

## A Simple Model for Salting In or Out in Reactor Conditions

Martin Bachet<sup>1, S, C</sup> and Iain Duncanson<sup>2</sup>

<sup>1</sup>*EDF R&D, Moret-Sur-Loing, France*

<sup>2</sup>*Electric Power Research Institute, Charlotte, NC, U.S.A.*  
*martin.bachet@edf.fr*

Water in nuclear reactors circuits has stringent requirements on purity levels. Despite that, in some specific local conditions, boiling can concentrate non-volatile impurities and generate concentrated solutions. It has long been recognized that electrolyte addition to an aqueous solution influences the solubility of neutral solutes. This effect, called salting-out when the solubility decreases (the less frequent opposite is called salting-in) is not related to the formation of new species, but must be reflected in the activity coefficient of the neutral solute. The Sechenow relation, stating that the logarithm of this activity coefficient is proportional to the salt concentration, usually holds.

Different theories have been proposed to explain the salting out effect. In this work we focus on one of these theories, that of McDevit and Long, and show how it can be applied for neutral solutes activity coefficient calculations. There are two terms in the McDevit-Long theory that are specific to the neutral solute: its partial molar volume at infinite dilution and a scaling factor. The former can be calculated with the Akinfiev and Diamond (A&D) 3-parameter equation. Since these parameters have been tabulated for several substances, only the scaling coefficient is needed to be able to calculate the salting coefficient over a very large range of conditions.

We compare the values obtained by combining the McDevit-Long theory with the A&D equation to experimental data from the literature and show generally good agreement, with a single adjustable parameter.