

The development of Operational Intervention Levels (OILs) for Soils – A decision support tool in nuclear and radiological emergency response

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In the event of a large-scale nuclear accident, the swift implementation of response actions is imperative. For food and agriculture, it is important to restrict contaminated food from being produced or gathered, and to put in place systems to prevent contaminated produce from entering the food chain. Emergency tools and response protocols exist to assist food control and health authorities but they tend to focus on radioactivity concentrations in food products as a means of restricting the distribution and sale of contaminated produce. Few, if any, emergency tools or protocols focus on the food production environment, for example radioactivity concentrations in soils. Here we present the Operational Intervention Levels for Soils (OIL for Soils) concept, an optimization tool developed at the IAEA to facilitate agricultural decision making and to improve nuclear emergency preparedness and response capabilities.

Effective intervention relies on the prompt availability of radioactivity concentration data and the ability to implement countermeasures. Sampling in food and agriculture can be demanding because it may involve large areas and many sample types. In addition, there are finite resources available in terms of manpower and laboratory support. Consequently, there is a risk that timely decision making will be hindered and food safety compromised due to time taken to sample and analyse produce. However, the OILs for Soils concept developed based on experience in Japan can help in this situation and greatly assist authorities responsible for agricultural production.

OILs for Soils – pre-determined reference levels of air dose rates linked to radionuclide concentrations in soils – can be used to trigger response actions particularly important for agricultural and food protection. Key considerations in the development of the OILs for Soils are: (1) establishing a pragmatic sampling approach to prioritize and optimize available resources and data requirements for decision making in agricultural sites; (2) creating a system that is adaptable to different countries, and; (3) developing a framework to calculate default values of OILs for Soils for application during an emergency.

The OILs for Soils reference levels are calculated using a mathematical model. Empirical equations, paired with radionuclide data (e.g. Cs-134, Cs-137 and I-131) from the ICRU 53 report, are utilized to determine soil contamination from aerial monitoring air dose rate data. Modelling allows soil contamination values to be readily approximated and this is used to prioritize soil and food sampling sites. Reference levels are based on a model that considers radionuclide transfer factors for up-take into plants, soil density, and soil sampling depth. Decision actions for determined reference levels are suggested for processed foods, animal products, animal feed and crop products (including plants at the growing stage, mature stage, fallow farmland, and forestry products). With these steps, OILs for Soils provide practical guidance that will equip authorities to respond efficiently and help maintain the safety of the food supply during large-scale nuclear or radiological emergency situations.