



RADIATION

EFFECTS and SOURCES

What is radiation?
What does radiation do to us?
Where does radiation come from?

>1 000 mSv

Dose used in radiotherapy

100 mSv

Astronaut dose
(4 months)

10 mSv

CT scan of the abdomen

1 mSv

Worker dose in nuclear industry
(1 year)

0.1 mSv

Chest X-ray or flight (20 hours)

0.01 mSv

Dental X-ray

0.001 mSv

Brazil nuts (30 g)



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United Nations Environment Programme

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This booklet is largely based on the findings of the United Nations Scientific Committee on the Effects of Atomic Radiation and on the United Nations Environment Programme publication *Radiation: doses, effects, risks*, initially edited in 1985 and 1991 by Geoffrey Lean.

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FOREWORD

Hiroshima, Nagasaki, Three Mile Island, Chernobyl and Fukushima-Daiichi: these names have become associated with the public's fear of radiation, either from use of nuclear weapons or accidents at nuclear power plants. In fact, people are much more exposed daily to radiation from many other sources, including the atmosphere and the Earth as well as from applications used in medicine and industry.



In 1955, nuclear weapon tests raised public concerns about the effects of atomic radiation on air, water and food. In response, the United Nations General Assembly established the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) to collect and evaluate information on the levels and effects of radiation exposure. The Committee's first report laid the scientific grounds for negotiating the Partial Test Ban Treaty in 1963 that prohibited atmospheric nuclear weapon testing. Since then, it has continued to produce high-profile reports on radiation exposure, including from the accidents at the Chernobyl and Fukushima-Daiichi nuclear power plants. The Committee has consistently delivered work of great value both to the scientific community and policymakers.

While the scientific community has published information on radiation sources and effects, it has tended to be technical and perhaps difficult for the general public to understand—which has often confused, rather than informed, the public, meaning that the fear and confusion engendered decades ago prevails. This publication tackles the issue by detailing the most up-to-date scientific information from UNSCEAR—on the types of radiation, their sources and effects on humans and the environment—and making it accessible to the general reader.

Today, the UNSCEAR secretariat operates under the auspices of the United Nations Environment Programme (UNEP), which helps countries implement environmentally sound policies and practices. Helping the public understand radiation and how it affects life on this planet lies within the core mandate of UNEP.

I am very pleased to congratulate all those who have contributed to this publication, as well as all the members of the Committee and their delegations, who have worked so diligently for the past six decades on these critical issues.

A handwritten signature in black ink that reads "Achim Steiner". The signature is written in a cursive, flowing style.

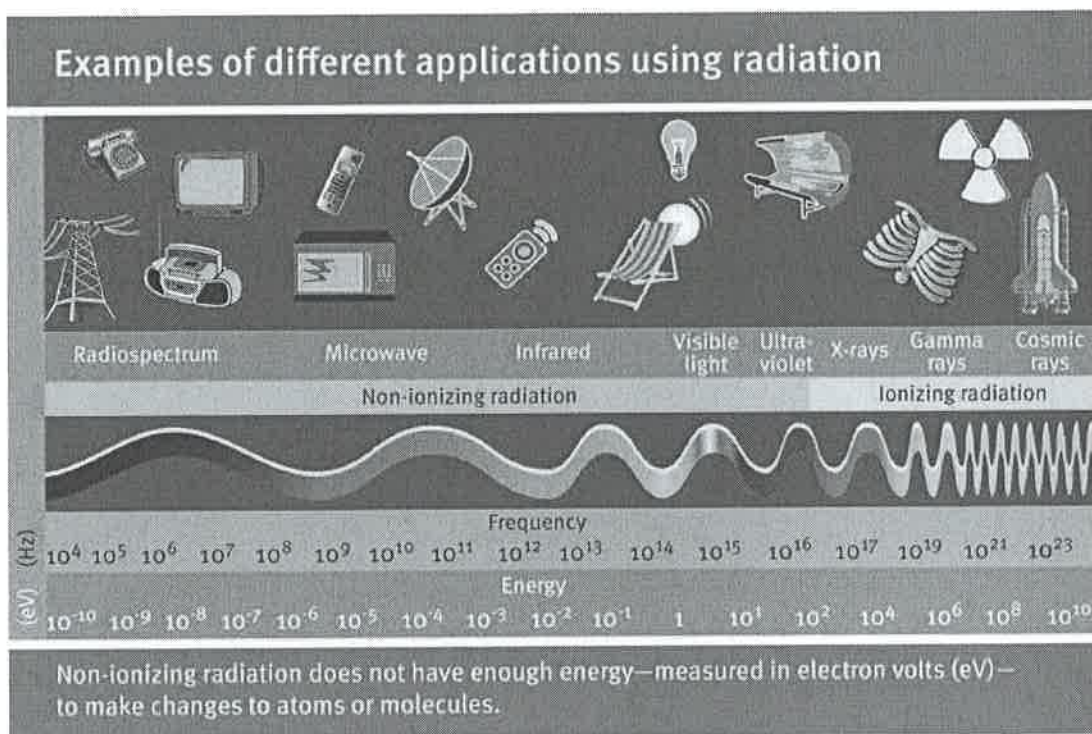
Achim Steiner
UNEP Executive Director and
Under-Secretary-General of the United Nations

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INTRODUCTION

Before we begin, we need to distinguish between ionizing and non-ionizing radiation. **Ionizing radiation** has enough energy to liberate electrons from an atom, thereby leaving the atom charged, whereas **non-ionizing radiation**, such as radio waves, visible light or ultra-violet radiation, does not. This publication is about the effects of radiation exposure from both natural and artificial sources. However, the word **radiation**, throughout, refers only to ionizing radiation.



Today, we know more about the sources and effects of exposure to radiation than to almost any other hazardous agent, and the scientific community is constantly updating and analysing its knowledge. Most people are aware of the use of radiation in the nuclear power production of electricity or in medical applications. Yet, many other uses of nuclear technologies in industry, agriculture, construction, research and other areas are hardly known at all. To someone who is reading about the topic for the first time, it may come as a surprise that the sources of radiation causing the greatest exposure of the general public are not necessarily those that attract the most attention. In fact, the greatest exposure is caused by natural sources ever present in the environment, and the major contributor to exposure from artificial sources is the use of

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radiation in medicine worldwide. Moreover, everyday experience such as air travel and living in well-insulated homes in certain parts of the world can substantially increase exposure to radiation.

This publication is an attempt by the United Nations Environment Programme (UNEP) and the secretariat of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) to help raise awareness and deepen understanding on the sources, levels and effects of exposure to ionizing radiation. Bringing together leading scientists from 27 Member States of the United Nations, UNSCEAR was set up by the United Nations General Assembly in 1955 to evaluate radiation exposures, effects and risks on a worldwide scale. However, it does not set, or even recommend, safety standards; rather it provides scientific information that enables national authorities and other bodies to do so. UNSCEAR's scientific evaluations over the past sixty years are the main source of information for this publication.