

# A CRITICAL ASSESSMENT OF THE ICRP SYSTEM FROM A SCIENTIFIC PERSPECTIVE

From a set of social and economic commandments  
to a system representing human rights and science

Katsuma Yagasaki

Professor Emeritus, University of the Ryukyus

The International Commission on Radiological Protection (ICRP) has arbitrarily introduced many concepts that go against scientific principles. It is not a system founded upon science. A scientific and democratic viewpoint is necessary in order to objectively criticize the ICRP.

## **§1 The Commandments, Utilitarian Philosophy and Hidden Nuclear Warfare of the ICRP System**

### **(1) Lack of scientific foundations: disregard of definitions and deviation from causality**

The ICRP is not a scientific system, but a set of “social and economic” commandments. These labels, borrowed from the international nuclear lobby, are used to mean “not hindering nuclear propulsion” and “not placing a heavy burden on the state and its industry.” The meaning of “commandments” here is a set of rules governing nuclear weapons and nuclear power production that have developed into a regulatory system.

#### Characteristics of the ICRP Commandments

- ① Physical quantities not used according to the proper definition
- ② Constructed with arbitrary physical quantities, in defiance of the principles of science and causality

This is not a system based on science.

#### Brief Explanation

① Not using physical qualities and quantities according to the proper definition is the same as removing the backbone of science.

To expand,

1. Units of measurement of absorbed dose are limited to “per internal organ/tissue”
2. Exposure dose is used instead of absorbed dose

② Arbitrary amounts are set in a high-handed manner and in violation of the principle of causality, which is the very pillar of scientific concepts.

The ICRP uses factors such as biological equivalent dose, radiation weighting factor, tissue weighting factor, effective dose and so on to create notions that go against the fundamental principles of science. If one kind of radiation has larger output (damage) compared with the others, ICRP multiplies the actual radiation energy (input) by the radiation weighting factor, and assumes that value to be the energy of that kind of radiation. This multiplied absorbed dose is referred to as equivalent dose.

A causal relationship can be explained thus: An action or stimulus (input) is imposed on a subject. A response to that stimulus arises inside the affected subject. Some phenomenon (output) is observed as a result of this response. ICRP does not apply the logic of “the response arises as a result of the stimulus to the activated subject.” The excited internal reaction is not considered on scientific basis and is closed in a black box. Closing this response relationship in a black box means they are using metaphysical formal logic, saying that the damage (output) is large because the radiation energy input is large.

Using this approach, the output of damage to health can be restricted to only the diseases accepted by ICRP: cancer and a few types of tissue damage. It is a way for the commandments of those in power to make the health effects of radiation appear to be less than they are, and these commandments are unfortunately in control of the world.

The ICRP has denounced the description of a causal relationship and made a complete departure from science. The following are some of the physical quantities created high-handedly and in defiance of the principle of causality:

1. Radiation quality weighting factor, biological equivalent dose
2. Tissue weighting factor, effective dose (units: Sievert)

These factors are used without clarifying the action of radiation, and the effects on living organisms are closed inside a black box. This black box has made it possible to confine radiation damage to a very narrow range of diseases.

## **(2) Utilitarian philosophy, which contradicts human rights and democracy**

The ICRP's 3 principles of radiological protection (justification, optimization and dose limits) are utilitarian and contradict democracy and human rights. We can think of these principles in terms of comparing risk to life (personal rights) to the business activities of industry.

The principles state the following:

- ① The principle of justification: If the common good is served, then the processes that cause health damage by radiation are justified.
- ② The principle of optimization of protection: Protective activities should be based on social and economic factors and carried out in moderation.
- ③ Dose limits: Dosage limits must not be so strict as to hinder industrial activity.

These principles have been accepted by many countries of the world. The first principle, that of justification, can almost be seen as a threat to democracy by the nuclear industry.

Politically, it is a practical policy of nuclear dominance based on the Treaty on the Non-Proliferation of Nuclear Weapons. In reality, the treaty enforces the continued promotion of nuclear power plants and the nuclear arms monopoly which they complement, and which is based on nuclear deterrent force.

### **(3) Hidden Nuclear Warfare**

The above-mentioned characteristics of the ICRP system are derived from its purpose of undervaluing nuclear damage, both scientifically and philosophically. This is why Katsuma Yagasaki uses the term “Hidden Nuclear Warfare.” This refers to the tactics they use to make exposure seem lower, by disregarding measurements and investigation and by the lack of integrity of their measured values. Another method used is their extremely narrow definition of health effects caused by radiation.

This is illustrated by the following representative examples:

- ① Although the legal radiation dose limit is set based on the full amount of environmental exposure, the Japanese government follows the ICRP by reducing it to exposure during daily activities, thereby forcing radiation exposure on its citizens.

Japanese laws have been made based on the “Ministerial Ordinance for Commercial Nuclear Power Reactors Concerning the Installation, Operation, etc.” This ordinance defines the inhabited “peripheral monitoring zone” as the area in the vicinity of a controlled access location, and any place beyond the exterior of this area where the radiation dose may not exceed a dose limit set by the Minister of Economy, Trade and Industry (Article 2, paragraph 6). This dose limit (effective dose) was set as 1mSv per year (Ordinance paragraph 3).

What is important to note here is that the limit is set on the environmental radiation of the affected area. In addition, the Environmental Radiation Monitoring Guidelines state that “fundamental data on the contaminated environment”, which is information provided to many areas, must use the air absorbed dose rate of gamma rays (in Greys per hour or Gy/h).

The calculation method proposed by The Japanese Government for absorbed dose rate, which corresponds to 1 mSv per year, is in clear violation of this guideline. Treating environmental dose as environmental contamination, if one were to simply convert from 1 year to 1 hour, the figure would be a physical amount of 0.114  $\mu\text{Sv/h}$ . However, the government does not present the environmental dose, but instead calculates a dose for daily activities, based on the assumption that people spend 16 hours a day indoors and 8 hours outside, and that the strength of irradiation indoors is 40% of that experienced outdoors. This amount is equivalent to 0.19 $\mu\text{Sv/h}$ , 60% of the environmental dose, which increases to 0.23 $\mu\text{Sv/h}$  when background radiation rate is incorporated. This value, which does not obey the law, is said to correspond with 1mSv per year.

② Monitoring posts: The systems in place show only half of the dose values measured by Yagasaki and co.

③ While investigation is supposed to be the responsibility of the state, this so-called civilized nation neither conducts investigation nor collects data, thereby abandoning its people. Specifically, “no data” is taken to mean “no data showing damage from radiation,” which translates to “there is no damage from radiation.” Prime Minister Shinzo Abe’s statement at time of the Olympic bid that “There have been no health problems and nor will there be” is a shrewd application of this political strategy.

A detailed explanation of the above points is necessary in order to objectively criticize the ICRP. However, this assessment will focus only on the scientific side of the issues.

## §2 Physical quantities not used according to definition

### Definition of absorbed dose

To begin with, the definition of absorbed dose is as follows:

$$D = dE / dm$$

Where D is the absorbed dose and E is the amount of energy transferred by radiation to mass m. The formula calculates the ratio of infinitesimal energy to the infinitesimal mass to which the radiation is transferred.

Absorbed dose is defined as the absorbed energy transferred to an infinitesimal mass (ICRP recommendation, 1990).

### ① Using “per type of internal organ/tissue” as a unit of measurement: selling internal exposure short

It was announced at the same time in the same recommendation that “per type of internal organ/tissue” would be used as a unit of measurement.

★ For external irradiation, for which ionizing action is distributed over a wide range, as well as Potassium-40 irradiation, the exposure expands to affect the whole body. In these cases, per-organ measurements can be used to approximate the level of exposure.

★ As for internal irradiation, especially that brought about by particle radiation, the ionization is concentrated and the range of alpha and beta rays is short, which means that radiation exposure is focused on certain areas and the majority of cells are not ionized. First of all, it can be shown that derivation is not carried out as defined, based on the spread of ionization in internal radiation.

Measuring per organ results in a very large calculation denominator for non-irradiated cells (those that do not undergo ionization) as well as an extreme underestimation of the high-dose radiation in the areas surrounding the ionized microparticles. The ICRP states that cancer originates from the division of individual cells with DNA anomalies. This self-produced definition functions as a red herring to obstruct the real conditions of cancer outbreak and divert attention from the dangers of internal irradiation. Furthermore, by saying that external and internal irradiation are the same thing, they are trampling on their own definition.

★ Also regarding internal radiation, water-soluble radiation (in which decomposition to single atoms occurs) permeates throughout the body, circulating via blood and lymph, in keeping with biological half-life. There is also chemical/physiological affinity, which is not in accordance with biological half-life. Insoluble radiation, where particles accumulate in one area of the body, is different to soluble radiation in that it is disproportionately higher in the organs. In the case of soluble radiation, organs with large blood flow are continuously exposed to high-level radiation, but even this effect is covered up.

### §3 Absorbed dose replaced with exposure dose

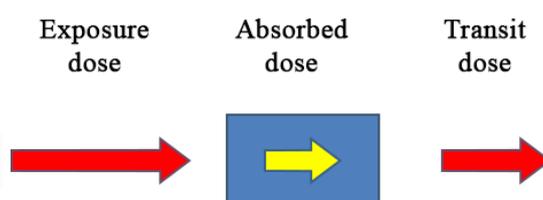
**Units of exposure dose are modified to match absorption dose**

By estimating effective dose from phantom measurements, everything is replaced with irradiation (surface exposure). While creating their own definition of absorbed dose, the ICRP system replaces every instance of absorbed dose with surface exposure.

Humans, mice and cultured cells vary in thickness, so even with the same amount of surface exposure their absorption doses will vary greatly. Smaller organisms show lower absorption doses and higher leakage doses. This results in gross overestimation of absorbed dose in cell culture and animal experiments, and factors such as the threshold amount of remaining unrepaired DNA are elevated by several orders of magnitude.

Consequently, the effects of low-dose radiation are ignored. Organizations like the ICRP and UNSCEAR are neglecting important scientific facts.

As illustrated in Figure 1, absorption dose is the amount subtracted from radiation exposure to give transit dose (the amount that passes through the other end). When measuring absorption dose in an experiment, the measuring instrument is placed in front of and behind the blue object, and the difference between those measurements is the absorbed dose. However, in today's experiments, the instrument is placed at a location corresponding to the depth from the surface of the phantom model to the organ, starting with 1cm of equivalent dose. The dose measured is recorded as the effective dose of the organ. Although it would be more appropriate to call this measurement the exposure (surface dose) received by the organ, in these experiments effective (absorbed) dose is equated with surface dose. Factors such as the thickness of the organ are not being taken into account, and all exposure is added into the absorbed dose. In this explanation, the phantom model is an anatomical model of the human body used to estimate the effects of radiation on humans.



*Figure 1 Exposure, absorption dose, transit dose. The blue object represents the body of the organism being observed. Transit dose (the amount that passes through and out the other end) does not have any ionizing effect on living organisms. Absorption dose should be measured by taking measurements at the front and behind the blue object and calculating the difference between them.*

The actual absorbed dose is just a percentage of the radiation dose. The same can be seen with the dose evaluation of the victims of the atomic bombings. All the initial radiation at the site of the nuclear chain reaction was calculated using distance from the blast, and this attained dose (the dose that reaches the body) was taken as the absorbed dose. While they did take into account the fact that people who were in the shadows of buildings were shielded from the blast, all external exposure was used as absorbed dose.

The differences between the effects of external irradiation (gamma rays and neutron radiation) and internal irradiation (alpha, beta and gamma rays) were completely ignored, and internal exposure was calculated on

the same scale as external radiation. The radioactive fallout, which caused internal exposure, was measured (disregarding what was washed away by heavy floods) and reported to be a small enough dose as to pose no threat to health. The results of animal and cultural cell experiments are also discussed only in terms of radiation exposure.

A perfect example of confusing exposure and absorbed dose can be found in the research of Shun'ichi Yamashita's group: *Effects of Low-Dose Radiation on the Induction and Exclusion of DNA Damage* (Masatoshi Suzuki et al, Nagasaki University School of Medical Sciences Journal 87, 239 (2012)). The research is described as being performed by cultivating cells on sterilized cover glass and exposing them to X-rays with a dose rate of 200mGy/min.

In the discussion, they say:

“In examining the effect of radiation exposure on DNA damage, even as low a dose as 100mGy was clearly found to cause DNA damage.”

“At a level of 100mGy, before 6 hours had passed the majority of DNA damage was gone. Further, within 24 hours it was observed that the cells had returned to their original condition from before the exposure. Of course, as there were foci present from before the exposure, it is difficult to determine whether or not all the radiation-induced DNA damage had been removed. However, from the fact that the ratio of focus-positive cells and the number of foci near the cell nuclei had returned to their original states, we have shown, with the results of not just simple numerical analyses but also qualitative analyses, that it is correct to say that radiation-induced DNA damage was completely repaired and removed.

From the above-mentioned results, we conclude that DNA damage caused by 100mGy low-level radiation is at a level that cells can handle. So, what level of radiation is too much for cells to deal with? In the results of this experiment we confirmed that above 250mGy of radiation exposure there was residual DNA damage that was not repaired after 24 hours. Observing the movement of DNA repair, it was seen that even after 24 hours there was a slight decrease in the amount of DNA damage. Even taking that into account, it was clear that DNA damage caused by 250mGy exposure cannot be fully repaired. Therefore, the lower limit of radiation exposure where cells can handle DNA damage is higher than 100mGy but lower than 250mGy.”

In this discussion there is no distinction between exposure and absorbed dose, as the only expression used is “low radiation exposure level of 100mGy.” This expression is a reflection of the true nature of ICRP's dose evaluation.

Assuming that the half-value layer was 100ml and the thickness of the culture fluid was 1mm, we can estimate the dose absorbed by the culture fluid. The result is that **the absorption dose at which DNA damage was**

**almost entirely repaired was not 100mGy but 0.69mGy, and the dose at which all DNA damage could not be repaired was not 250mGy but 1.73mGy.** Incidentally, the half-value layer is the distance at which the strength of the introduced radiation is halved.

The following equation calculates the strength of radiation when moving a distance  $l$  through a single material:

$$N(l) = N_0 e^{-(\log 2/L)l}$$

where

$N(l)$  is the radiation strength after passing through a distance  $l$ , and

$N_0$  is the radiation strength at the point of insertion in the substance.

If we assume the length of target substance is  $l$ , the absorbed radiation  $N_{\text{absorb}}$  is as follows:

$$N_{\text{absorb}} = N_0 - N(l).$$

We need to evaluate the value of  $N_{\text{absorb}}$  for absorbed dose.

Narrowing down the focus to absorbed dose, the conclusion should not be “at 100mGy all DNA damage is recovered” but “at 0.69mGy all DNA damage is recovered,” and not “at 250mGy DNA damage is not fully recovered” but “at 1.73 mGy DNA damage is not fully recovered.”

The problem lies with taking the whole dose that the cells cultured on top of the cover glass were exposed to and making it the same thing as the absorbed dose. The majority of the rays would go right through the extremely thin cell layer and out the other side. The amount of energy applied to the cells by ionizing the cell organization (energy counted into absorbed dose) is exceedingly small, but this team is using the erroneous ICRP idea that the energy of the radiation coming out the other end is also “absorbed.”

They consolidated their experiment’s results thus: that 24 hours after exposure to 100mGy of radiation all of the DNA damage was repaired, and that at 250mGy of radiation exposure the damage repair was not perfect and damaged cells still remained. However, their values of 100mGy and 250mGy as effective dose are a gross overestimation. Taking total exposure as effective dose is an outrageous error, but one that is part of ICRP’s “resolutions” and is inevitable to occur as compelled by the ICRP system.

A more accurate calculation instead yields values of 0.69mGy and 1.73mGy, respectively. When they say that “below 100mGy all damage was repaired” it should actually be “at an absorbed dose of 0.69mGy all damage was repaired.” Likewise, instead of “at 250mGy DNA damage was not all repaired,” they should say that “at an absorbed dose of 1.73mGy there was remaining DNA damage.”

A Swiss study performed on over 2 million children below the age of 16 examined the link between background radiation and childhood cancers. In the study they report the cancer hazard ratio as 1.04 per 1mSv

of cumulative dose (Spycher BD et al., Environ. Health Perspectives, 123, 622-628 (2015)). The aforementioned research of Suzuki et.al. endorses the results of this study.

The results of correct scientific processing are proof that even at a level of 1.7mGy, unrepaired genetic anomalies persist and can be linked to carcinogenesis. In this way, the physical application of their self-defined “absorbed dose” is consistently and systematically flawed. As in the above example, where although DNA damage persists at an absorbed dose of less than 2mGy, they instead come to the false conclusion that 100mGy is safe because there is no remaining DNA damage.

Likewise, saying “Below 100mSv is safe” has no scientific basis and is an outrageous claim. Not only Yamashita Group, but almost all animal and cell culture experiments use this technique. Threshold levels and the radiation dose at which the causes of “harmful tissue response” and “stochastic effect” start to appear are deduced excessively. In the above experiment, threshold dose and so on are estimated at 150 times higher than they should be, and the result is that there are now campaigns featuring the claim that low-dose radiation is safe and harmless.

Because of this manipulation, an immeasurable amount of “harmful tissue response” and “stochastic effect” owing to damage brought about by low-level radiation has been ignored or underestimated, and countless victims have been discounted.

For more information, please read the article below (Japanese only).

<https://www.sting-wl.com/yagasakikatsuma19.html>

## **§4 Destruction of the principle of causality, removing the backbone of science**

### **① Radiation weighting factor (1990 and onwards), biological equivalent dose**

When an object is subjected to a stimulus, a reaction occurs in that object in response to the stimulus, and as a consequence of that reaction (a result of receiving the stimulus), some phenomenon is observed. The stimulus described here is an action that forms the cause of the phenomenon (result). In data processing terms we would call this the “input.” As such, the phenomenon that results from the stimulus (i.e. the result brought about by the action to which the object is subjected) would be called the “output.”

The scientific approach is to discuss the relationship between the response and the result, and to represent the principle of causality. The ICRP system fails to apply this most fundamental logic.

To explain biological equivalent dose: supposing damage from alpha rays was 20 times that of beta and gamma rays, then the radiation energy of the alpha rays would also be 20 times larger. So, if the actual

radiation dose of alpha rays was 1mGy, then multiplying by 20 gives 20mSv, which is biological equivalent dose. A radiation weighting factor of 20 means a “biological equivalent dose” of 20 times the radiation energy, based on the fact that alpha rays cause extensive health effects. “Biological equivalent dose” is an imaginary physical quantity.

This ignores the principle of causality. While this expression may be useful in the medical field and so forth, the radiation weighting factor ignores the mechanisms and responses inside the object (organism), and uses a single value to express the fact that energy was large, which is entirely unscientific.

Saying that a large output occurs simply because of a large input is the same as enclosing the organism’s response process inside a black box. By doing so, limiting the output to cancer greatly underestimates the adverse health effects of radiation and provides the system with a scientific smoke screen, going against the principle of causality. This scientific smoke screen continues with quantities such as the tissue weighting factor. This is part of the ICRP’s imperial domination.

## ② Tissue Weighting Factor (1990 and onwards)

Essentially, tissue weighting factor is set according to the incidence of cancer and was created with the reasoning that effective dose could be divided between the tissues.

The idea of dividing absorbed dose amongst organs by way of tissue weighting factor shows another of ICRP’s arbitrarily composed, mysterious physical quantities. It is the same kind of error as if we were to add the population densities of each prefecture and claim the result as the population density of the whole country. It is not a scientifically rational physical quantity.

Absorbed dose is a quantity defined (and derived) thus: energy from irradiation is divided by the mass which absorbed that energy and then normalized. If you take the absorbed energy and mass of each tissue and add it up you get the absorbed energy and mass of the whole body (extensive variable). However, absorbed dose cannot be calculated in the same way (intensive variable). This is the same as the population density example above.

Further, calculating effective dose by multiplying the actual absorbed dose by tissue weighting factor brings about a considerable underestimation. This is the second of ICRP’s cheap tricks.

Calculating “effective dose” by this outrageously arbitrary composite restricts the effects of irradiation to cancer only, and serves as the culmination of ICRP’s imperial deception, designed to play down the scope of damage. An “imperial deception” idea means that the ICRP possesses an imperial-like controlling power, which it uses to force its illogical ideas on the public.

### ③ The unit called “Sievert:” Terminology that runs counter to science’s fundamental spirit of rationality

The unit called “Sievert” is used for fictional physical quantities that arbitrarily modify absorbed dose on several levels. The first of these is biological equivalent dose, which is radiation quality weighting factor added to the strength of radiation energy.

The second is effective dose, which is obtained by dividing absorbed dose among the internal organs according to tissue weighting factor. The ICRP systematizes the underestimation of damage by limiting the assessment adverse health effects to cancer only, making it a system that is not up to the standards of science.

### §5 In Supplement

(1) The ICRP’s 3 principles of radiological protection serve as a system whose anti-democratic doctrines defy human rights and justify the existence of the nuclear industry.

For example, the first principle, “justification,” certainly claims that loss of life due to radiation can be forgiven if it works in favor of the public good. To put it frankly, this is a societal justification for murder via radiation from nuclear power stations, and part of the nuclear industry’s defensive “so-what” attitude.

(2) By standardizing the units of absorbed dose and exposure, many of their concepts can be applied in various areas, as is convenient for the country and nuclear power companies. The first and foremost of these applications is the use of “effective dose” to claim that the low numbers shown on glass badges are valid.

Radioactive contamination and the doses shown on monitoring posts are defined in legal terms as “amounts expressing the contamination of the region” and “atmospheric absorbed dose.” Regardless, the calculation of exposure from daily activities (16 hours spent inside and 8 hours outside, and so forth) was introduced, which greatly undervalues the amount of irradiation. Further, the monitoring posts set up both within and outside Fukushima prefecture only reflect half the absorbed dose to which the citizens are being exposed. Considering these facts, we can say that the ICRP system does not exist to protect citizens (against radiation) but rather to provide a full-scale smoke screen to hide the damage caused by radiation.