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Contaminated Land Remediation on decommissioned nuclear facilities: an optimized approach

Emilie SAUER

EDF CIDEN, 154 avenue Thiers, 69009 Lyon, France

emilie.sauer@edf.fr

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INTRODUCTION

The site of the Monts d'Arrée located in Brennilis in the area of Brittany in France is a former 70 MWe heavy water reactor. EDF is now in charge of its decommissioning. The effluent treatment facility (STE) is currently being dismantled. As the future use of the site will exclude any nuclear activity, EDF is taking site release into consideration. Therefore a land management strategy for the land and soil is needed. An optimized approach is being proposed for the STE, to the French Regulator.

NUCLEAR OPERATORS' APPROACH

In France, there is no specific regulation related to contaminated land (either radiologically contaminated or chemically contaminated). The French Nuclear Safety Authority's doctrine for radioactively contaminated land is a reference approach which involves complete clean-up, removing any trace of artificial radioactivity in the ground. If technical difficulties are encountered or the quantity of radioactive waste produced is too voluminous, an optimised clean-up can be implemented.

EDF has been engaged since 2008 in drawing up a common guideline [1] with other French nuclear operators (CEA and AREVA). The operators' guideline proposed the first steps to define how to optimise nuclear waste and to carry out a cost-benefits analysis. This is in accordance with the IAEA's prescriptions [2].

THE EFFLUENTS TREATMENT FACILITY (STE)

Historically, various incidents involving effluent drum spills caused radiological contamination in the building platform and the underlying soil. While conducting the decontamination works in 2004/2005, it was impossible to remove all contamination (that went deeper than expected).

FIG.1: THE BRENNILIS EFFLUENTS TREATMENT FACILITY BEING DISMANTLED

FIG.2: BOREHOLES IN THE TREATMENT FACILITY

A large characterization campaign was carried out in order to map the contamination. For the site investigation, 34 boreholes were drilled from 2 to 5 m under the building platform and 98 samples were analyzed to search for gamma, beta and alpha emitters.

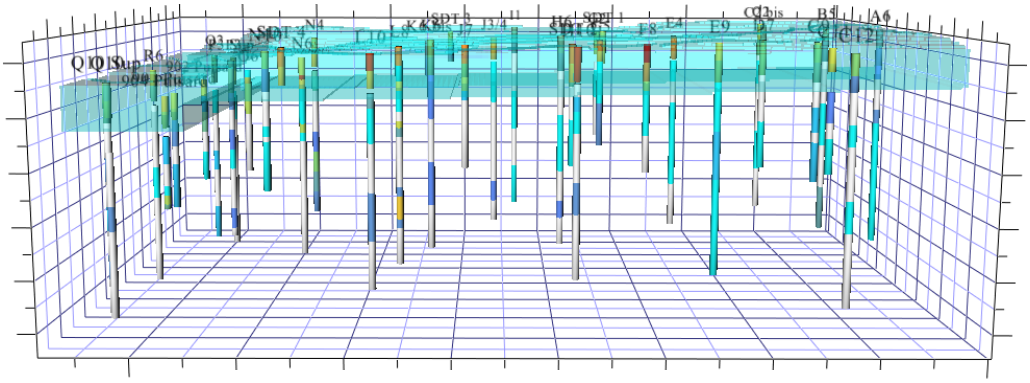

FIG.3: 3D-MAP OF THE SOILS STE SAMPLING

With the results, the contamination was mapped using a geostatistical approach developed by Géovariances™. Main results were :

- Soils are contaminated by low activities of ^{137}Cs (0,26 Bq/g median activity), diffused and unstructured in the zone,
- Two layers have a specifically higher activity, but remain low : the 0/50 cm layer under the platform (0,69 Bq/kg ^{137}Cs) and the 3m/3m50 layer (0,58 Bq/g ^{137}Cs)
- The platform source term represents 80% of the global Source Term (platform+ soils)

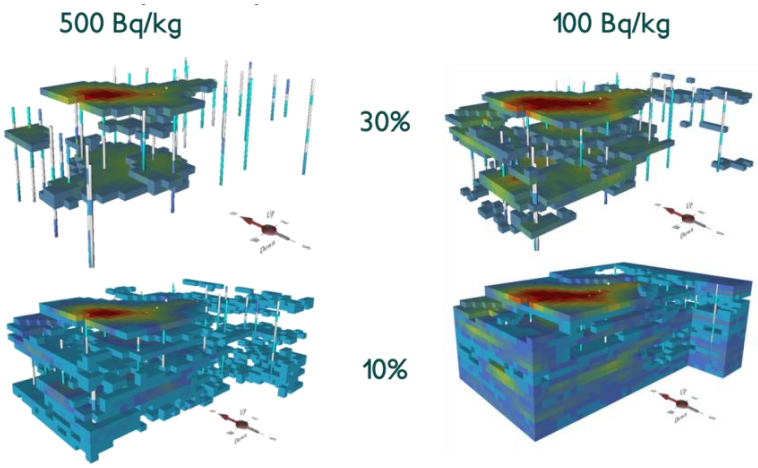

FIG.4 : MAP OF THE 137CS ACTIVITY IN SOILS OBTAINED WITH THE GEOSTATISTIC APPROACH

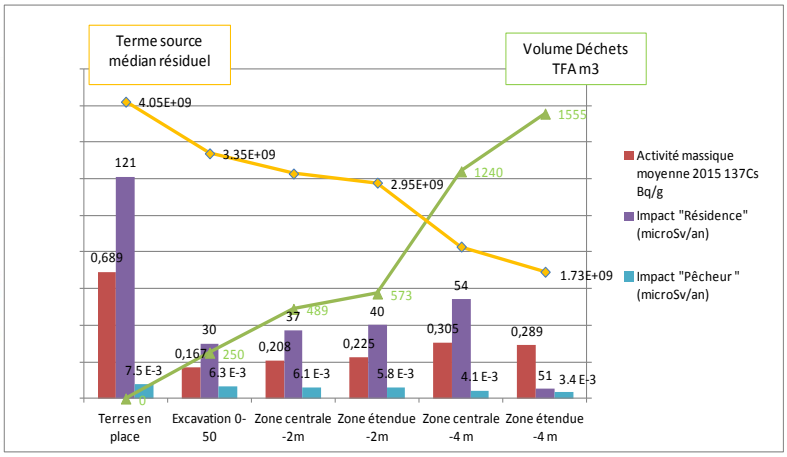

FIG.5 : OPTIMIZATION CURVES

The reference approach of the French Nuclear Authority (i.e. removing any artificial activity) is disproportionate here to the risks (10 00 m^3 of low level waste of soils would be produced). An optimized approach is being proposed. EDF demonstrated compliance between the land and all foreseeable uses, with an impact of the soil activities of 8 10^{-3} µSv/y for a realistic use (fisherman in the river close to the nuclear site).

The spatial distribution of the source term brought EDF to establish a technical and economical strategy. It involved optimizing soil excavations (only the first 0/50 cm layer of soils) to reduce the source term as far as reasonably achievable, taking into account technical difficulties, quantities of low level waste produced, sustainable management and workers' safety.

Conclusion

If accepted by the French Regulator, this approach would reduce significantly radiological waste production and set an example for the other EDF nuclear licensed sites undergoing decommissioning.

1. CEA – EDF – AREVA, 2010, "Guide inter-exploitants – Réhabilitation des sols d'une installation nucléaire de base", Marcoule-Lyon-Paris
2. IAEA, 2006, "Release of Sites from Regulatory Control on Termination of Practices", Safety Guide n°WS-G-5.1, Vienna.