the International BSS, it shall be ensured that no emergency worker is subject to an exposure in excess of 50 mSv (corresponding to the maximum dose limit for a given year) while the European BSS fix a reference level of 100 mSv. The Commission also recommends a reference level of 100 mSv (the upper bound of the band 20-100 mSv typically for emergency exposure situations). In all cases, flexibility is planned, recognising the possibility of exceptional circumstances. In the long-term phase, the BSSs consider the responders to be workers and recommend the application of the occupational dose limit while the Commission recommends the use of reference levels, at the same value or below.

Since the exposure situation is emergency or existing depending on the phase, the Commission recommends the use of reference levels for the optimisation of protection and to guide the implementation of protective actions, for both responders and the general population. The application of dose limits is not appropriate in emergency and existing exposure situations following an accident; this only applies in planned exposure situations

when the source has been deliberately introduced and exposures are fully under control and regulated.

In the long-term phase on-site, the exposure situation is reasonably characterised, and the source is mostly under control, although some technical difficulties may remain, and unforeseen situations may occur at any time. For the management of responders, the recommended dose criterion (20 mSv/y or below) is a reference level and the requisites for occupational exposure should apply as relevant. It is recognised that some authorities and stakeholders may desire to apply dose limits. This may be suitable, but not essential, in circumstances when the source is well characterised and controlled. However, even in such a situation, exceeding the dose limit is not necessarily an indication of failure in the management of the situations. Moreover, a strict application of the dose limit may lead to a critical turn-over of responders and an increased collective dose. Furthermore, circumstances on-site may require planning for exposures higher than the reference level. In that case, the Commission recommends special arrangements limited in time, which should be prepared with the greatest care after deliberation among concerned parties with the aim of optimising protection.

Taking into account the comments received, the Commission made some adjustments the use of reference levels for the protection of responders, summarised as follows.

For protection of responders on site, the reference level during the early phase should not generally exceed 100 mSv, while recognising that higher levels, in the range of a few 100 mSv, may be permitted to responders in exceptional circumstances to save lives or to prevent further degradation at the facility leading to catastrophic conditions. Lower reference levels may be selected based on the situation, in accordance with the severity of the accident. During the intermediate phase, the reference level should not exceed 100 mSv. For the long-term phase, the reference level should not exceed 20 mSv per year with possible special arrangements limited in time. The Commission recommends that responsible organisations take all practical actions to avoid unnecessary accumulation of exposures for responders involved in both the early and intermediate phases.

For protection of responders off-site, the Commission recommends selection of a reference level not exceeding 100 mSv for the early phase and 20 mSv per year for the intermediate phase. For the long-term phase, the reference level should be selected within the lower half of the 1 to 20 mSv per year band, since the exposure should be managed using the same requisites as for the general population in affected areas.

The co-expertise process

Several comments suggested initiating the process of co-expertise from the emergency response and relying on it during preparedness planning for possible future accidents.

In the draft, the co-expertise process was proposed for the development of practical culture of radiological protection with a view to promoting self-help protective actions in the long-term phase. In final version, the approach is recommended from the intermediate phase onwards (see Chapter 3). In addition, the ethical dimensions of the process have been developed to emphasise its role in the restoration and preservation of human dignity. Support of the co-expertise process helps radiological protection professionals appreciate

the ethical structure of radiological protection while respecting the choices of those affected. The co-expertise process approach aids the organisation of citizen vigilance during the implementation of local projects. As explained in the chapter on the long-term phase, the co-expertise process is inherent in the implementation of self-protective actions with adequate support from the authorities. Finally, the approach is also recommended for preparedness planning in Chapter 5.

Termination of protective actions

Some comments underlined that although the recovery process could be considered finished in some affected areas, the situation for the population in these areas may remain difficult due to the stigmatization of the territory, its products (especially agricultural and fishery), and even of the people who reside there.

In the long-term phase, even after the end of protective actions, people should be able to benefit from the support of authorities and experts, not only to ensure adequate protection against radiation, but also to guarantee sustainable living and working conditions and a safe environment ensuring respectable means of subsistence and way of life. To pass on experience and build the future, the Commission recommends that all necessary attention be paid to the development of accompanying measures to support initiatives and citizens' projects in the fields of education, culture, and memory, which contribute to a decent life and the sustainable development of the living conditions of present and future generations (section 4.4.3).

Management of business activities

Publication 146 clarifies the responsibility of employers to provide adequate information on the radiological situation to their employees and their families and to implement radiation monitoring adequate and self-protective actions if necessary.

These provisions are introduced during the intermediate phase (section 3.4.2.5) as well as during the long-term phase (section 4.4.1.3). The recommendation of the Commission is to manage the people employed for various economic activities in the affected areas as members of the public. However, for workers involved in activities inducing specific exposure situations, such as foresters, the Commission recommends that they be considered occupationally exposed.

Thyroid cancers

Because the Fukushima health management survey detected an increase of thyroid cancer cases in Fukushima children aged 0-18 years as early as 2011-2013, several comments called for advice from the Commission on this subject. The Task Group carefully reviewed all the scientific work concerning the analysis of the cause-and-effect relationship carried out, by the international organisations competent in the matter such as WHO / IARC and UNSCEAR, and by researchers from Fukushima Medical University and other research organisations. Based on this review the Commission recommends how to plan health surveillance of the affected population after an accident, in particular with regard to potential thyroid cancers.

Annexes on the Chernobyl and the Fukushima accidents

As suggested in several comments, the two annexes of have been completely revised so that their content conforms more to the structure of the main text therefore making comparison easier. In this revision, the main references of the international organisations were mentioned as they contributed to the analysis of the accidents at Chernobyl and Fukushima and to the evaluation of their consequences. The Commission considers that it is not its responsibility to supplement or even these contributions.

References

ICRP, 1984. Protection of the Public in the Event of Major Radiation Accidents - Principles for Planning. ICRP Publication 40. Ann. ICRP 14 (2).

ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4).

ICRP, 2009. Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas After a Nuclear Accident or a Radiation Emergency. ICRP Publication 111. Ann. ICRP 39 (3).

Appendix A

List of individuals and organisations that submitted comments during the public consultation period

Individuals

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Aki Hashimoto
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Akira Tanabe
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Aoki Mihoko
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Asada Masafumi
Atsuko MASANO
Atsushi
Atsushi Aragane
Augustin Janssens
Barbara Wefing
Bob Applebaum
Chia Yoshida
Chiharu Hisaichi
Christopher Lish
Daipen
Denise Lytle
Eisuke Naramoto
Emi Sakagami
Etuko Maruyama
Fumiaki Toudou
Fumio MATSUDA
Guento MISAWA
Harada Hirofumi
Haruko
HashizumeKenso, KawaharaKoki
Hide Nakagawa
HIdeko Wada
Hideo Oguri
Hideyuki Koyama
Hiroshi Kurihara
Hiroshi Nishi
Hisako Sakiyama
Ichiro Yamaguchi
Ishikawa Kazuhiro
Jane Danjin
Jim Lykins
Jun Ichiro TADA
Jun'ichi Nukushina
Junko Suzuki
KAKUTA NAOKO
Kakutaro Kauchi
Kamoshita Miwa
Kaneko Yoshiko
KAORI OYAMA
Kaoru Kobashi
Katherine O'Sullivan
Kato Rin
Katsuo Ikeda
Kazuyoshi Takahashi
Keiko
Kenji Imaoka
Kenneth Kepler
Kenzo Fujimoto, Ph.D.
Kevin Rolfes
Kimiko Namba
Kishida Madoka
Kiyoshi Enomoto
Kiyoshi Koyama
Kiyoshi Uchide, MD
Koichi Takitani
Kosaku Yamada
Koyama Shinjiro
Kuroda Shizuyo
Kyoko Shima
Laura Hanks
M. Mihara
Madoka Murai
Majia
Maki Kumagai
Makoto Takahashi and Anja Rue
Mamoru HAYASHI
Mari Hoshikawa
Marina Watabe
Masaki Oshikawa
Masashi Shirabe
Masato IDA（井田 真人）
Masatoshi Ohyama
Masui Akito
Matsuzaki Michiyuki
Michael Crowden
Michiko AIKAWA
Michio Murakami
Mineki Nishikawa
Mio Tonoya
Miwa Chiwaki
Motomi Ushiyama M.D.
Nagaaoe Yasuko
Nagase Satoko
Naoki KUBO
Naoki Tajima
Naomi Maki
Naoyuki Murakami
Nishikawa·Kazuo
Noboru Kojima
Norihisa Sakaguchi
Noriko Nonaka
Oki Kiyoko
ONO HIROSHI
Osamu Imaizumi
Pamella K. Kilavi
Patrick Bosold
Patrick Smeesters
Paul Langley
Philip Thomas
Reiko Saito
Rieko Takahashi
Rintaro Nishigaki
Robert Travaline
Ruiko Muto
Sachiko Yamanaka
Saki Okawara
Sandra Couch
Sandy Sanders
Satoko Tanaka
Satoru Ono
Sayoko Yamadera
Seiko Nishikawa

Seri Ishikawa
Shibayama
Shie Ida
Shigeru Taguchi
Shin Aiuchi
Shingo Itonaga
Shinpei Tanno (Sugar Nat)
Shiro Ogura
Shizue Tomoda
Shoko Ohnuma
SOKAWA, Yoshihiro
Stephen and Robin Newberg
Stephen Gliva
Steven M Baker, Ph.D.
Sugiura Motoki
TADAYOSHI NARITA
Takagi Izumi
Takagi Kuniko
Takao SHIRAKURA
Takashi Akutsu
Takeaki Yatsuhashi
Takezo TAKAHASHI
Tamie Ando
Tariko Nishikawa
Taro Abe
Taro TANAKA
Teruko Nishida
Tim Deere-Jones
Tito Galdo
Toch
Tom Hougham
Tomoko Okuuchi
Tomoya YAMAUCHI
Toshinori YAMAKI
Toyoda Mamoru
Tsuyoshi Ebina
Tsuyoshi Fujioka
TSUYOSHI SANO
UJIBASI AKIRA
Umehara Kiyoko
Y Adachi
Yamadera. Sayoko
Yamamoto Hidehiko
YASUKO NAKAMURA
Yasushi KAKIHARA
Yasushi Nozawa
Yasuyuki Taneichi
Yayoi Yoshida
Yoko Chase
Yoko Ohara
Yoko Shimosawa
Yoko Tamaki
Yokoyama Marina
Yoshihiko Wada
Yoshiko ANDO
Yoshiko Sasaki
Yoshinori Ueno
Yukie Kanno
Yukiko Tanaka
Yukio Takashima
Yuko Yoshida
Yumiko Fuseya
Yutaka Hamaoka
Yuya Kamoshita
中村泰子　Nakamura Yasuko
井野博満　Hiromitsu INO
伊藤かつみ
佐藤千鶴子
勝守　真知子
原田　浩
宗川吉汪
小澤洋一
尾崎のりまさ
山口サエ子
山本　美秀子
岩州　信太郎
弦巻英市
服部賢治　Kenji Hattori
木村雅英　Masahide KIMURA
林 衛
林勝彦
根本　仁
武井隆明
水澤　靖子
永田文夫
永野　勇
温品惇一　Jun'ichi Nukushina
瀬川　嘉之　Yoshiyuki SEGAWA
牛山　元美
矢ヶ﨑克馬　Katsuma YAGASAKI
足立義子
青木美保子

Organisations

ACRO, France (ACRO.eu.org)
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
Beyond Nuclear
Campaign Against Radiation Exposure
Canadian Nuclear Safety Commission
Chernobyl-Hibakuhsa Support, Kansai, Japan
Citizen and Scientists Demanding Standards That Protect People From Radiation Exposure
Citizens' Commission on Nuclear Energy (CCNE)
Citizens' Nuclear Information Center (CNIC)
CRIEPI, Japan
EDF Energy
Federal Office for Public Health Switzerland
Friends of the Earth Japan
German Commission on Radiological Protection (SSK)

Greenpeace, Radiation Protection Advisors unit
Health Canada - Radiation Protection Bureau
IPPNW Germany
IRSN
Iryou Mondai Kenkyukai
Japan Health Physics Society
Miyake Consulting House
National Institutes for Quantum and Radiological Science and Technology
NERIS - European platform on preparedness for nuclear and radiological emergency response and recov
OECD-NEA CRPPH-EGIR
Organisation of thinking atomic
Planning Committee for the international conference 'Applicability of Radiation-Response Models to Low Dose Protection Standards
Public Health England
Refugee's group in Japan asking for the refuge right
Rotarians4Ban of nuclear weapons
Save Fukushima Children Lawyers' Network (SAFLAN)
Scientists for Accurate Radiation Information (SARI) and XLNT Foundation
Spanish Society of Radiological Protection (SEPR)
Swedish Radiation Safety Authority
Takagi School
Takaokachikukouikiken no gomimonndai wo kangaerukai
The Federation of Electric Power Companies of Japan
The Ishikawa Medical & Dental Practitioners Association
The plaintiffs' group of the Fukushima Nuclear Disaster Compensation Trial, Kyoto, Japan
The Society for Radiological Protection
The Stella Group, Ltd.
Thyroid Cancer Support Group ”Ajisai No Kai” 甲状腺がんヲ
Vattenfall AB
VGB PowerTech e.V., Working group radiation protection
World Nuclear Association
一般社団法人 被曝と健康研究プロジェクト
原子力規制を監視する市民
原発いらん！山口ネットワ
原発を考える町田の会
名古屋市民測定 C ラボ
山口被爆二世の会
平和と民主主義をめざす全国交歓会
放射線被曝を学習する会
放射能から子供を守る会・
望月牛女子
福島原発告訴団
福島県飯舘村民有志会、日本大学飯舘村支援チーム
経産省前テントひろば
虹とみどりの会