SUMMARY REPORT ON FUKUSHIMA ACCIDENT CONTAMINANTS IN CANADA

DECEMBER 2015

Canada

Health Canada is the federal department responsible for helping the people of Canada maintain and improve their health. We assess the safety of drugs and many consumer products, help improve the safety of food, and provide information to Canadians to help them make healthy decisions. We provide health services to First Nations people and to Inuit communities. We work with the provinces to ensure our health care system serves the needs of Canadians.

Également disponible en français sous le titre :
Sommaire du rapport sur les contaminants au Canada provenant de l'accident de Fukushima

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This publication can be made available in alternative formats upon request.

Publication date: December 2015

Cat.: H129-51/2015E-PDF
ISBN: 978-0-660-02798-2
Pub.: 150103

INTRODUCTION

On March 11, 2011, a 9.0 magnitude earthquake occurred near Honshu, Japan. This earthquake triggered a tsunami, which flooded over 500 square kilometers of land, resulted in the loss of more than 20,000 lives and destroyed property, infrastructure and the environment (United Nations Scientific Committee on the Effects of Atomic Radiation, 2013). The combination of the earthquake and tsunami also resulted in the loss of off-site and on-site electrical power at the Fukushima Daiichi Nuclear Power Plant (NPP). This loss of power compromised the plant's safety systems, and resulted in the worst nuclear disaster since the 1986 accident at the Chernobyl NPP. The accident resulted in significant releases of radioactive contaminants to the environment beginning March 12, 2011. The emissions caused substantial domestic concern in Japan and resulted in low but measureable levels of radioactive contaminants world-wide.

In Canada, the Radiation Protection Bureau (RPB) of Health Canada is responsible for promoting and protecting the health of Canadians by assessing and managing the risks posed by radiation exposure. To this end, the RPB has been monitoring environmental radioactivity on a routine basis since 1959. Health Canada currently operates multiple radioactivity monitoring networks, which represent over 100 detection and sampling stations located across Canada. These networks are extremely sensitive, and are able to detect even small changes in radionuclide concentrations in Canada.

Measurements from these networks confirmed that the quantities of radioactive material that reached Canada as a result of the Fukushima Daiichi nuclear accident were very small and did not pose a health risk to Canadians. In fact, the increases in radiation observed across the country were smaller than normal day-to-day fluctuations from background radiation. Background radiation is the constant natural radiation present in the environment, which includes: cosmic radiation, terrestrial irradiation from rocks and soils, and ingestion and inhalation of naturally-occurring radionuclides, with exposure to radon gas typically the largest component of natural background radiation. In Canada, individuals typically receive a background radiation dose between 2–3 millisieverts (mSv) per year, depending on location. In comparison, the dose resulting from exposure to radioactive material resulting from the Fukushima Daiichi accident was estimated to be less than 1% of the dose due to natural background radiation, approximately 0.004 mSv.

This report summarises Health Canada's monitoring and surveillance activities in the months following the Fukushima Daiichi accident, and describes the doses and risks to Canadians from the event. Further details are available in the Special Environmental Radioactivity in Canada Report on Fukushima Accident Contaminants: Technical Report (available upon request at: rpb-brp@hc-sc.gc.ca).

ENVIRONMENTAL MONITORING

The RPB of Health Canada currently operates:

- The Canadian Radiological Monitoring Network
  - Consists of 26 monitoring stations located across Canada.
  - Measures radiation in air and precipitation as well as background radiation.
- The Fixed Point Surveillance System (FPS)
  - Consists of 77 radiation detectors located across the country in major population centres, around Canadian NPP sites, and at other strategic locations.
  - Includes deployable stations to be used on an as-needed basis to augment this system.
  - Measures gamma radiation levels.
- The Canadian Comprehensive Nuclear Test Ban Treaty (CTBT) stations
  - Includes 4 stations for the daily measurement of airborne particulate, 2 stations for the daily measurement of radioactive noble gases and 1 test station in Ottawa, which measures both air particulate and noble gases.
  - Contributes to the global CTBT International Monitoring System (IMS).
- The National Data Centre
  - Provides analysis of air particulate and noble gas sample measurements from the Canadian CTBT and FPS stations and over 65 sites of the global CTBT IMS stations.

Immediately following the onset of the Fukushima Daiichi accident, sampling at Health Canada's radiation monitoring network stations was increased. Additional monitoring stations were deployed to British Columbia and the Yukon Territories. A small amount of radiation was first detected on Canada's west coast approximately one week after the start of the accident. Measurements of total external radiation showed no change beyond normal fluctuations in background radiation. However, Health Canada's monitoring networks are capable of detecting changes in individual radionuclide concentrations and were able to detect small increases in the concentrations of xenon-133 (^{133}Xe), iodine-131 (^{131}I), cesium-134 (^{134}Cs) and cesium-137 (^{137}Cs) in air as a result of the accident. The radiation levels in Canada resulting from the Fukushima Daiichi accident were so small that they were not a concern to public health.

ATMOSPHERIC DISPERSION AND DEPOSITION MODELLING

Prior to the detection of radiation in Canada from the Fukushima Daiichi accident, Health Canada staff were working in close collaboration with Environment Canada's Canadian Centre for Meteorological and Environmental Prediction (CCMEP). The atmospheric dispersion models operated by CCMEP were used to predict when and where radioactivity would arrive in Canada. These predictions corresponded with the measured arrival of radioactivity by the Health Canada monitoring networks. The CCMEP models were fine-tuned with the measured data and were then used to model air concentrations and ground deposition across Canada. This was particularly valuable for areas where no monitoring data was available.

FOOD MONITORING

From April 2011 to December 2012, over 500 imported and domestic food samples were measured at the RPB laboratories for radioactivity resulting from the Fukushima Daiichi accident. This included 159 samples from the 2012 Health Canada Food Basket Survey, which focused that year on food from British Columbia. No radioactivity resulting from the Fukushima Daiichi accident was measurable in these food basket samples. Additional fish and milk samples from British Columbia were measured, and again were found to contain no measurable radioactivity from the Fukushima Daiichi accident. The Canadian Food Inspection Agency (CFIA) provided 300 food samples from Japan for analysis. Of these, ^{137}Cs was only detected in 6 dried tea samples and 1 dried fish sample; however, these measurements were far below any international or domestic guidance values for radioactivity in food (HC, 2000; CODEX, 2011).

DOSE ASSESSMENT

Since small but measurable increases in radionuclide concentrations originating from the Fukushima Daiichi accident entered Canadian airspace, it is possible to estimate small incremental increases in radiation dose. Generally, there are 4 major pathways of exposure to radiation in the environment [Figure 1]:

(1) *Cloudshine* or external exposure to a cloud of radioactivity.

(2) *Groundshine* or external exposure to radioactivity deposited on the ground.

(3) *Inhalation* of airborne radionuclides.

(4) *Ingestion* of radionuclides by uptake through the food chain.

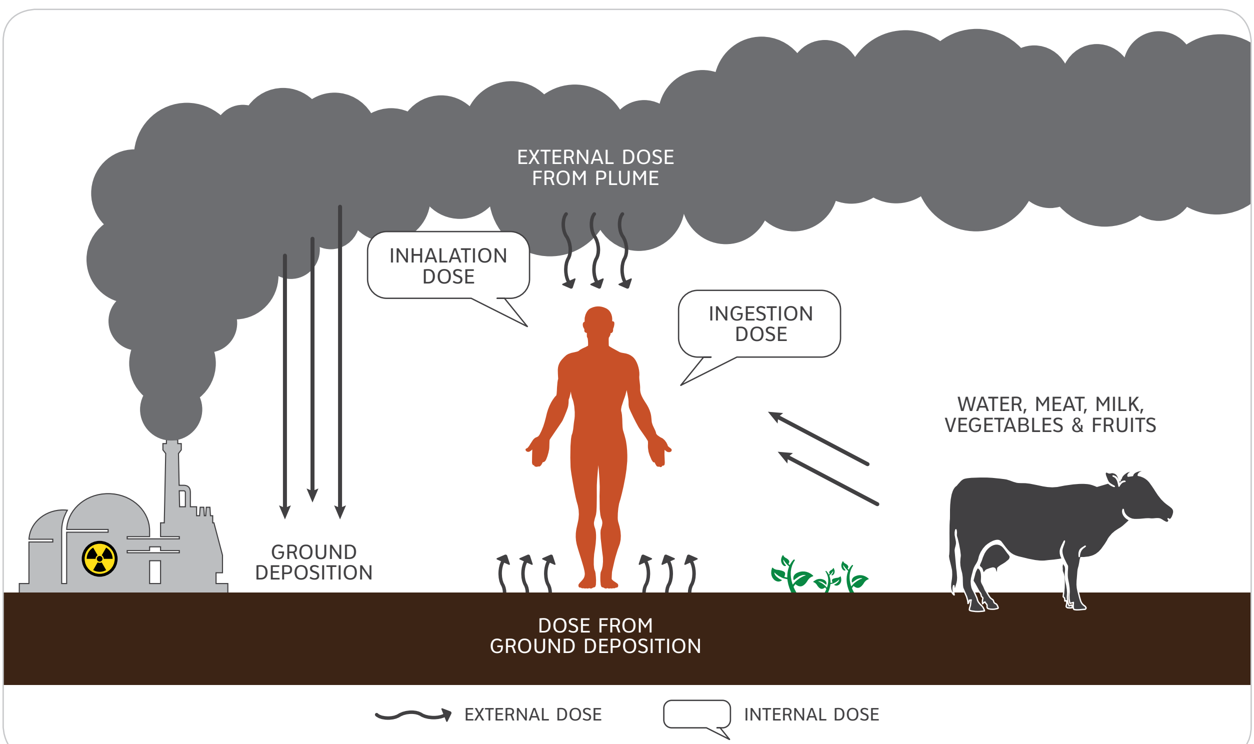

Figure 1: Possible pathways for exposure to radiation in the environment (Health Canada, 2014)

Doses were estimated for adults, 10-year-old children, and 1-year-old infants living at each Canadian monitoring station location. The International Commission on Radiological Protection (ICRP) recommends the use of these three age categories to characterise the radiological impact of an exposure and to ensure consideration of younger, more sensitive populations (ICRP, 2006). The measured air concentration and the modelled ground deposition data were used to calculate the dose assessment. It should be noted that there is a degree of uncertainty when completing this type of assessment; however, conservative values were used whenever possible to ensure a "worst-case" scenario estimate. The doses in Canada calculated for the first year following the Fukushima Daiichi accident were estimated to be 3.8–4.4 microsieverts (μSv) for an adult, 1.8–2.4 μSv for a 10-year-old child and 1.1–1.9 μSv to a 1-year-old infant. The maximum estimated dose of 4.4 μSv (0.0044 mSv) can be compared to the normal background radiation exposures to individuals living in Canada of 2–3 mSv per year [Figure 2]. There are no health impacts related to this incremental dose.

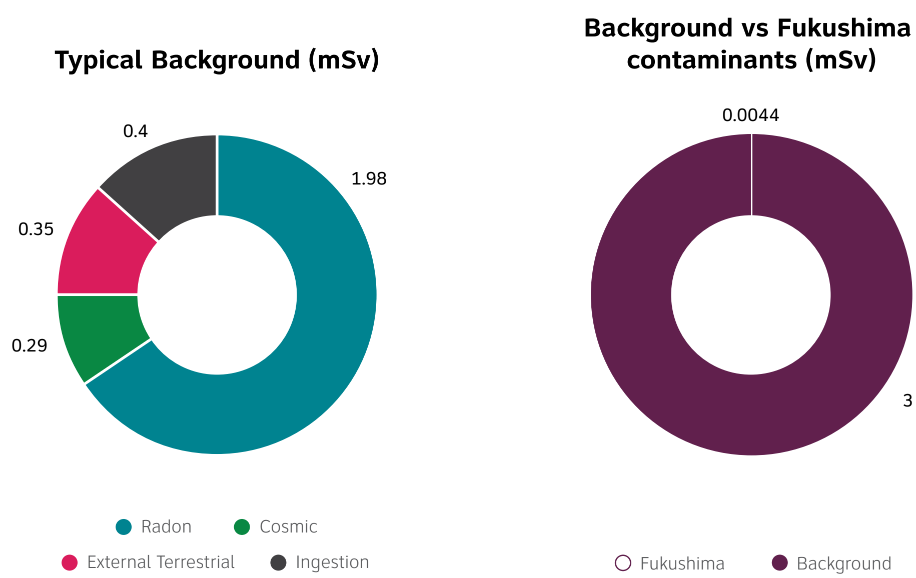

Figure 2: Typical background radiation dose in Canada compared to the dose resulting from the Fukushima Daiichi accident.

CONCLUSIONS

- The nuclear accident at the Fukushima Daiichi NPP in March 2011 was the worst since the 1986 accident at the Chernobyl NPP. It resulted in significant releases of radionuclides to the environment, which were of substantial concern in Japan and resulted in low but measurable levels of radioactive contaminants world-wide.
- Measurements from Health Canada's radioactivity monitoring networks confirmed that the quantities of radioactive material that reached Canada were very small and did not pose a health risk to Canadians.
- Measurements of total external radiation showed no change beyond normal fluctuations in background radiation; however, the networks were able to detect small increases in the levels of individual radionuclides.
- No radioactivity from the Fukushima Daiichi accident has been measured in domestically produced food samples measured by Health Canada.
- Of the 300 Japanese food samples provided by CFIA, only 7 had measurable levels of ^{137}Cs. These were all very low.
- Using the air concentrations measured by the Health Canada networks and the CCMEP modelled ground deposition, doses were estimated for adults, 10-year-old children, and infants at each monitoring station location in Canada. The highest dose resulting from the Fukushima Daiichi accident was estimated to be ~4 μSv (0.004 mSv). This small dose is negligible compared to the normal background radiation exposure to individuals living in Canada of 2–3 mSv per year. There are no anticipated health impacts related to this incremental dose.

Further details on the Health Canada's activities summarised in this document are available in the Special Environmental Radioactivity in Canada Report on Fukushima Accident Contaminants: Technical Report (available upon request at: rpb-brp@hc-sc.gc.ca). Additionally, detailed radioactivity measurements collected by Health Canada are available on the Government of Canada's Open Data Portal.

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