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Ethical Foundations of the System of Radiological
Protection



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Aims and Scope

The International Commission on Radiological Protection (ICRP) is the primary body in protection against ionising radiation. ICRP is a registered charity and is thus an independent non-governmental organisation created at the 1928 International Congress of Radiology to advance for the public benefit the science of radiological protection. ICRP provides recommendations and guidance on protection against the risks associated with ionising radiation from artificial sources such as those widely used in medicine, general industry, and nuclear enterprises, and from naturally occurring sources. These are published approximately four times each year on behalf of ICRP as the journal *Annals of the ICRP*. Each issue provides in-depth coverage of a specific subject area.

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ICRP is composed of a Main Commission, a Scientific Secretariat, and five standing Committees on: radiation effects, doses from radiation exposure, protection in medicine, the application of ICRP recommendations, and protection of the environment. The Main Commission consists of a Chair and twelve other members. Committees typically comprise 10–15 members each.

ICRP uses Task Groups to prepare its reports. A Task Group is usually chaired by an ICRP Committee member and usually contains a number of specialists from outside ICRP. Thus, ICRP is an independent international network of specialists in various fields of radiological protection, and, at any one time, about two hundred eminent scientists and policy makers are actively involved in the work of ICRP. The Task Groups are assigned the responsibility for drafting reports on various subjects, which are reviewed and finally approved by the Main Commission. These reports are then published as the *Annals of the ICRP*.

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ICRP PUBLICATION 138

Ethical Foundations of the System of Radiological Protection

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Editorial

ETHICS OF RADIOLOGICAL PROTECTION: THE CHALLENGE AHEAD

The International Commission on Radiological Protection (ICRP) makes recommendations on how to behave wisely in relation to exposure of people and the environment to ionising radiation. Radiation is an ever-present part of the natural world, so the question of whether people and the environment should be exposed to radiation is moot. The question is what *action*, if any, we should take when faced with existing sources of radiation, or when considering introducing new ones.

How to respond to that fundamental question is the core business of ICRP.

An excellent place to begin is by trying to understand the effects of exposure to radiation. This is the realm of science.

Radiation epidemiology relies on statistical analyses of observed effects on large populations (of people, animals, and even plants) that have been exposed to radiation. For effects of radiation exposure on humans, the gold standard today is the work being done by the Radiation Effects Research Foundation with survivors of the atomic bombs dropped on Hiroshima and Nagasaki. In recent decades, this has been supplemented by studies of other large groups, such as workers in mines and nuclear facilities, medical patients, and people exposed to radon in homes, to name just a few.

Radiation biology takes a different approach, looking at how radiation exposure affects people, plants, and animals at the individual, tissue, cellular, and even sub-cellular level. This work is often done in laboratories with cell cultures or mice.

More recent efforts try to combine information from both approaches to best understand the relationship between exposure to radiation and resulting biological effects.

Scientific facts are essential to understanding, but, alone, are not enough to decide what to do. Ethical values are the other ingredient necessary for making recommendations on how to behave in light of our scientific knowledge. ICRP also relies on experience to help make recommendations practical.

The current publication is the first by ICRP dedicated to eliciting and describing the ethical foundations of the system of radiological protection. It gives us a common language to discuss ethics in this context. This includes identifying and describing four core ethical values that drive all ICRP recommendations, and several procedural values that aid practical implementation.

This common language will help professionals in radiological protection, ethics, and other fields to more deeply examine and refine the ethical basis of ICRP recommendations. It will also be helpful for a wider audience, by making the ethical basis of radiological protection more transparent.

To this end, there is an intention to describe the ethical basis of ICRP recommendations more explicitly in future publications, just as we often describe the scientific basis in detail, using the language of the current publication as a foundation. Sometimes, this will be relatively straightforward, deserving of only brief mention. Where this publication will help the most is in more ethically complex situations. One example of this is the protection of animals not normally considered part of the environment. We are just beginning to explore this area, which includes, e.g., veterinary patients and animals used in scientific experiments.

We are also considering a companion to the current publication that will focus on the ethics of radiological protection in medicine. The strong body of research in biomedical ethics had a considerable influence on the development of this publication. In addition, medicine is by far the largest source of intentional exposure to radiation, making it a major part of ICRP's programme of work. Together, these factors argue that this is a logical next step, and a good opportunity to describe the core ethical values in a less abstract context.

So, while this publication is a major step forward in describing one of the three pillars of the system of radiological protection (scientific knowledge, ethical values, and practical experience), it is much more a beginning than an end. There is no doubt that the core ethical values need to be examined in more depth. There is also a need to balance these values, all of which are essential, and none of which are absolute. There is no a-priori hierarchy among them; a definite context is needed to use these values in deciding how best to act in a particular circumstance. This is the challenge that lies ahead.

CHRISTOPHER CLEMENT
ICRP SCIENTIFIC SECRETARY
EDITOR-IN-CHIEF

ETHICAL FOUNDATIONS OF THE SYSTEM OF RADIOLOGICAL PROTECTION

ICRP PUBLICATION 138

Approved by the Commission in October 2017

Abstract—Despite a longstanding recognition that radiological protection is not only a matter of science, but also ethics, ICRP publications have rarely addressed the ethical foundations of the system of radiological protection explicitly. The purpose of this publication is to describe how the Commission has relied on ethical values, either intentionally or indirectly, in developing the system of radiological protection with the objective of presenting a coherent view of how ethics is part of this system. In so doing, it helps to clarify the inherent value judgements made in achieving the aim of the radiological protection system as underlined by the Commission in *Publication 103*. Although primarily addressed to the radiological protection community, this publication is also intended to address authorities, operators, workers, medical professionals, patients, the public, and its representatives (e.g. NGOs) acting in the interest of the protection of people and the environment. This publication provides the key steps concerning the scientific, ethical, and practical evolutions of the system of radiological protection since the first ICRP publication in 1928. It then describes the four core ethical values underpinning the present system: beneficence/non-maleficence, prudence, justice, and dignity. It also discusses how these core ethical values relate to the principles of radiological protection, namely justification, optimisation, and limitation. The publication finally addresses key procedural values that are required for the practical implementation of the system, focusing on accountability, transparency, and inclusiveness. The Commission sees this publication as a founding document to be elaborated further in different situations and circumstances.

Keywords: Radiological protection system; Ethical values; Procedural values

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PREFACE

The ICRP Main Commission established Task Group 94 of Committee 4 during its meeting in Fukushima, Japan in October 2012 to develop an ICRP publication presenting the ethical foundations of the system of radiological protection. To achieve this goal, the Commission asked the task group to review the publications of the Commission in order to identify the ethical values associated with the system of radiological protection for occupational, public, and medical exposures, and for the protection of the environment. In proposing this approach, the Commission recognises that the system of radiological protection has, during its evolution, been informed by ethical values.

Given the nature of the work, the Commission also encouraged Task Group 94 to develop its work in close cooperation with specialists of ethics and radiological protection professionals from around the world. With this in mind, a series of workshops was organised by ICRP in collaboration with the International Radiation Protection Association (IRPA) and academic institutions to fully examine, discuss, and debate the ethical basis of the current system of radiological protection. These workshops were held in: Daejeon (Korea) and Milan (Italy) in 2013; Baltimore (MD, USA) in 2014; and Madrid (Spain), Cambridge (MA, USA), and Fukushima (Japan) in 2015. Presentations were given to spur discussion in group sessions. Presenters were from a variety of backgrounds and fields of expertise.

Task Group 94 also benefited from discussions at an International Symposium on Ethics of Environmental Health in Budweis, Czech Republic in 2014; the Fourth Asian and Oceanic Congress on Radiation Protection in Kuala Lumpur, Malaysia in 2014; the UK Workshop on the Ethical Dimensions of the Radiological Protection System in London, UK in 2014; the Third International Symposium on the System of Radiological Protection in Seoul, Korea in 2015; and the 14th IRPA Congress in Cape Town, South Africa in 2016.

The membership of Task Group 94 was as follows:

K-W. Cho (Chair)	N.E. Martinez	R. Toohey
M-C. Cantone	D. Oughton	S. Wambani
S.O. Hansson	T. Schneider	F. Zölzer
C. Kurihara-Saio		

The corresponding members were:

R. Czarwinski	B. Le Guen	E. Van Deventer
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The Committee 4 critical reviewers were:

F. Bochud

J. Takala

The Main Commission critical reviewers were:

C.M. Larsson

E. Vañó

Task Group 94 worked mainly by correspondence and met three times on 2 and 3 February 2015 at the Technical University of Madrid, Spain; and on 8–10 July 2015 and 26–28 January 2016 at Nuclear Protection Evaluation Centre, France. The task group wishes to thank the organisations and staff that made facilities and support available for these meetings.

In drafting the publication, Task Group 94 received significant contributions from ICRP Vice-Chair Jacques Lochard and ICRP Scientific Secretary Christopher Clement, and also received input from several participants of the workshops organised in cooperation with IRPA and the other organisations mentioned above.

The membership of Committee 4 during the period of preparation of this publication was:

(2009–2013)

J. Lochard (Chair)

T. Homma

A. McGarry

W. Weiss (Vice-Chair)

M. Kai

K. Mrabit

J-F. Lecomte (Secretary)

H. Liu

S. Shinkarev

P. Burns

S. Liu

J. Simmonds

P. Carboneras

S. Magnusson

A. Tsela

D.A. Cool

G. Massera

W. Zeller

(2013–2017)

D.A. Cool (Chair)

M. Doruff

A. Nisbet

K-W. Cho (Vice-Chair)

E. Gallego

D. Oughton

J-F. Lecomte (Secretary)

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T. Pather

F. Bochud

M. Kai

S. Shinkarev

M. Boyd

S. Liu

J. Takala

A. Canoba

A. McGarry

MAIN POINTS

- Radiological protection relies on scientific knowledge, ethical considerations, and practical experience. This is the first ICRP publication dedicated to elaborating the ethical foundations of the system of radiological protection.
- This publication provides a foundation and common language for discussion of the ethical aspects of radiological protection between experts and with a wider audience, and insight into applying the system of radiological protection where there are competing ethical priorities.
- The system of radiological protection relies on four core ethical values:
 - Beneficence/non-maleficence: promoting or doing good, and avoiding doing harm. This is reflected, for example, in the primary aim of the system of radiological protection: ...an appropriate level of protection...without unduly limiting...desirable human actions.
 - Prudence: making informed and carefully considered choices without full knowledge of the scope and consequences of an action. Prudence is reflected, for example, in the consideration of uncertainty of radiation risks for both humans and the environment.
 - Justice: fairness in the distribution of advantages and disadvantages. Justice is a key value underlying, for example, individual dose restrictions that aim to prevent any individual from receiving an unfair burden of risk.
 - Dignity: the unconditional respect that every person deserves, irrespective of personal attributes or circumstances. Personal autonomy is a corollary of human dignity. This underlies, for example, the importance placed on stakeholder participation and the empowerment of individuals to make their own informed decisions.
- The core ethical values support the aims of the system of radiological protection and its three fundamental principles: justification, optimisation, and individual dose limitation.
- Three procedural values are highlighted to aid the practical implementation of radiological protection: accountability, transparency, and inclusiveness (stakeholder participation).

GLOSSARY

Accountability

The obligation of individuals or organisations who are in charge of decision making to answer for their actions to all those who are likely to be affected, including reporting on their activities, accepting responsibility, and accounting for actions taken and the consequences, if necessary.

Autonomy

The capacity of individuals to act freely, to decide for themselves, and to pursue a course of action in their life.

Beneficence

To promote or do good. Beneficence is a key value of biomedical ethics. In radiological protection, it is to increase the direct and indirect benefits for individuals, communities, and the environment.

Consequentialism (also called teleological ethics)

An approach to ethics that judges the morality of an action based on the action's impact on the well-being of people and the common good. Utilitarianism ethics is the most well-known variant of consequentialism.

Deontological ethics

An approach to ethics that judges the morality of an action based on the action's adherence to rules or duties.

Dignity

The value and respect that every person has and deserves regardless of her/his age, sex, health, social condition, ethnic origin, religion, etc.

Equity

The quality of being fair and impartial. In radiological protection, equity refers to the fair distribution of risks and benefits of radiation exposures.

Ethics

The branch of philosophy that explores the nature of moral virtue and evaluates human actions using sets of moral principles and concepts to govern behaviour or the conducting of an activity.

Fairness

The quality of treating people equitably and in a way that is reasonable.

Harm

Damage or injury that is caused by a person or an event.

Inclusiveness

Ensuring that all those concerned are given the opportunity to participate in discussions, deliberations, and decision making concerning situations that affect them.

Informed consent

The voluntary agreement to an activity based on sufficient information and understanding of the purpose, benefits, and risks.

Justice

The upholding of what is right, equitable, and fair.

- Distributive justice: fairness in the distribution of advantages and disadvantages among members of communities.
- Environmental justice: equitable distribution of environmental risks and benefits; fair and meaningful participation in environmental decision making; and recognition of community ways of life, local knowledge, and cultural differences.
- Intergenerational justice: fairness towards everyone, with attention also to future generations.
- Procedural justice: fairness in the rules and procedures in the process of decision making.
- Restorative justice: giving priority to repairing the harm done to victims, communities, and the environment.
- Social justice: promoting a just society by recognition of human rights to equitable treatment and assuring equal access to opportunities.

Non-maleficence

To avoid doing harm. Non-maleficence is a key value of biomedical ethics. In radiological protection, it is to reduce the direct and indirect harm and risk for individuals, communities, and the environment.

Practical radiological protection culture

The knowledge and skills enabling citizens to make well-informed choices and behave wisely in situations involving potential or actual exposure to ionising radiation.

Precautionary principle

A principle in risk management whereby measures are put in place to prevent or reduce risks when science and technical knowledge are not able to provide certainty.

Procedural values

Set of values to take practical actions that align the conduct of a given activity with the ethical principles.

Prudence

To make informed and carefully considered choices without the full knowledge of the scope and consequences of an action.

Radiation risk

The potential harm posed by exposure to radiation. In risk assessment, risk is a combination of the probability of occurrence of damage or injury and its severity.

Reasonableness

To make rational, informed, and impartial decisions that respect other views, goals, and conflicting interests.

Right to know

The right of individuals to be informed about what hazards they are exposed to and how to protect themselves.

Self-help protection

Informed actions taken by individuals to protect themselves, their family, and their communities.

Stakeholder participation

The participation of all relevant parties in the decision-making processes related to radiological protection. Also referred to as ‘stakeholder involvement’ or ‘stakeholder engagement’.

Tolerability

The degree or extent to which something can be endured.

Transparency

Accessibility of information about the deliberations and decisions concerning potential or on-going activities, and the honesty with which this information is transmitted.

Utilitarian ethics

An approach to ethics that judges the morality of an action based on the action’s impact on individual and social welfare.

Value judgement

A subjective assessment based upon available knowledge and a particular set of values and priorities.

Virtue ethics

An approach to ethics that emphasises the role of personal character and virtue in determination of morality.

Wisdom

The quality of having knowledge, common sense, experience, and good judgement in order to make reasonable decisions and to act accordingly.

1. INTRODUCTION

1.1. Background

(1) In an address to the Ninth Annual Conference on Electrical Techniques in Medicine and Biology in 1956, Lauriston Taylor, then incumbent President of the National Council on Radiation Protection and Measurements, and Chairman of the International Commission on Radiological Protection (ICRP), declared, ‘Radiation protection is not only a matter for science. It is a problem of philosophy, and morality, and the utmost wisdom’ (Taylor, 1957). By using the term ‘wisdom’, one of the fundamental virtues of many cultures worldwide, Taylor emphasised that beyond its undeniable and compelling scientific and ethical basis, radiological protection was also a question of insight, common sense, good judgement, and experience. Through his formulation, he brought to light three pillars of the system of radiological protection that have been built up gradually for almost half a century, namely science, ethics, and experience.

(2) Despite a longstanding recognition that radiological protection is not only a matter of science, but also relies on ethical considerations, ICRP publications have rarely addressed the ethical foundations of the system of radiological protection explicitly. This does not mean that the Commission has been unaware of the importance of such considerations. Protection recommendations inevitably represent an ethical position, irrespective of whether that position is explicit or implied. Therefore, ethical considerations can be traced in many ICRP publications.

(3) Regarding the ethical dimension of radiological protection, it should be pointed out at the outset that there are very few writings devoted to it compared with the vast literature related to the scientific, technical, and practical aspects. The first contributions directly addressing the subject only appeared in the 1990s. Among them, it is worthwhile mentioning the pioneering contribution of Giovanni Silini, who reviewed the ethical foundation of the system during the Sievert Lecture he delivered in 1992 (Silini, 1992). He concluded his lecture by emphasising that the system has been developed rationally, but at the same time with the desire to act reasonably. Also interesting to note are the articles published subsequently by academics questioning the ethical theories underpinning the system (Oughton, 1996; Schrader-Frechette and Persson, 1997) which ultimately led to the recognition that the system of radiological protection can be seen as being based on the three major theories of philosophical ethics that combine the respect of individual rights (deontological ethics), the furthering of collective interest (utilitarian ethics), and the promotion of discernment and wisdom (virtue ethics) (Hansson, 2007). In turn, inspired by these reflections, eminent professionals of radiological protection have seized the subject (Lindell, 2001; Clarke, 2003; Streffer et al., 2004; Clarke and Valentin, 2009; Gonzalez, 2011; Valentin, 2013; Lochard, 2016; Clement and Lochard, 2017). Worthwhile to note is also the cross-cultural approach to the ethics of radiological protection, exploring the commonalities between Western theoretical and applied ethics and written and oral traditions worldwide (Zölzer, 2013, 2016).

(4) This relatively recent interest in ethical aspects of radiological protection is certainly not unrelated to the difficulties encountered for decades by radiological protection professionals facing the questions and concerns of people. The traditional emphasis on the science of radiation by the Commission has been shown to be insufficient, and it is now acknowledged that human and ethical dimensions of exposure situations are also important, and sometimes decisive, in both the decision-making process and in communication, particularly when engaging with stakeholders.

(5) The lessons learned from the management of the consequences from the Chernobyl accident have certainly played a key role in this awareness (Oughton and Howard, 2012; Lochard, 2013), as have challenges from radioactive waste management (NEA/OECD, 1995; Streffer et al., 2011), increasing use of medical applications (Malone, 2013), and, more recently, the Fukushima accident. It is in this context that ICRP initiated a reflection on the ethical foundations of the system of radiological protection in early 2010 and a task group in 2012. In order to involve a wide variety of expertise in this process, the Commission invited ethicists, philosophers, social scientists, and radiological protection professionals from different regions of the world to a series of regional workshops organised in collaboration with the International Radiation Protection Association (IRPA) and academic institutions.

1.2. Scope and objective

(6) This publication reviews the Commission's previous publications to identify the ethical values associated with the ICRP system of radiological protection for occupational, public, and medical exposures, and for protection of the environment. It describes key components of the ethical theories and principles prevailing in the fields of health and the environment relevant to radiological protection.

(7) This publication aims to emphasise how the Commission has relied on ethical values in developing the system of radiological protection, with the objective of presenting a coherent view of how ethics is part of this system. Ethics cannot provide conclusive solutions, but can help to facilitate discussions among those seeking to promote the well-being of individuals, the sustainable development of society, and the protection of the environment. A clearer understanding of the core ethical values and related principles of radiological protection will help to address issues emerging from potential conflicts in decision making.

(8) A particular objective of this publication is to outline what can reasonably be expected from radiological protection to individuals and societies. In so doing, it helps to clarify the inherent value judgements made in achieving the aim of the system of radiological protection as underlined by the Commission in *Publication 103* (ICRP, 2007a), and thus hopefully facilitates decision-making processes and communication on radiation risk.

(9) Although primarily addressed to the radiological protection community, this publication is also intended for authorities, operators, workers, medical

professionals, patients, the public, and its representatives acting in the interest of the protection of people and the environment.

(10) The Commission recently adopted a Code of Ethics (ICRP, 2015b) setting out what is expected from its members in the development of its recommendations and guidance. This code emphasises the need for ICRP members to be committed to public benefit, and to act independently while being impartial, transparent, and accountable. Various professional societies have also developed codes of ethics for their members (e.g. IRPA, 2004). These behavioural requirements are beyond the scope of this publication, and are not discussed further here. However, the ethical values discussed in this publication can help to guide radiological protection professionals in the conduct of their duties.

(11) The work leading to this publication is the first concerted effort by the Commission to reflect upon and describe the ethical basis of the system of radiological protection in some detail. The Commission sees this publication as a founding document for addressing ethical issues in future recommendations. As such, it does not discuss in detail the questions and dilemmas that still exist in radiological protection, nor provide advice to any specific scenario involving radiation exposure. Initiating a discussion of both the ethical values and their implementation should make ethical reasoning more accessible to those working in the field, and hopefully encourage them to apply it explicitly in decisions and practices (Martinez and Wueste, 2016).

1.3. Structure of this publication

(12) Section 2 presents the milestones which marked the evolution of the system of radiological protection since the first ICRP publication in 1928. Section 3 describes the core ethical values that shape the system, and also discusses how these core ethical values underpin the principles of radiological protection, namely justification, optimisation, and limitation. Section 4 discusses key procedural values underlying the requirements for the practical implementation of the system. Section 5 summarises the main implications of ethics for the system of radiological protection. Annexes A, B, and C address ethical theories, biomedical ethical principles, and cross-cultural values relevant to radiological protection, respectively. Annex D provides lists of participants at the workshops on the ethics of the system of radiological protection.