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AN INNOVATIVE SYSTEM FOR MONITORING RADIONUCLIDES IN FOOD AND AGRICULTURE PRODUCTION

Given the growing number of nuclear power plants and nuclear power stations being built, the aging of existing ones, and the nuclear incidents that have occurred in the past, the improvement of nuclear emergency preparedness and response in food and agriculture has never been more necessary and urgent.

A nuclear incident often leads to disarray, and may have long-term consequences for people, trade and the economy.

In fact, these events can also release significant quantities of radioactive material into the environment that makes water, local produce, milk from grazing animals and other foods unsafe for consumption, thus representing a threat to human health, agricultural production and socio-economic development.

Lessons learned from previous power plant accidents have identified critical areas for improvement – including data sampling and analysis, data management, and data visualization for swift decision-making – which would allow food control and health authorities to respond and disseminate information to all relevant stakeholders on a timely basis. In addition, these improvements form the basis of an effective emergency response system that can protect the food chain and water supply systems and prevent the consumption of contaminated foods.

The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has developed the Decision Support System for Nuclear Emergencies Affecting Food and Agriculture (DSS4NAFA), a cloud-based Information Technology (IT) decision support system with improved capacity to manage large volumes of spatial and temporal data, real-time information processing and visualization, and provide enhanced aid to response actions and decision-making.

A DECISION SUPPORT SYSTEM TO RESPOND TO NUCLEAR EMERGENCIES AFFECTING FOOD AND AGRICULTURE

Past nuclear incidents released radionuclides into the environment, affecting rural communities and agricultural production areas and posing a high risk of contaminated agricultural products entering the food supply chain. In such circumstances, the co-ordination and implementation of relevant procedures and response mechanisms are complex and tedious due to the large areas, the plurality of crop types, the presence of water bodies, and the variety of soils concerned, in addition to the involvement of different branches of government and multiple organizations.

The challenge is therefore multifaceted. It calls for timely delineation of the relevant areas and a swift response to prevent affected produce from

KEY FACTS

DSS4NAFA

NUCLEAR AND RADIOLOGICAL EMERGENCIES MAY RESULT IN RADIONUCLIDES BEING RELEASED INTO THE ENVIRONMENT, AFFECTING FOOD PRODUCTION AND SAFETY

A MAJOR CHALLENGE ARISING IN NUCLEAR EMERGENCIES IN AGRICULTURE IS THE LARGE VOLUME OF SPATIAL AND TEMPORAL INFORMATION TO BE HANDLED AND PROCESSED

FAO AND IAEA JOINTLY DEVELOPED DSS4NAFA TO SUPPORT INTEGRATED DECISION-MAKING THROUGH REAL-TIME INFORMATION PROCESSING AND VISUALIZATION

DSS4NAFA IS AN ONLINE INFORMATION SYSTEM THAT COLLECTS, MANAGES AND VISUALIZES DATA GENERATED DURING EMERGENCY RESPONSES AND ROUTINE MONITORING

DSS4NAFA IS CURRENTLY BEING TESTED AND ADJUSTED FOR BELGIUM

IAEA/ FAO-DSS4NAFA

E-MAIL

Food-Chain-Crisis@fao.org

NAFA.Soil-and-Water-Management-Section-Contact-point@iaea.org

WEBSITES

www.fao.org/food-chain-crisis

https://youtu.be/Ut4GzjKabMc

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reaching the consumer. This requires monitoring the evolving spatial and temporal distribution of radionuclides, supplying up-to-date information to decision-makers, ensuring coordination among response organizations and effectively communicating intervention plans.

DSS4NAFA is designed to optimize the collection, management and visualization of agriculture-related data during the response process. The system is also designed to link decision-makers with field officers and analytical laboratories.

DSS4NAFA contains modules that help public authorities determine sampling locations and assign sampling, in-situ or laboratory analysis tasks using crop calendars and land use maps, on the basis of standardized protocols.

In addition, upon obtaining data on radionuclide concentration in soil and food, the DSS4NAFA restriction dashboard suggests food and planting restrictions based on the level of risk and specified tolerance levels.

Some of the functionalities of the modules are listed below:

Data management:

- Standardized data input
- Data are stored within one server
- All data collected in the field are sent directly to the server

Data visualization:

- Geo-referenced and time-stamped data visualization, for understanding of the situation of radioactive contamination on the ground
- "Logmap" for at-a-glance sampling and analyses status
- Comprehensive information is intuitively displayed on the dashboard

Logistics and decision support:

- Sampling or in-situ measurement assignments
- Food and planting restrictions

The features of DSS4NAFA

The specific feature that sets DSS4NAFA apart from other similar systems is that it uses mobile tools and advanced geographic visualization to overcome the logistical challenges encountered in a nuclear emergency.

The system's platform is accessible from the field through a mobile application or the office via a desktop interface, allowing for streamlined uge and communications. In addition, it has a user-friendly data analysis component that visualizes the decision support options that decision-makers may consider as response actions. The combination of these functionalities brings together all stakeholders in the process and fosters robust emergency response capabilities.

DSS4NAFA is built in a modular way, including several IT components that are integrated but can be exchanged separately, making the system flexible and adaptable. While it was originally developed as a system for nuclear emergency response management and communication, its ability to discern data quality, provide user-friendly geographic and time-stamped visualizations for decision-makers, and support the production of communication materials makes it a credible candidate tool for natural hazard risk mitigation.

The beta version of DSS4NAFA, which was released in late 2018, was developed through public-private partnerships and in collaboration with nuclear research centres, ministries of agriculture, and national atomic energy agencies from ten Member States, as well as European Commission research institutes. Outreach materials (videos, interviews and articles) have been prepared for disseminating knowledge on efficient preparedness for and response to radiological emergencies in food and agriculture.

Thanks to an extrabudgetary contribution provided by the Belgian Federal Agency for Nuclear Control, in 2019, the DSS4NAFA system is being customized and adjusted for further testing in Belgium.

Future work that is also envisaged to serve Member States will consist in developing modules complementary to DSS4NAFA on the remediation of radioactive contamination in agriculture and rolling out pilot tests in other Member States.

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