

International Conference on Effective Nuclear Regulatory Systems Transforming Experience into Regulatory Improvement

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Radiation Protection Issues: Challenges for Communication, Coordination and Consistency in the Response to Emergencies

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Content

1. Aim

2. Selected Issues with Communication Challenges

- a) Quantities, Units, and Exposure
- b) Public Protection
- c) '*Contamination*'
- d) Radiation Risks and Effects

3. Epilogue:

Misunderstandings $\Rightarrow$ Psychological Effects

1. Aim

The aim of the paper is to discuss challenges in

- communication,**
- coordination and**
- consistency**

in the response to emergencies,

**which can be derived from radiation protection
issues identified by ICRP following Fukushima.**



INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

ICRP ref 4832-6303-9753

June 18, 2011

Terms of Reference for Task Group 84 of the ICRP Main Commission

**Initial Lessons Learned from the NPP Accident in Japan
vis-à-vis the ICRP System of Radiological Protection**

Approved by the Main Commission on June 18, 2011

Issues identified by ICRP

1. inferring radiation risks;
2. attributing radiation effects;
3. quantifying radiation exposure;
4. assessing internal exposures;
5. managing emergency crises;
6. protecting rescuers and volunteers;
7. responding with medical aid;
8. justifying disruptive protective actions;
9. transiting from the emergency to an existing situation;

Issues identified by ICRP

- 10. rehabilitating evacuated areas;
- 11. categorizing public exposures due to an accident;
- 12. restricting public individual doses;
- 13. caring for infants and children;
- 14. considering pregnant women;
- 15. monitoring public protection;
- 16. dealing with 'contamination' of territories, rubble and residues, and consumer products;
- 17. recognizing psychological consequences; and,
- 18. fostering the sharing of information

2.

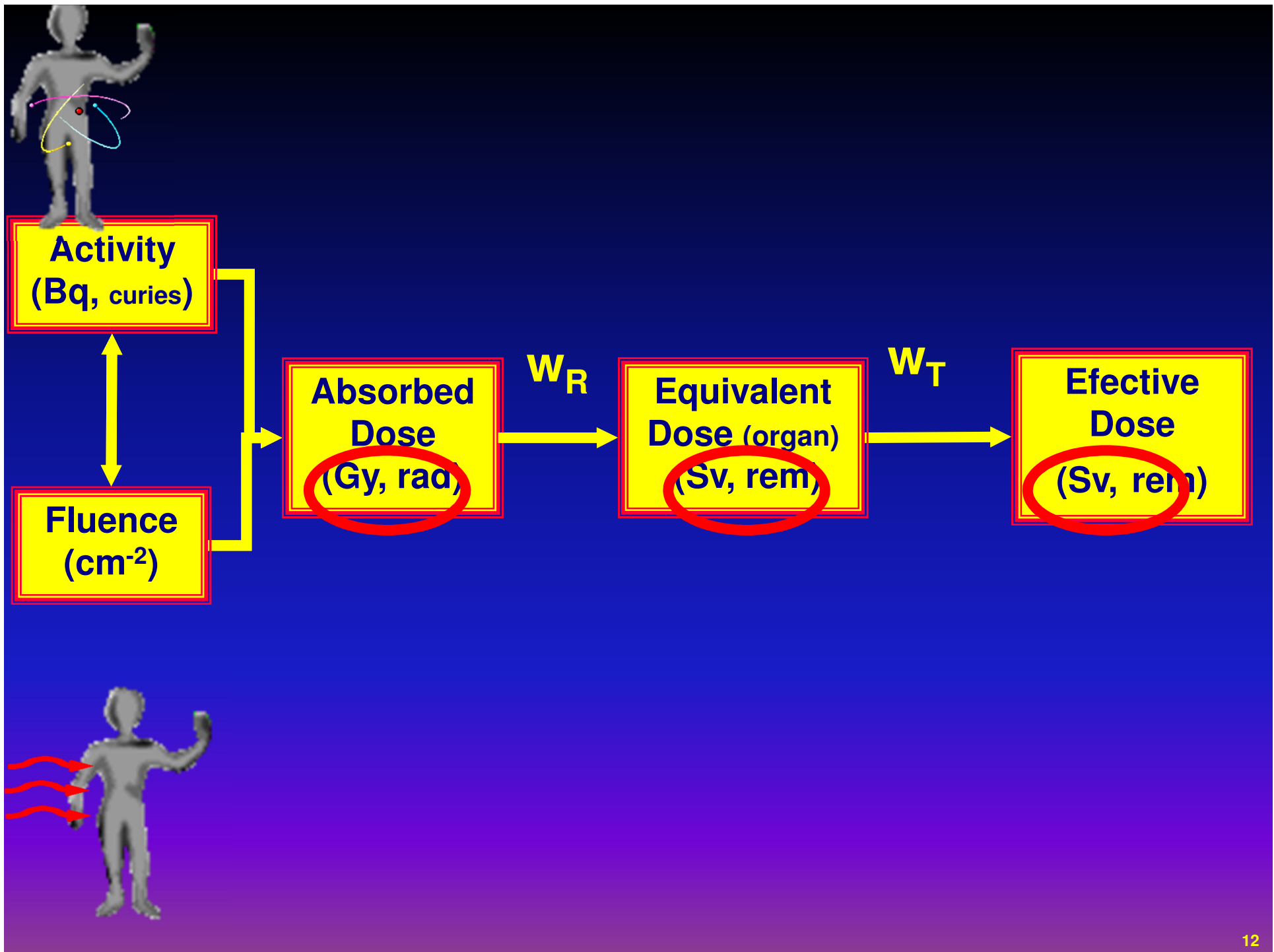
**Selected Issues with
Communication Challenges**

Selected Issues with Communication Challenges

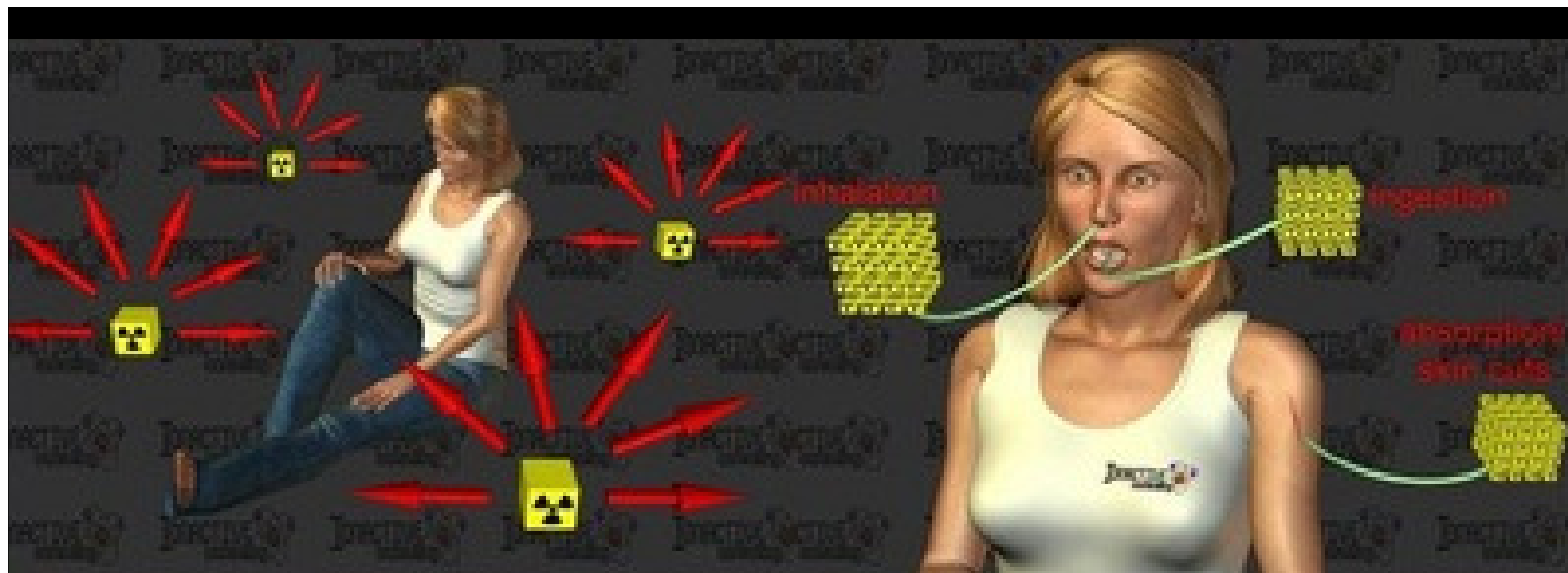
- a) Quantities, Units, and Exposure**
- b) Public Protection**
- c) ‘*Contamination*’**
- d) Radiation Risks and Effects**

a) Quantities, Units, and Exposure

Confusion with quantities and units



**Confusion with the relevance
of internal exposure**





United Nations Scientific Committee
on the Effects of Atomic Radiation

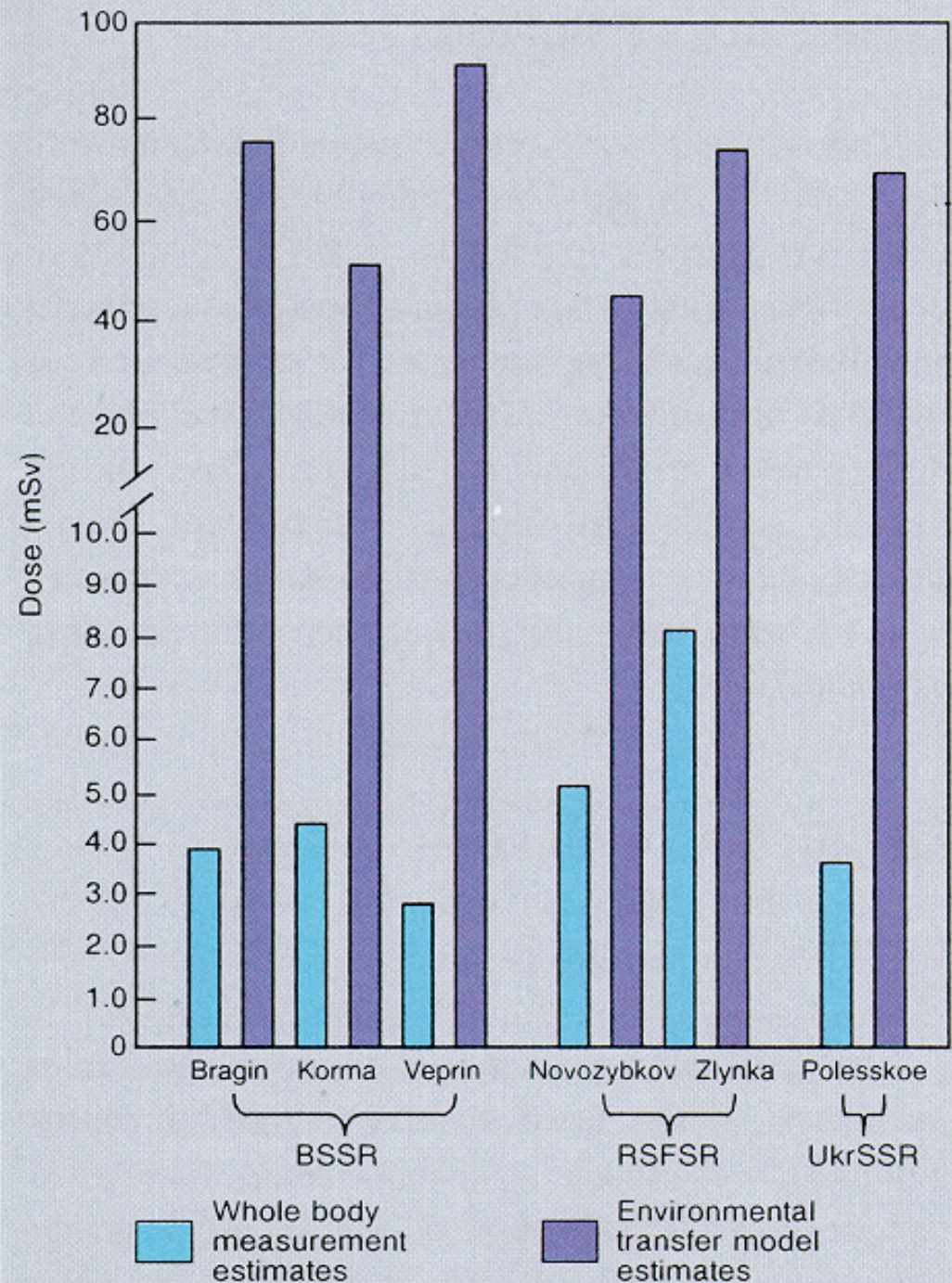
Fifty-ninth session
Vienna, 21 to 25 May 2012

Agenda item 4(e)
Technical discussions

BIOLOGICAL EFFECTS OF SELECTED INTERNAL EMITTERS

Confusion
with dose levels:
assessed theoretical levels
vis-à-vis
monitored real levels

A lesson from
Chernobyl:
radiation doses
measured
in vivo
were much lower than
doses *theoretically*
estimated.





Preliminary dose estimation

from the nuclear accident
after the 2011 Great East Japan
Earthquake and Tsunami



annual dose
mSv/year

**Natural
Background**

Few people
In few areas $\Rightarrow \sim 100$

VERY HIGH

Many people
In many areas $\Rightarrow \sim 10$

TYPICALLY HIGH

Majority of people
around the world $\Rightarrow \sim 2.4$

AVERAGE

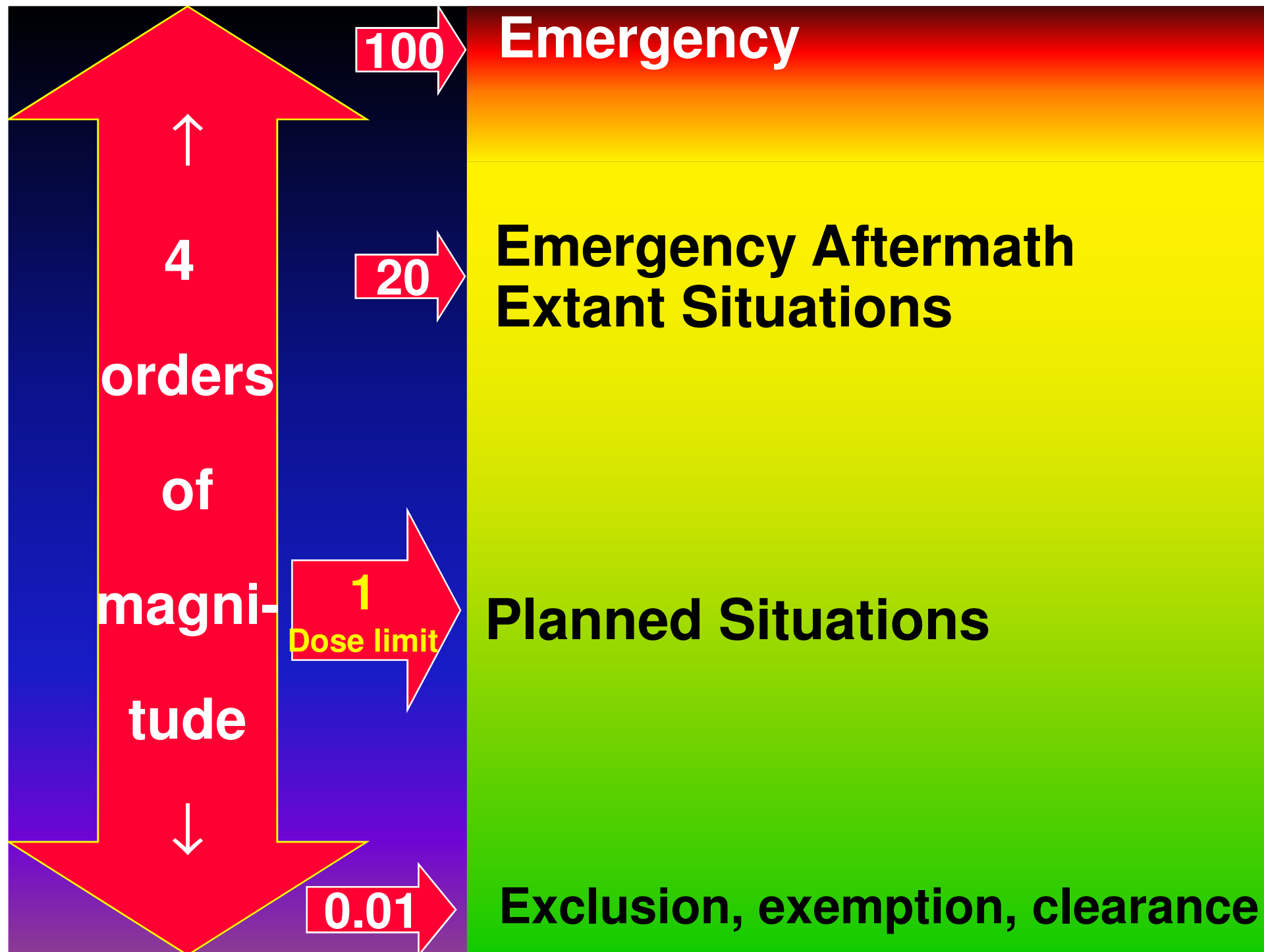
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MINIMUM

**Doses
Estimated
Theoretically**

b) Public Protection

Confusion with Individual dose restrictions



➤ A typical question from the public is:

What is the rationale for permitting doses of 20 mSv per year after an accident, when the dose limit is 1mSv per year and therefore doses greater than 1 mSv per year were unacceptable before the accident?

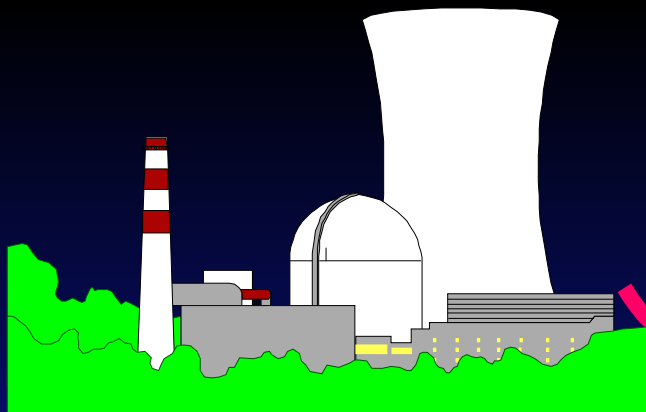
Planned Exposure Situations (*'Practices'*)

Restrictions: dose limits and constraints

Expected
additional
dose

Extant
Radiation
Exposure

Activity introduced



Individual restriction = 'Delta' Dose

Limit to
expected
additional
dose
=
1 mSv/y

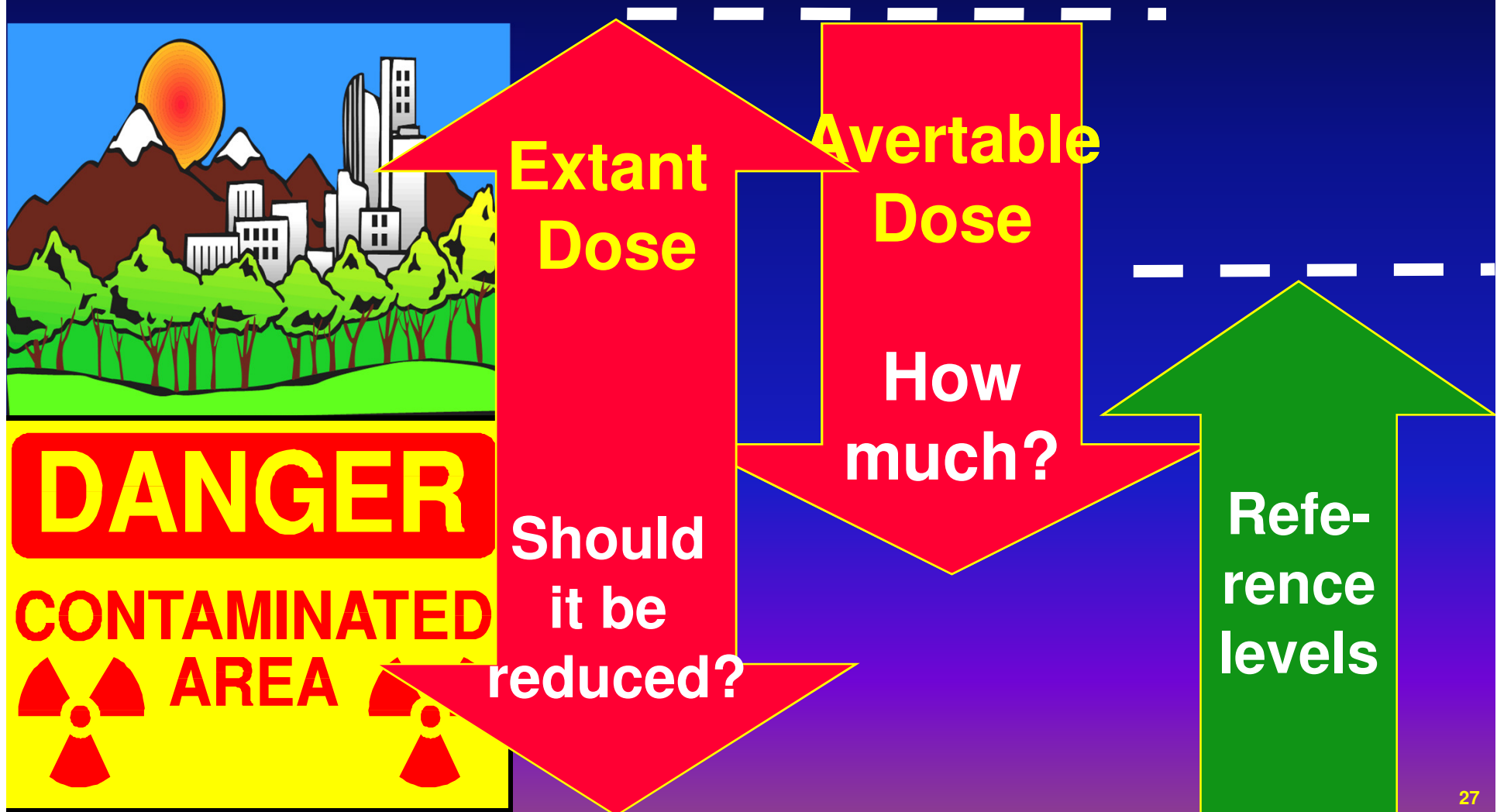
Exant
Dose
1 – 10
mSv/y

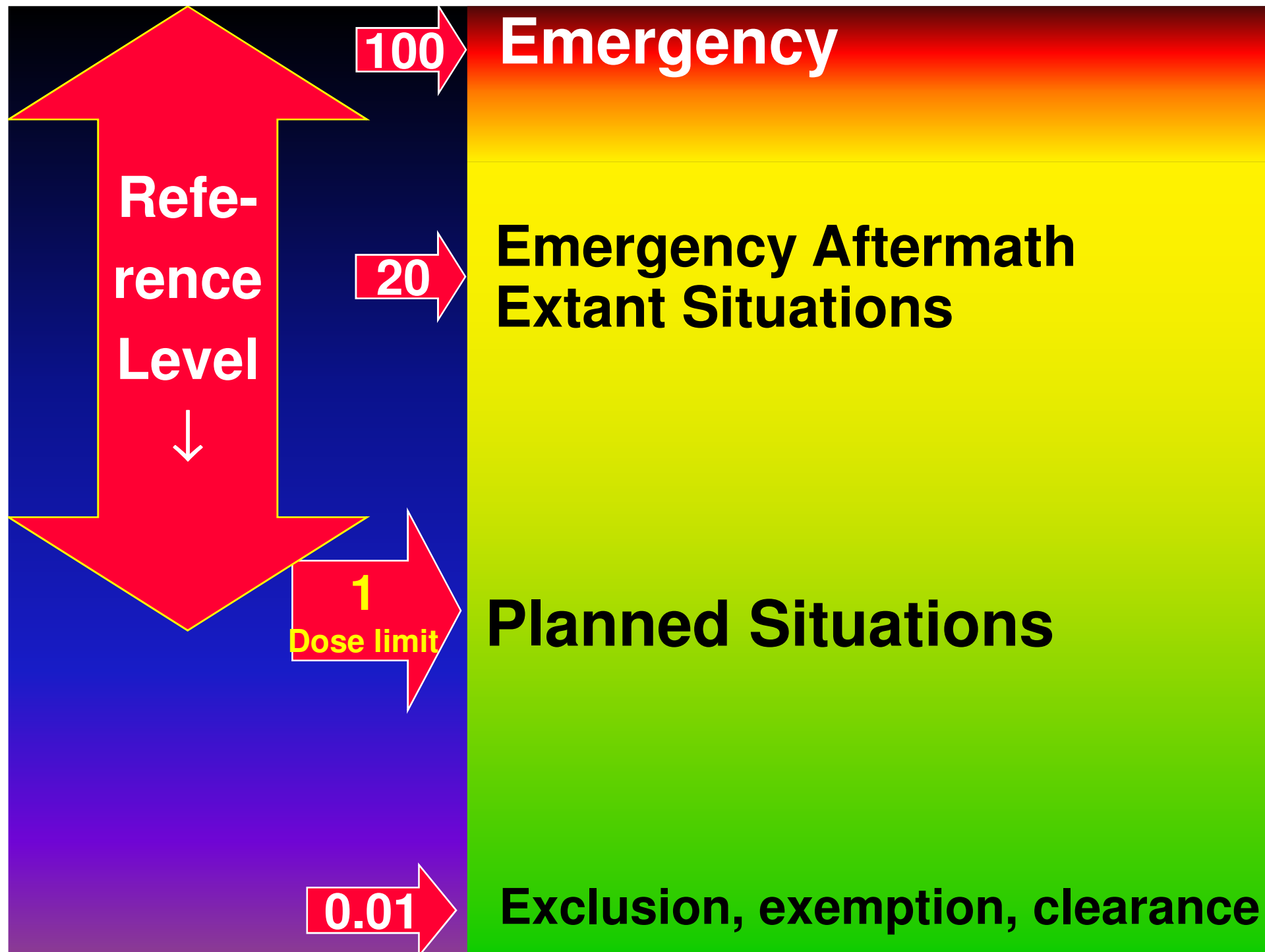




Interventional situation

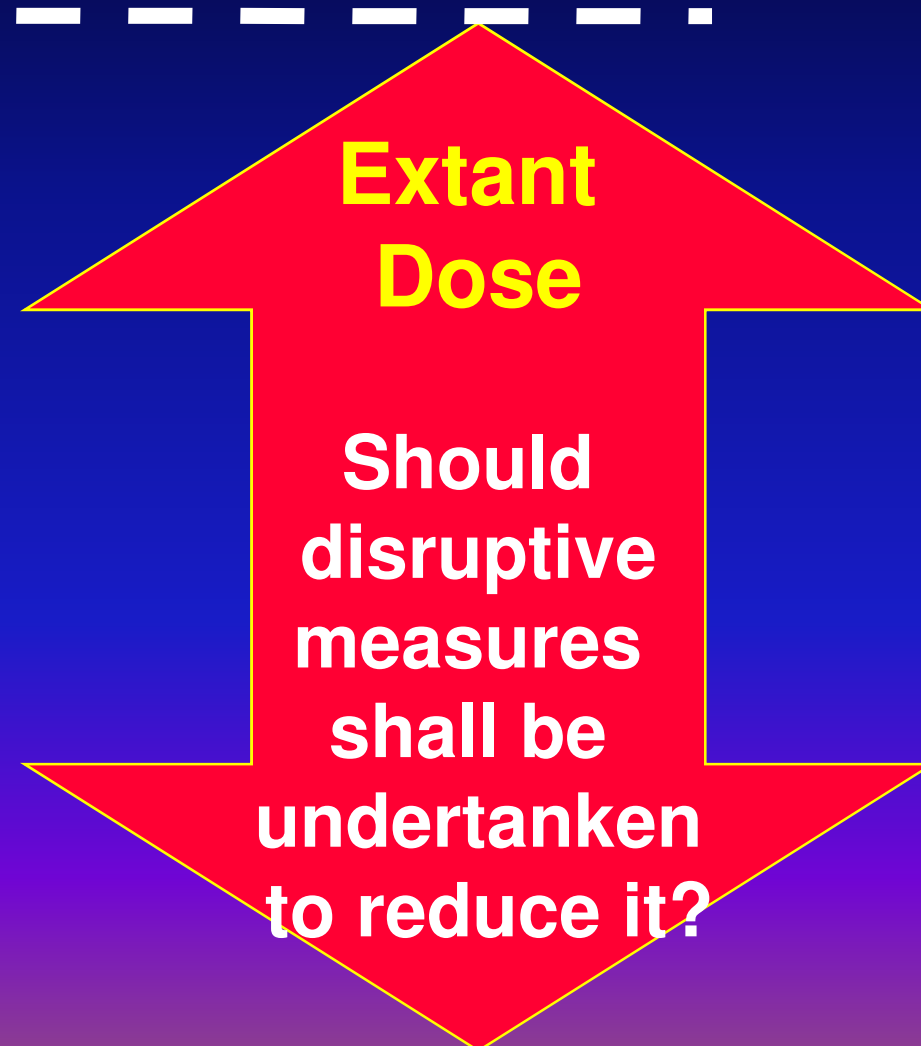
Emergency and Existing Situations





Interventional situation

Emergency and Existing Situations



The ICRP Principle of Justification:

“Any decision that alters the radiation exposure situation should do more good than harm.”

Is evacuation justified?



Lost in translation?

- The Japanese expression for **dose limit**, 線量限度, is less ambiguous than its English version.
- 線量 means **dose**, used as an adjective, and
- 限度 means **bound, boundary, end, border, brim, edge, verge**, used as a substantive;
- Namely, 線量限度 means *a boundary of dose that shall not be exceeded under no circumstance*.
- It is therefore unsurprising that the Japanese population was perplexed with the use of dose restrictions higher than the dose limits.

➤ Hans Blix's dictum:

“There is much confusion on the subject of the regulation of low doses,people are surprised that what we term a dose limit is lower than the natural background radiation doses that we unavoidably incur.....few decision makers understand...the... control [of] additions to background doses.”

Last key note address as IAEA DG – Seville; Nov.17, 1997



**Dose
limit that
is not a
limit?**

Confusion with the protection of children

Are Children Properly Protected?

- Parents do not believe that children are adequately protected by the radiation protection standards



Detriment-adjusted nominal risk coefficients for stochastic effects after exposure to radiation at low dose rate [% Sv⁻¹]

Nominal Population	Total
Whole	5.7
Adult	4.2

30 %



United Nations Scientific Committee
on the Effects of Atomic Radiation

Fifty-ninth session
Vienna, 21 to 25 May 2012

Agenda item 4(g)
Technical discussions

EFFECTS OF RADIATION EXPOSURE ON CHILDREN

Confusion with the protection of pregnancy

**Should I
terminate my
pregnancy?**



Confusion with public monitoring

Why members of the public are not monitored?



If it is done for them....



....why not for them

c) ‘*Contamination*’

'Contamination' is a confusing term

- from Latin *contaminare*, 'made impure'.
- Religious origin (e.g., no-kosher food)
- Professional denotation: **presence of radioactivity**
- Public connotation: **radioactive danger**

Translation confuses the term even more!
e.g., translation to Japanese

Contamination → 汚染

- 汚 → Dirt, Filth
- 染 → Dyed

*The food is
'contaminated', but
do not worry the
'contamination' is
low?*



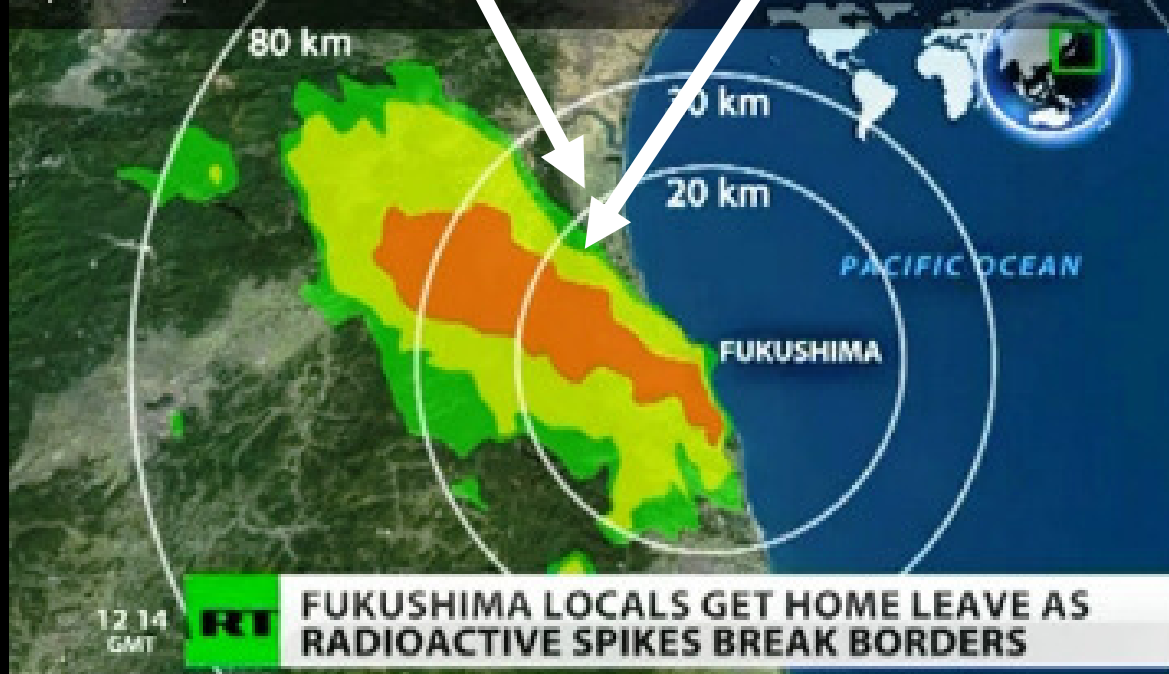
***'Contaminated'* Territories**

We are not in danger!

We are in
danger!



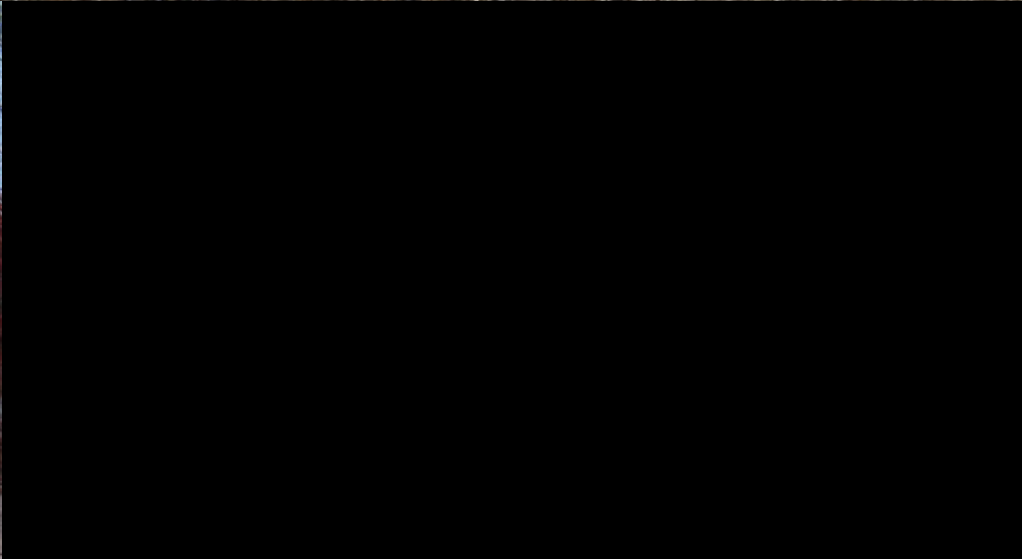
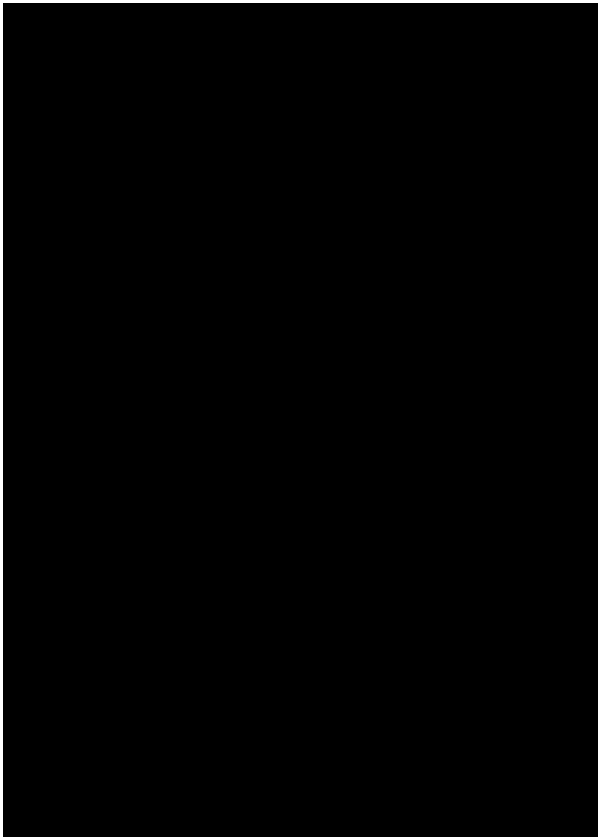
Nuclear collapse looms? Fukushima No. 4 reactor 'leaning'
by Russia Today



A still from a Japanese film showing a family in a dining room. A woman in a red top stands in the background. A young boy in a striped hoodie sits with his back to the camera. A man in a white shirt sits at the table, looking thoughtful with his hand to his chin. A young man in a purple shirt sits on the right, reading a book. A large red thought bubble is positioned above the man in white, containing the text 'Is it safe for me and my family to live here?'. Three small red circles lead from the bubble to the man's head. The table is set with bowls, plates, and glasses of orange juice. The room has wooden shelves and a window in the background.

*Is it safe for me
and my family
to live here?*

***'Contaminated'* Rubble**



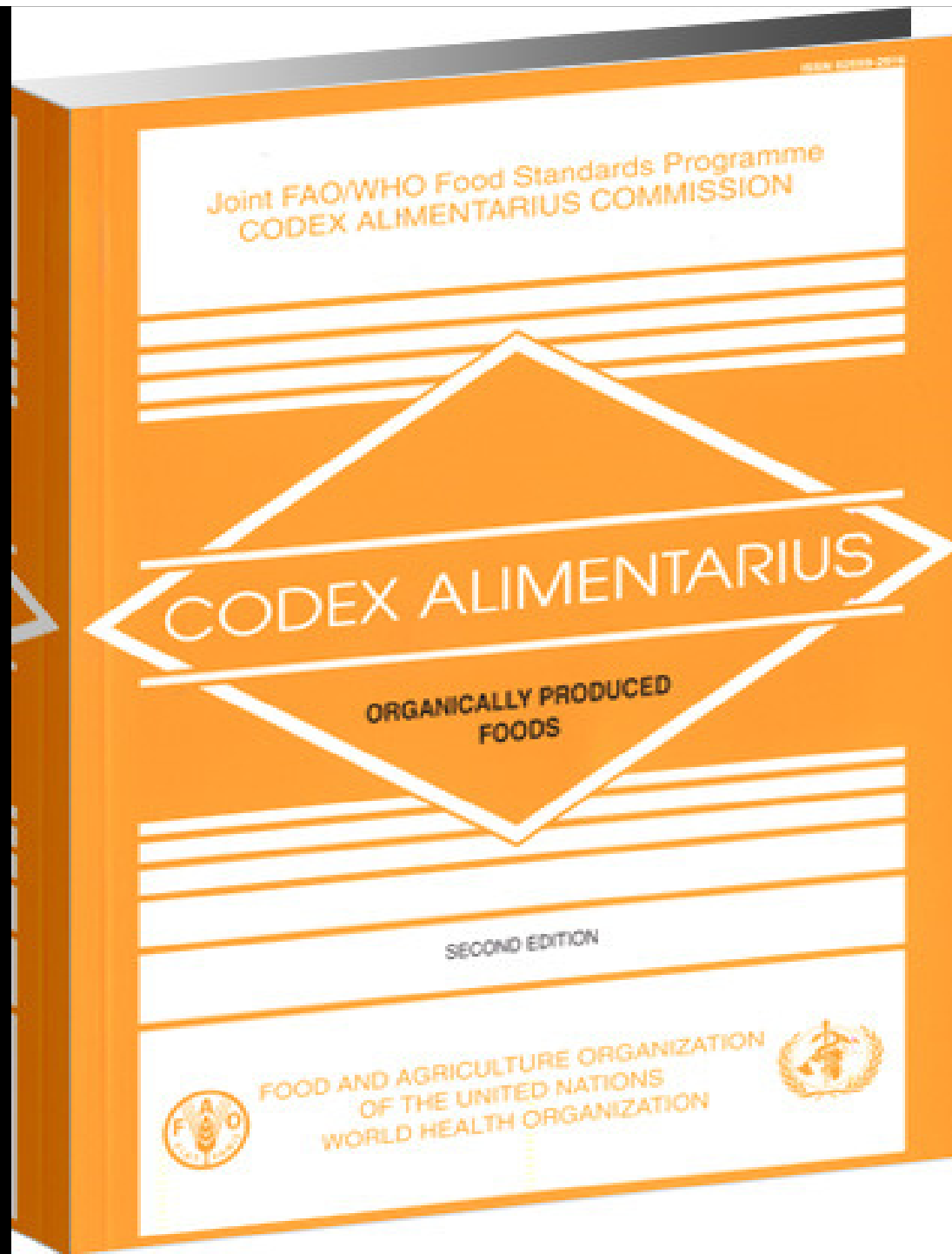


*May I dump this
waste in the truck
or shall I phone
the radioactive
waste
management
group?*



***'Contaminated'* Consumer Products**

Foodstuff



Water

Guidelines for Drinking-water Quality

FOURTH EDITION



Non edible

IAEA SAFETY STANDARDS SERIES

Application of the
Concepts of Exclusion,
Exemption and
Clearance

SAFETY GUIDE

No. RS-G-1.7



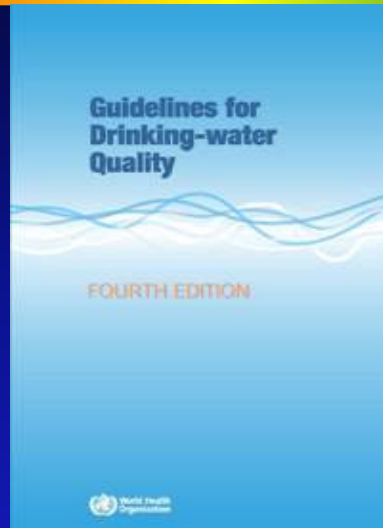
IAEA

International Atomic Energy Agency

Incoherence in drinking liquids



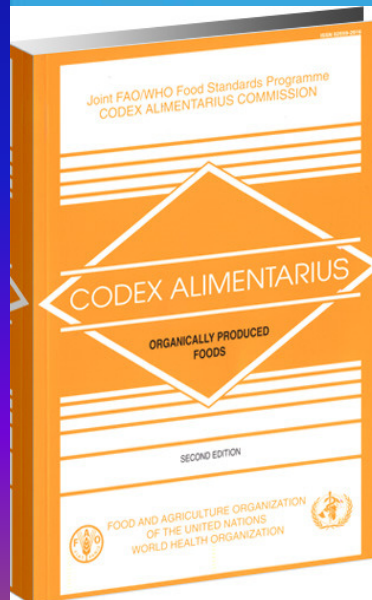
+



= 10 Bq/l for ^{137}Cs



+



= 1000 Bq/l for ^{137}Cs

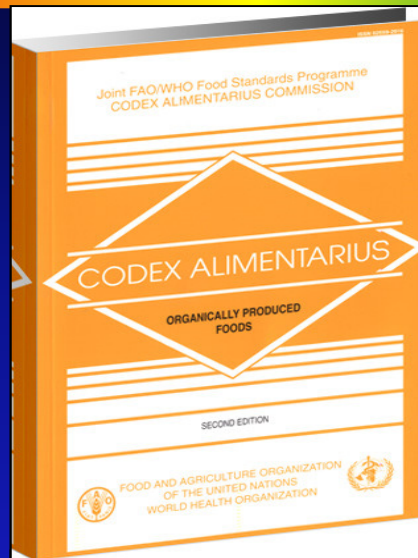
Incoherence in non-edible vs. edible



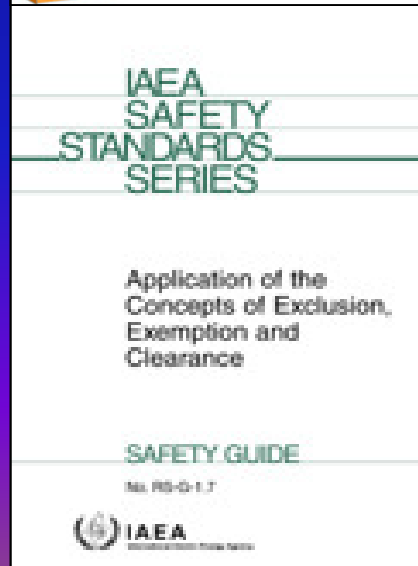
月宫殿 (日本)
Moon Palace Rice Paper (Made in Japan)



+



+



= 1000 Bq/kg for ^{137}Cs

= 100 Bq/kg for ^{137}Cs

***These
kakis
(persimmons)
contain 90
Bq/kg,
but when
dried they
contain
110;
are they
edible?***

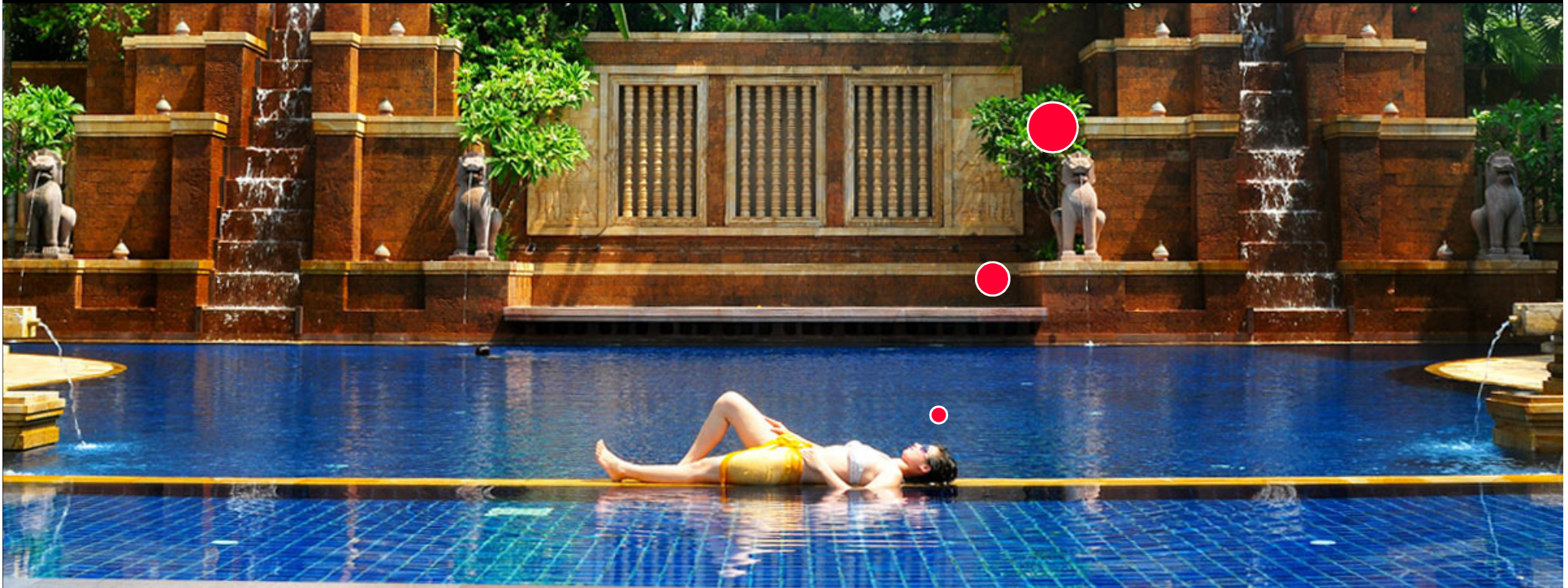




A family of five is gathered around a low wooden table in a traditional Japanese room with tatami flooring and shoji screens. The father, wearing a green shirt, is serving food from a large, ornate red and gold lacquered tray. The mother, in a white striped shirt, is drinking from a cup. Two young children, a boy and a girl, are also eating. An older woman, likely a grandmother, is seated at the head of the table, holding a small cup. The room is brightly lit by natural light coming through the shoji screens.

*Is it safe for
me and my
family to eat
this food?*

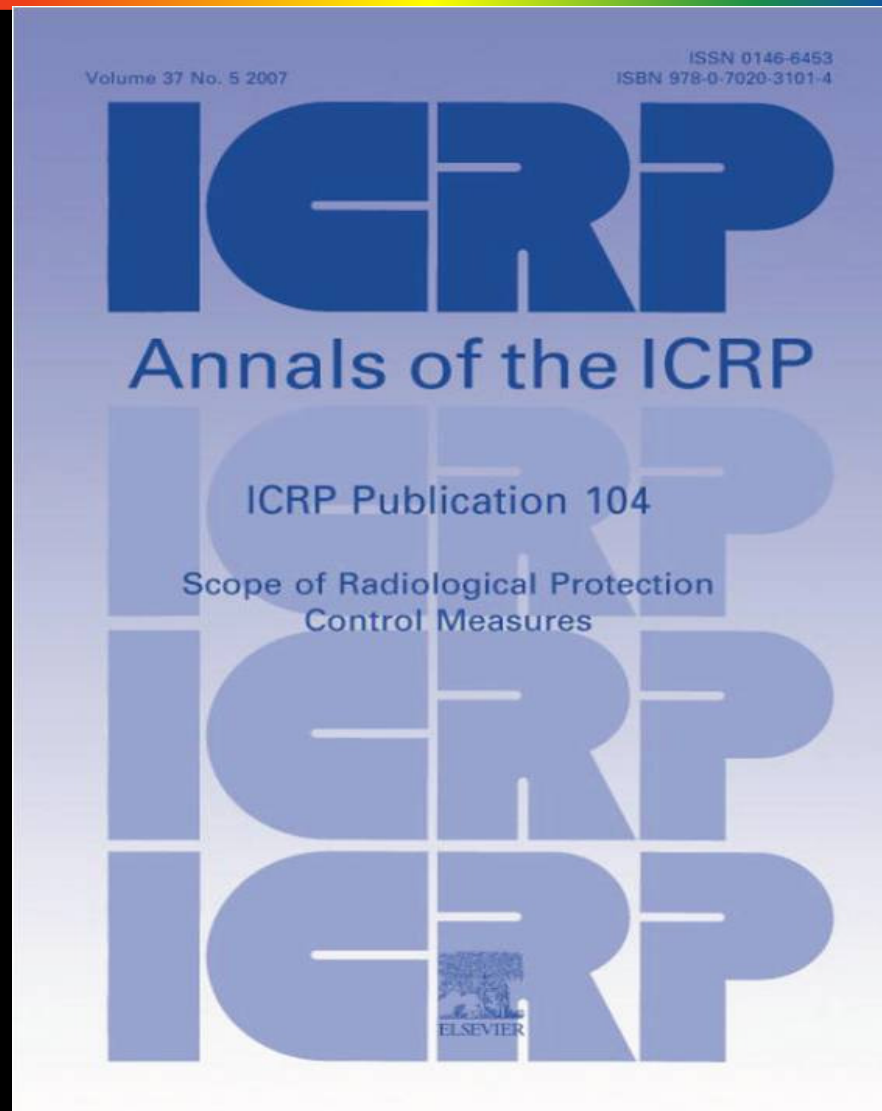
*Why I am
permitted to drink
this water but not
to swim in it?*



***We were told this water is contaminated;
shall we use it?***



ICRP 104 may be helpful



Radiation Risks and Effects

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Manipulative Extraterrestrial ideologies Fukushima Radiation is good for you

Q: Obama's Capitalistocracy: S

Death toll from Japan nuclear catastrophe could top 500,000

DATE: 13 AUGUST 2011 POSTED BY : SPECIAL TO THE CANADIAN



John H. Large has been reported as having predicted that the death toll in the years ahead could top the 500,000 attributed to the Chernobyl accident of 1986 and warned that panicked repair attempts could lead to an even greater disaster. Mr. Large, a British nuclear engineer, said: "The Japanese don't know how to deal with it. They're ad-libbing."

"Just throwing water on to the reactors, when they cannot get inside to see what the situation is, could mean the fuel goes critical again."

"And while the radiation leak so far is only a tenth of that at Chernobyl, that was in a rural area with a low population. In Japan it's an urban, densely packed area so the potential numbers of deaths and cancers are much higher."

Mr. Large is an independent [nuclear engineer](#) and analyst primarily known for his work in assessing and reporting upon [nuclear safety](#) and [nuclear related accidents and incidents](#). [\[LINK\]](#) From the mid-1960s until 1986 Large was an academic in [Brunel University's](#) School of Engineering, where he undertook research for the [United Kingdom Atomic Energy Authority](#).

Mr. Large prepared a critical review of the preliminary report of the [IAEA](#) Fact Finding Mission undertaken to Fukushima Dai-ichi in May 2011. [\[LINK\]](#)[\[LINK\]](#)

Polls



Do you welcome and have reservations about Target taking over Zellers in Canada?

☐ Welcome it

☐ Have reservation

Vote

Result

Blog

Books

Latest

Culture

Manipulative Extraterrestrials control Earth suggests Dr. Michael Salla

Humanized face of aliens control Earth suggests Dr. Michael Salla

Perpetuated War and Canada's First Nations

Toronto Housing Project linked to

**Will I be one of
the 500,000?**



Modeling



Discharge from Fukushima



Collective doses



**Collective dose
(person-sieverts)**

X

**Nominal
Risk
Coefficient
(0.05/Sv)**

=



Number of corpses

**UNSCEAR:
Report to the UN General Assembly**



United Nations

Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

**Fifty-ninth session
(21-25 May 2012)**

**General Assembly
Official Records
Sixty-seventh session
Supplement No. 46**

§25. The Committee has addressed the attribution of health effects to different levels of exposure to ionizing radiation, and has reached the following conclusions:

.....

(f) increases in the incidence of health effects in populations cannot be attributed to chronic exposure to radiation at levels that are typical of the global average background levels of radiation....

.....

Therefore, the Scientific Committee does not recommend multiplying very low doses by large numbers of individuals to estimate numbers of radiation-induced health effects within a population exposed to incremental doses at levels equivalent to or lower than natural background levels.

Natural Background

annual dose
mSv/year

Few people
In few areas $\Rightarrow \sim 100$

VERY HIGH

Many people
In many areas $\Rightarrow \sim 10$

TYPICALLY HIGH

Majority of people
around the world $\Rightarrow \sim 2.4$

AVERAGE

~ 1

MINIMUM

Namie,
Iitate

Katsurao,
Minami-Soma,
Naraha,
Iwaki

In sum, at low radiation doses

1. **EFFECTS** cannot be *retrospectively demonstrated* and, therefore, *actual effects can not be attributed*.

...however...

2. **RISKS** can be *prospectively inferred* and, therefore, it is ethically correct to protect people even at low doses.

Risk is akin to

Probability

i.e., to the ability to estimate by ***inference***
the ***prospective possibility*** of health effects

Health effects are akin to

Provability

i.e., to the ability to reveal by ***evidence***
the ***retrospective true existence*** of health effects

3.

Epilogue:

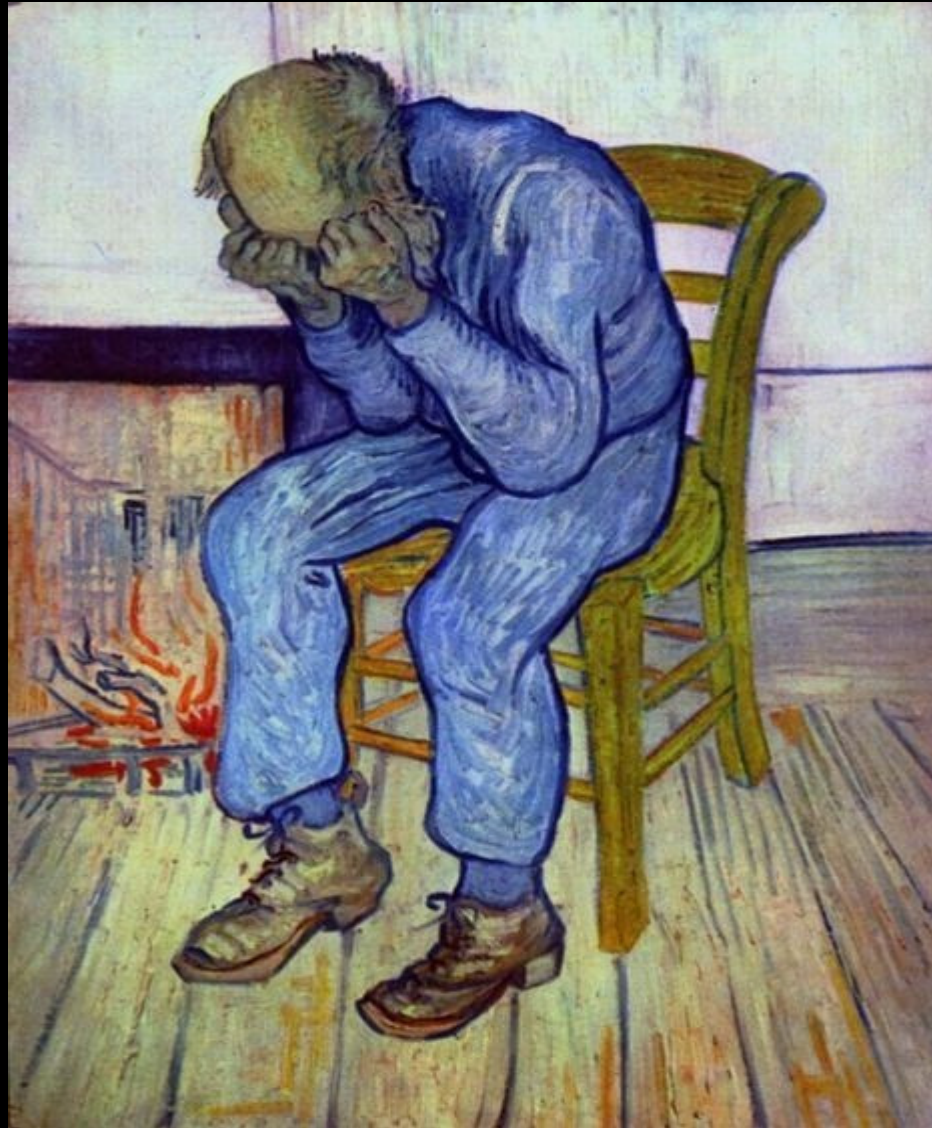
Misunderstandings⇒ Psychological Effects

Probably the big lesson of Fukushima

- The described confusions are not free of charge.
- They are responsible of the **only serious health consequence** attributable to Fukushima:

psychological effects!

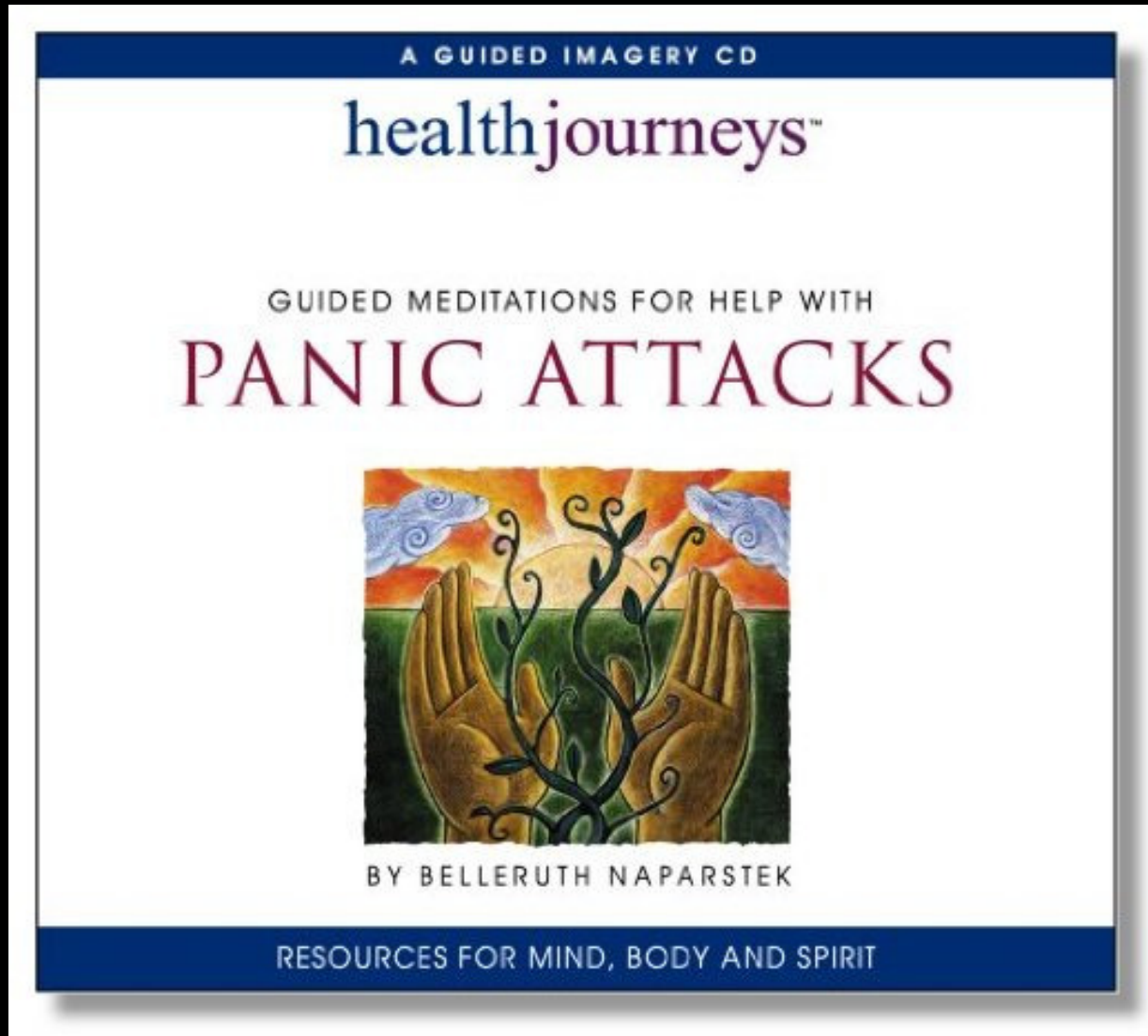
Depression



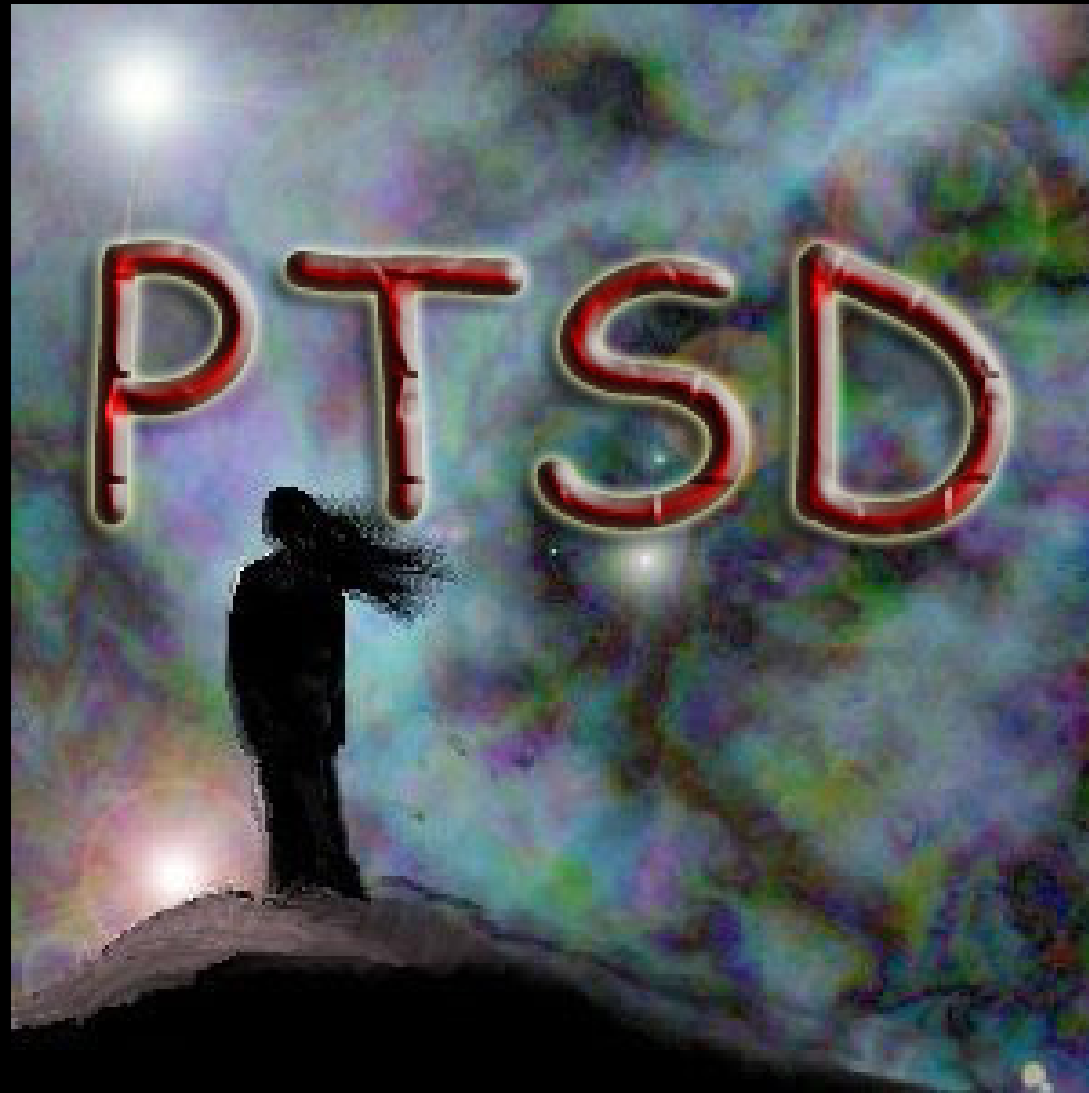
Grieving



Chronic anxiety



Post-traumatic Stress Disorder



Insomnia



Severe headaches



Smoking and alcoholism



Anger



Desperation



Parents' Anguish



Stigma



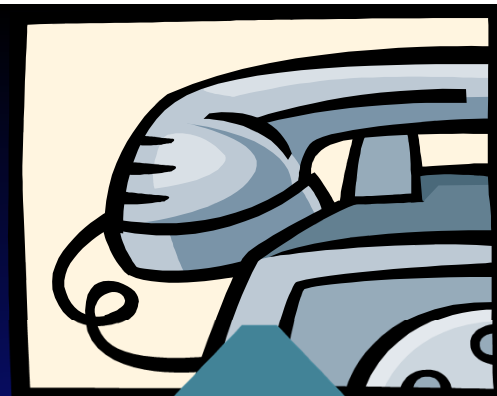
1. In sum, we should humbly recognize our **failures in communication** and its challenges in the response to emergencies.

2. I submit that we have the **ethical duty** of:

- **learning from these failures** and
- **resolving their challenges.**



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Thank you!

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10 April, 2013

