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► To cite this version:

Aislinn Boylan, Sophie Le Caër, Fanny Buhler-Varenne, Daniel Ortiz, Laure Menin, et al.. Investigating the biodegradation of organic compounds released from irradiated ion exchange resins under deep geological repository relevant conditions. Goldschmidt 2019, Aug 2019, Barcelona, Spain. cea-02419346

HAL Id: cea-02419346

<https://cea.hal.science/cea-02419346>

Submitted on 19 Dec 2019

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Investigating the biodegradation of organic compounds released from irradiated ion exchange resins under deep geological repository relevant conditions.

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Ion exchange resins are used extensively in the capture of radioactive material at nuclear power plants, accounting for ~ 40% of the organic nuclear waste inventory in Switzerland [1]. These wastes will be stored in deep geological repositories and subjected to radiation doses over very long timescales. Under these conditions, resins may release organic compounds into the aqueous phase within a repository. A series of anoxic experiments were performed on resins subjected to high irradiation doses (200 kGy) using a cobalt gamma source. The results show that, in the gas phase, the primary constituents are H₂ and CO₂ with benzene and chloromethane detected. In the aqueous phase, ammonia and trimethylamine were measured. Geochemical, microbiological and spectroscopic analyses were undertaken to determine the extent of biodegradation of these compounds by the deep subsurface microorganisms present in Opalinus Clay porewater (Mont Terri Underground Research Laboratory, Switzerland) and to consider the implications of these processes occurring in a repository environment.

[1] Diomidis, N., et al.,(2016) Technical Report 16-03, Nagra.