



Assessment of radiation exposure to the environment due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami

In the spring of 2014, The United Nations Scientific Committee on the Effects of Atomic Radiation, UNSCEAR, published a report on the levels and effects of radiation exposure due to the nuclear accident at the Fukushima-Daiichi plant that occurred in 2011. Scientists from the Norwegian Radiation Protection Authority were involved in this assessment and provided the lead on work concerning exposures to and effects upon wild-life arising from the extensive environmental contamination that arose from the accident. Although the assessment led to the conclusion that significant effects on populations of wildlife would not have been likely, controversy remains over the severity of impacts on the environment.

The accident at the Fukushima-Daiichi nuclear power station, FDNPS, on 11th March 2011, led to very significant releases of radioactive substances and was allocated the highest level 7 on the International Nuclear Event Scale. Estimates for atmospheric releases of radionuclides varied, for example falling in the ranges 6.1 - 62.5 PBq and 65 - 200 PBq for ^{137}Cs and ^{131}I respectively. The protection of human health was paramount, with an evacuation order to a radius of 20 km from the FDNPS being given on March 12th, 2011. In comparison, around 85 PBq ^{137}Cs and 1760 PBq ^{131}I were released following the Chernobyl accident in 1986.

On April 2nd 2014, The United Nations Scientific Committee on the Effects of Atomic Radiation, UNSCEAR, published a report entitled 'Levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami.' This report dealt with numerous aspects of the Fukushima Dai-ichi accident providing details on the chronology of the accident, the release, dispersion and deposition of radioactive contamination and doses to the public and to workers. A key conclusion in the report was that no discernible increased incidence of radiation-related



The front cover of UNSCEARs report available at the web address :

http://www.unscear.org/docs/reports/2013/13-85418_Report_2013_Annex_A.pdf

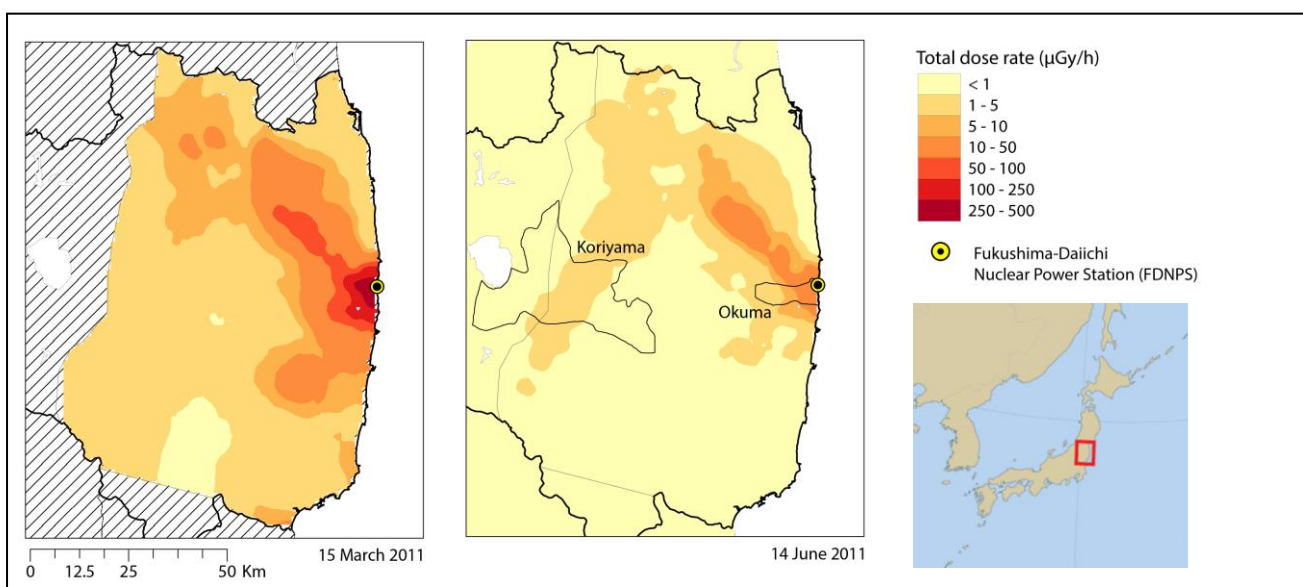
health effects are to be expected among exposed members of the public or their descendants. An important component of the assessment concerned the impacts of radiation on wild plants

and animals. Scientists from the Norwegian Radiation Protection Authority were asked by UNSCEAR to lead this part of the assessment and were tasked with forming a team of scientists to complete this work drawing upon international expertise. The link to the Centre of Excellence for Environmental Radioactivity, CERAD, was critical for efficacy.

Evidence from field studies

The UNSCEAR group undertook a review of published literature. They found that a few studies had reported effects in the field, such as reduced abundance of birds and insects and morphological

and genetic disturbances in butterflies. In these field studies, uncertainties with regard to dosimetry and possible confounding factors (including the impact of the tsunami itself) made it difficult to substantiate firm conclusions and some of the studies had been widely questioned by the scientific community. Furthermore, the main body of radiobiological data did not support the appearance of reported effects at the dose rates recorded in the publications. Most notably, in the study on butterflies, manifestation of similar effects under laboratory conditions required radiation exposures that were orders of magnitude higher than those observed in the field.



Conclusions from UNSCEAR’s wildlife impact assessment

The environmental assessment of the releases from Fukushima Dai-ichi conducted by UNSCEAR was split into two time periods – an intermediate phase encompassing the first two to three months following the accident and the late phase covering the periods after three months and extending to one year or so post-accident.

The Fukushima-Daiichi nuclear accident and subsequent radioactive releases into the environment led to estimated exposures for the intermediate phase that may have exceeded the corresponding (acute phase) benchmarks for some organisms such as macroalgae over a geographically constrained area and short periods. Although alterations to population integrity were deemed unlikely, it was considered possible that more subtle

effects at the individual level may have occurred for radiosensitive and/or sedentary species living in high deposition areas. Despite the highest exposures being calculated for the marine ecosystem, maximum doses estimated for the terrestrial environment were of the same order of magnitude.

For the late phase of the assessment, a potential risk to individuals of certain species, especially mammals over limited areas was considered possible. For example the best estimate of dose for deer/large mammals exceeded dose rate bands where some risk of harm might occur, by some margin. Nonetheless, despite large assessment uncertainties and lack of knowledge to predict long-term effects under realistic exposure situations, population effects were considered unlikely reflecting the limited nature of the elevated exposures in time and space.