Session 2:

Response of International Organizations

Abel J. González

Autoridad Regulatoria Nuclear; Av. del Libertador 8250; (1429)Buenos Aires, Argentina; +54 1163231758; agonzale@arn.gob.ar
The Future: Expectations

Graded Response from the International Organizations to Lessons Learned
Radiological protection issues arising during and after the Fukushima nuclear reactor accident

Abel J González¹, Makoto Akashi², John D Boice Jr³, Masamichi Chino⁴, Toshimitsu Homma⁴, Nobuhito Ishigure⁵, Michiaki Kai⁶, Shizuyo Kusumi⁷, Jai-Ki Lee⁸, Hans-Georg Menzel⁹, Ohtsura Niwa¹⁰, Kazuo Sakai², Wolfgang Weiss¹¹, Shunichi Yamashita¹⁰,¹² and Yoshiharu Yonekura²,¹³
Some Identified Issues for the International Organizations to consider

1. Radiation Risks
2. Quantities/Units
3. Internal Exposure
4. Occup. Protection
5. Public Protection
6. Psychological Effects
7. Monitoring
8. ‘Contamination’
1. Radiation Risks
Misunderstandings on risk coefficients

- On the one hand, the concept of risk of radiation exposure is misunderstood.
- On the other hand, risk coefficients intended for radiation protection purposes have been incorrectly used to attribute future hypothetical deaths to the accident, by simply multiplying their values by collective doses of low individual doses over large populations.
WHO Health Risk Assessment of the Fukushima Daiichi Nuclear Accident

• **Statement:**
  ...for thyroid cancer, the estimated lifetime risk increases by up to around 70% over baseline rates in females exposed as infants.

• **Caveats:**
  - ...the assessment was based on the [WHO] preliminary estimate of radiation doses....
  - ...the calculated percentages ‘represent estimated relative increases over the baseline rates and are not estimated absolute risks for developing such cancers’...
  - ...‘due to the low baseline rates of thyroid cancer, even a large relative increase represents a small absolute increase in risks’...
REPORTED:

- ...[by 2006] Chernobyl may have caused about 1,000 thyroid cancer and 4,000 other cancers in Europe.
- ...by 2065 about 16,000 thyroid cancer and 25,000 other cancers may be expected due to radiation from the accident.

CAVEATS

- ...several hundred million cancers are expected from other causes...
- ...estimates are subject to considerable uncertainty...
- ...it is unlikely that the cancer burden could be detected...
- ...trends in cancer incidence and mortality in Europe do not indicate any increase in cancer rates that can be attributed to Chernobyl.
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]
UNSCEAR response

Fifty-ninth session
(21-25 May 2012)

ATTRIBUTING HEALTH EFFECTS TO IONIZING RADIATION EXPOSURE AND INFERRING RISKS
2. Quantities and Units
Confusion on Quantities and Units

- Quantities and units used in radiation protection appear to be confusing and have jeopardized clear communication.
Absorbed Dose (Gy, rad)
Equivalent Dose (organ) (Sv, rem)
Effective Dose (Sv, rem)

Activity (Bq, curies)
Fluence (cm\(^{-2}\))
Standards: Equivalent Dose

Monitoring Dose Equivalent
Confusion

- The quantities *equivalent dose* and *effective dose* have a common unit, *sievert*. (Confusion in the reporting of thyroid doses).

- Further confusion between the use of the quantity *equivalent dose* (等価線量) for radiological protection purposes and the quantity *dose equivalent* (線量当量) on which instruments are calibrated.
3.

Internal exposure
Concerns on internal exposure

• Internal exposures are perceived as more dangerous than external exposures.

• This created a lot of anxiety among the people.
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
4. Occupational Protection
Protection of rescuers and volunteers

• There is a lack of *ad hoc* international protection systems applicable to rescuers and volunteers.

• This complicates the regulation of the occupational doses of ‘nuclear’ workers.
Radiation Worker = Rescuer
Radiation Worker \(=\) Volunteers
5.

Lessons on Public Protection
Justification of severe countermeasures, such as evacuation.
Level of Doses

- The ICRP reference levels for the protection of the public are widely misunderstood by the public.
- As a result, the public feels unprotected.
NO INDIVIDUAL/SOCIETAL BENEFIT ABOVE THIS

DIRECT OR INDIRECT BENEFIT TO THE INDIVIDUAL

- 4 orders of magnitude

SOCIETAL, BUT NO INDIVIDUAL DIRECT BENEFIT

- Exclusion, exemption, clearance

Dose limit

Σ?

Δ?
A typical question from the public is:

*Why doses of 20 to 100 mSv per year are allowed after the accident, when doses greater than 1 mSv per year were unacceptable before the accident?*

The Japanese expression for the 1mSv/y dose limit, 線量限度, [線 = radiation, 量 = amount, 限 = border, 度 = time] is unequivocal: amount of radiation dose not to be exceeded in the time.
Dose limit that is not a limit?
Are Children Properly Protected?

Parents are particularly concerned with the protection of children.
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
Pregnancy

Should I terminate my pregnancy?
Importance of clarifying effects on pregnancy
6. Psychological Effects
• Psychological effects are dominant in the Fukushima aftermath.

• They are health effects in their own right

• However, they are basically ignored in radiation protection recommendations and standards
The psychological aftermath

**Common Symptoms after catastrophes**

* Depression
* Grieving
* Post-traumatic stress disorder (PTSD)
* Chronic anxiety
* Sleep disturbance
* Severe headaches
* Increased smoking and heavy alcohol use

**Plus:**

* Anger
* Despair
* Long-term anxiety about health and health of children
* Stigma
7. Public Monitoring
Why members of the public are not monitored?

If is it done for them....

....why not for them
8.

‘Contamination’
Dealing with ‘contamination’

- remediation of “contaminated” territories;
- disposing of “contaminated” debris and rubble;
- use of “contaminated” consumer products.
‘Contaminated’ Territories
Is it safe for me and my family to live here?
‘Contaminated’ Rubble
‘Contaminated’ Consumer Products
Foodstuff
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
Is it safe for me and my family to eat this food?
Epilogue
International Organizations my wish to:

- consider the Fukushima lessons and
- resolve their challenges.
...and humbly recognize failures in communication

• Public communication of international radiation protection policy is still an unsolved problem.
Thank you!

agonzalez@arn.gob.ar