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Time: 3:00 to 4:00 PM
Refreshments: 2:30 to 3:00
Room: Wilsdorf 101

"CORROSION OF NUCLEAR FUEL INSIDE A FAILED WASTE CONTAINER"

ABSTRACT:

Containers for the storage and disposal of high level nuclear waste (used fuel) are designed to resist failure until radiotoxicity levels have decayed to innocuous levels. Regulatory release limits make it necessary to achieve containment for thousands to tens of thousands of years. Such reassurances are hard to give making it judicious to study the consequences of container failure on the corrosion of the fuel and the release of long-lived radionuclides.

The primary oxidant driving fuel corrosion will be the oxidizing products of water radiolysis, making the decay of radiation fields the essential template upon which corrosion models must be developed. The other key issue in model development is the chemical state of the fuel on discharge from reactor. Depending on the extent of in-reactor burn-up the originally well-ordered UO_2 fluorite lattice will be rare earth-doped, locally non-stoichiometric, and interspersed with secondary phase oxide and metal alloy particles, making its corrosion behaviour complex.

This presentation will summarize the key properties of the fuel, briefly describe the mixed potential model developed to predict fuel behaviour, and discuss, in more detail two key issues: (i) the influence on corrosion of non-stoichiometry; and (ii) the effect of hydrogen, produced by corrosion of the steel liner in the container, on fuel corrosion. The presence of non-stoichiometry significantly changes the local UO_2 structure. We have determined the influence of fuel structure on corrosion rate using a combination of microRaman spectroscopy and scanning electrochemical microscopy. The suppression of corrosion by dissolved hydrogen has been mapped using a combination of electrochemical techniques and X-ray photoelectron spectroscopy.

BIO:

David Shoesmith is a Professor in the Department of Chemistry at the University of Western Ontario (London, ON, Canada) and specializes in research on the electrochemistry, surface analysis and corrosion of materials. He has held this

appointment since June 1, 1998, and is the Canadian Natural Sciences and Engineering Research Council and Nuclear Waste Management Organization (NSERC/NWMO) Industrial Research Chair holder in Nuclear Fuel Disposal Chemistry (since November 2000). Initially a five year appointment, this chair was renewed for a further five years in November 2005.

Previously, he worked for Atomic Energy of Canada Ltd for 25 years, achieving the rank of principal scientist. Since 1980 he has been an active researcher in the Canadian Nuclear Waste Disposal Program, and is a recognized international expert on waste form and waste container issues. He is an elected fellow of the National Association of Corrosion Engineers (NACE International) (1996) and the Canadian Society for Chemistry (1985).He has won awards from the Electrochemical Society (Lash Miller), the Canadian Society for Chemistry, the Canadian Institute of Mining and Metallurgy (Cohen Award), Atomic Energy of Canada (Discovery Award), and a University of Western Ontario Distinguished Professorship. He is currently funded by waste management organizations in Canada, Sweden and Switzerland. He has served on program review boards in Switzerland, USA and France, and as a consultant on corrosion issues for many nuclear and non-nuclear companies. He has written over 350 publications, 210 of which are in refereed journals and conference proceedings.