Session 3
Emergency Exposure Situation

ICRP Task Group 124
Application of Justification Principle:
Setting the Scene
15 - 16 May 2023

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Session 3 Plan

- 15 minutes presentation
- 45 minutes discussion
  - Guided by 4 questions
  - To speak during the session please use the raise hand function
How do you know when you’re doing more good than harm in an emergency exposure situation?

Nuclear or radiological emergency:

- People are protected from radiation by protective actions
- Sheltering, evacuation or iodine thyroid blocking...

Health, societal, economic, or other effects?
After the Fukushima accident:

Fig. 1. Changes of mortality rates among the institutionalized elderly before and after the Fukushima NPP accident.
Research Article

Evacuation after the Fukushima Daiichi Nuclear Power Plant Accident Is a Cause of Diabetes: Results from the Fukushima Health Management Survey

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Mental Health Consequences and Social Issues After the Fukushima Disaster

Masaharu Maeda, MD, PhD1 and Misari Oe, MD, PhD1,2

Abstract
The Great East Japan Earthquake and subsequent nuclear power plant accident caused multidimensional and long-term effects on the mental health condition of people living in Fukushima. In this article, focusing on the influence of the nuclear disaster, we present an overview of studies regarding the psychosocial consequences of people in Fukushima. Studies revealed that the experiences of the explosions at the plant as well as the tsunami are deeply embedded in their memory, leading to posttraumatic responses. Chronic physical diseases, worries about livelihood, lost jobs, lost social ties, and concerns about compensation were also associated with posttraumatic responses. Furthermore, the radioactive fallout brought chronic anxiety regarding physical risks of radiation exposure to people, especially young mothers. People often have different opinions about the radiation risk and their own future plans,
After Fukushima accident – no discernible radiation induced health effects

Were the protective actions justified?

Didn’t they do more harm than good?
Current basis for protective actions

- Current basis for protective actions:
  - Stochastic effects based on Linear Non-Threshold (LNT) model.
  - Emphasis is protecting people from radiation—the lower the dose, the better.
  - No consideration given to harm associated with protective actions.
  - Predetermined projected dose criteria for tissue reactions and stochastic effects.

Diagram:
- Conservatism
- Radiation hazards
- Under estimated Protective action hazards

ICRP
ICRP - Justification in emergencies

- Any decision altering a radiation exposure situation should do more good than harm (ICRP 103).
- A dose rising towards 100 mSv will almost always justify protective action (ICRP 103).
- An assessment based on health effects would be insufficient and due considerations must be given to societal, economic and other consequences (ICRP 103).
- Should take careful account of all non-radiological factors in order to preserve or restore the living and working conditions of all those affected (ICRP 146).
Comparing radiation risks with protective action risks

ICRP Publication 103
Dose Constraints and Reference Levels

Greater than 20 to 100 mSv

Actions to reduce doses would be disproportionately disruptive.

Individuals should receive information on radiation risk

Numerical guidance lacking

Table 5. Framework for source of constraints to workers and the public from ionizing radiation.

<table>
<thead>
<tr>
<th>Categories of constraints</th>
<th>Reference levels</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 20 to 100 mSv</td>
<td>Individual sources of control and actions to reduce doses would be disproportionately disruptive. Exposures are usually controlled by action on the exposure pathways.</td>
<td>Reference level set on the highest planned dose from a radiation emergency.</td>
</tr>
</tbody>
</table>

Individuals should receive information on radiation risk and on the actions to reduce doses. Assessment of individual doses should be undertaken.
Key stakeholders need to be involved

Need to present risks in understandable way

What do these numbers mean?

- Odds Ratio
- Hazards Ratio
- Relative Risk
- Local decision maker or public
Relocate or remain – what is justified?

Which is doing more good than harm?

- Averting 20 mSv E when relocating, or receiving 20 mSv E and remaining?
- What if the protective action is more harmful?
<table>
<thead>
<tr>
<th>Dose criterion [mSv]</th>
<th>Radiation-induced deaths possibly prevented by triggered protective actions</th>
<th>Deaths associated with protective actions or dislocations</th>
<th>Mental health problems associated with dislocations and perceived risk of exposure to ionizing radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absolute Excess Risk [per 1000]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General population</td>
<td>Elderly (70 and above)</td>
<td>Under 18</td>
<td>General population</td>
</tr>
<tr>
<td>1</td>
<td>0.05</td>
<td>0.02</td>
<td>0.1</td>
</tr>
<tr>
<td>5</td>
<td>0.25</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Relocate</td>
<td>0.5</td>
<td>0.2</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>0.3</td>
<td>2</td>
</tr>
<tr>
<td>50</td>
<td>2.5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>
Journal of Radiological Protection

PAPER

What’s better for our health? Conducting protective actions during a nuclear emergency or accepting a certain radiation dose?

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Keywords: nuclear emergencies, radiation risk, protective action risk, radiation-induced health effects, radiological protection, justification

Abstract

The threat caused by ionising radiation has resulted in the establishment of strict radiation protection guidelines. This is especially true for severe nuclear power plant (NPP) accident scenarios, which may involve the release of significant amounts of ionising radiation. However, we believe that the fine balance between the benefit of a certain protective action (e.g. evacuation) and its risks is not always accounted for properly. Deaths and mental health problems have been associated with protective actions (e.g. evacuation) implemented in the response to the Fukushima
Example scenarios

- Whether to evacuate or shelter residents located around an NPP based on conditions at the NPP (actual or projected severe core damage).

- Whether to monitor and decontaminate the affected population.

- Whether food restrictions in terms of consumption, distribution or export will need to be implemented.

For discussion:

Think of different scenarios when justification could be applied in an emergency exposure situation and identify those that may need further analysis by TG124.
Discussion - Guiding Questions

- Which scenarios require in-depth consideration?
- What factors need to be taken into account in the relevant scenarios?
- What areas of expertise and stakeholders could provide additional insight?
- What guidance would be helpful to improve the application of the justification principle?