Radiological impact of the Fukushima nuclear accident on the human and biota in the Republic of Korea

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Introduction

- A severe nuclear accident occurred at the Fukushima Daichi nuclear power plants (NPP) in Japan on 11 March, 2011, and a significant amount of gaseous radioactive materials was released into the atmosphere, and dispersed by wind
- This study presents the estimation results of the radiation dose to humans and biota in the Republic of Korea as a result of the Fukushima accident.

Human dose assessment method

- ECOSYS code (Müller and Pröhl, 1987)
- Radionuclides: ^{131}I, ^{134}Cs, ^{137}Cs, ^{133}Xe
- Measured time integrated air activity & ground deposition
- Four exposure pathways (Fig.1)
  1) internal exposures due to the ingestion and inhalation
  2) external exposures from the radionuclides in the passing cloud and from radionuclides deposited on the ground
- Five age groups: infant, 5, 10, 15, adult
- Ingestion: 8 food stuffs & 3 feedstuffs (Fig.1)
- Use of the Korean food consumption rate
- Consideration of ecological properties of rice
- Breathing rate (ECOSYS 87 model)
- Reduction factor for external exposure from cloud and soil: (ECOSYS default data)
- Iodine fraction : aerosol (0.23), element (0.27), organic bound(0.5) (from the measurement of the Chernobyl accident)
- Rainfall rates during deposition (Daejeon, March to May, 2011): 40mm

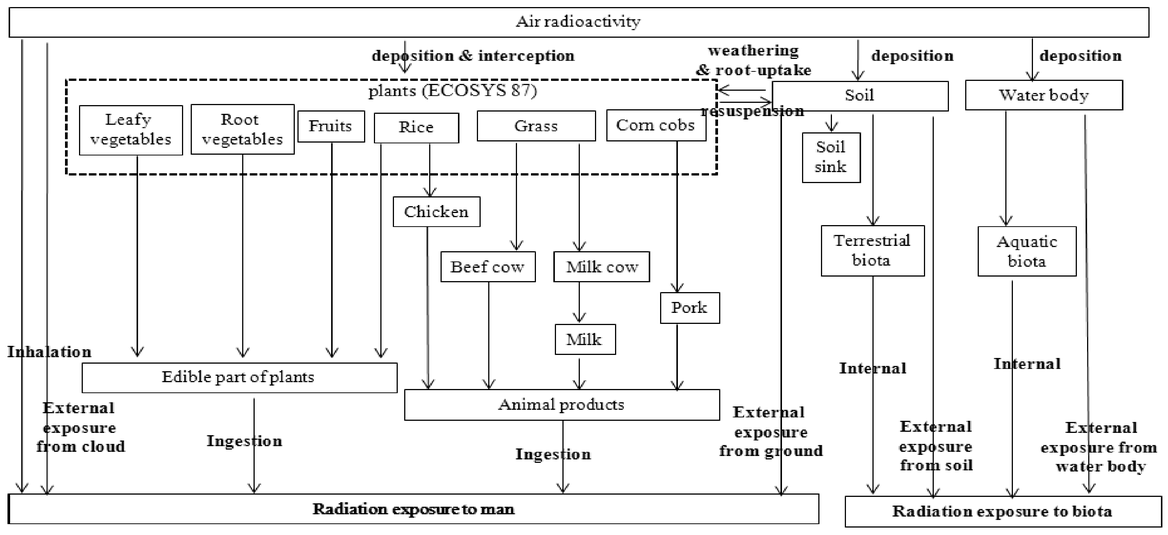

Fig.1 Exposure pathways considered in this study

Human dose result

- First-year effective human dose: 5.7E-5 mSv of infant group ~ 2.0E-4 mSv of 5 years group
- First-year thyroid human dose: 5.0E-4 mSv of infant group ~ 3.4E-3 mSv of 5 years group

- Life-time (70 years) effective human dose: from 1.5E-4 mSv of infant group to 3.0E-4 mSv of 5 years group,
- Life-time thyroid human doses: 6.0E-4 mSv of infant group ~ 3.5E-3 mSv of 5 years group

Non-human biota dose assessment method

- K-BIOTA (Korean computer code to assess the risk of radioactivity to wildlife)
- Semi-equilibrium model (CR equilibrium model, but time-dependent environmental medium activity concentration)
- Radionuclides: ^{131}I, ^{134}Cs, ^{137}Cs
- Eight Koran reference animals and plants (Table 1)

Table 1 Korean draft reference animals and plant

RAPs	Size(cm)			Habitats
	major axis (a)	1st minor axis (b)	2nd minor axis (c)	
Pine tree	1000	30	30	on-soil
Rat	10	3	2.5	on-soil and in-soil
Deer	105	50	50	on-soil
Frog	3.2	3	2	in freshwater and on-soil
Snake	85	1	1	in-soil and on-soil
Pelagic fish (minnow)	8	3	1	in freshwater
Bee	1.8	0.5	0.5	on-soil
Earthworm	9.5	0.4	0.4	in-soil

Non-human biota dose result

- The estimated maximum whole body absorbed dose rate to the Korean RAPs was 6.7E-7 mGy/d of a snake living in soil (terrestrial biota), and 2.0E-5 mGy/d of freshwater fish (aquatic biota): Fig.2

- The dose rates are far less than the generic dose criteria to protect biota from the ionizing radiation (1 mGy/d for terrestrial animals, and 10 mGy/d for terrestrial plants and aquatic biota)

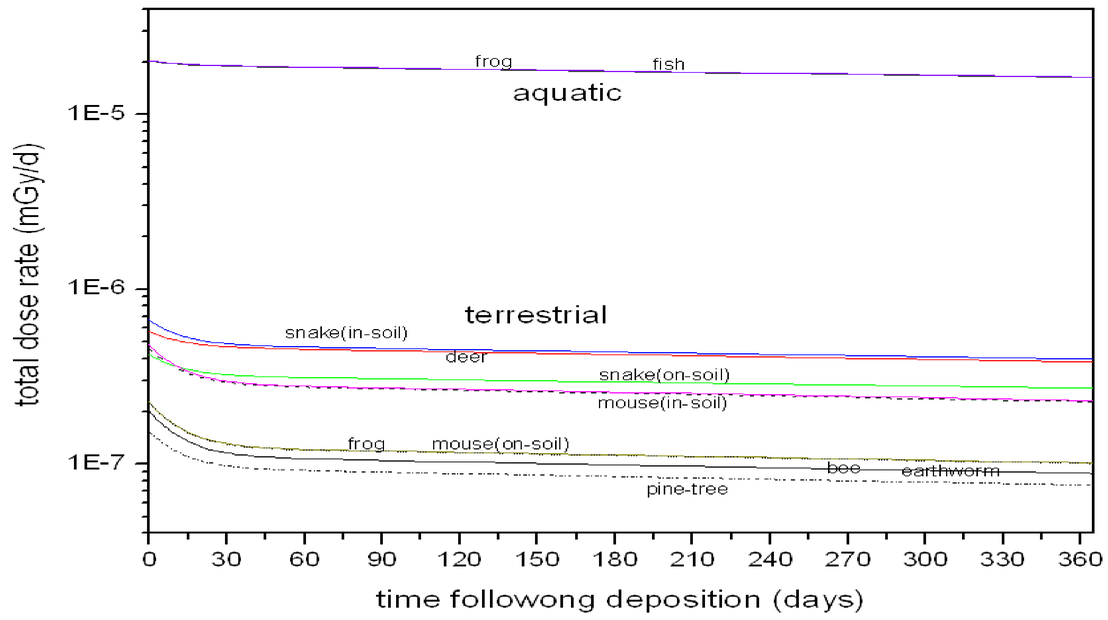

Fig.2 Time-dependent total absorbed dose rate to the Korean reference RAPs

Conclusion

- The risk to the public and biota in the republic of Korea of the radioactivity released due to the Fukushima nuclear accident could be considered negligible.

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