

POTENTIAL-pH DIAGRAMS FOR ALLOY-WATER SYSTEMS UNDER LWR CONDITION

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Objectives: To calculate from thermodynamic data the regions of oxide compound stability (Pourbaix diagrams) for the water-Fe-Cr-Ni system at room temperature and at typical LWR temperature. Diagrams for Fe-Cr-water, Fe-Ni-water, and Cr-Ni-water systems are also given.

Comments: Potential-pH or Pourbaix diagrams present the regions of stability of metallic species with water. They indicate the areas of potential and pH in which the dissolved species, the metal oxides, or the metal itself is stable. Regions for stable dissolved species are ones in which the metal can undergo corrosion. Where the metal itself is the stable form, the region is one of immunity. In the regions where the metal oxide is stable, the oxide can form on the metal as a protective layer.

Remarks/Potential for dose limitation: Corrosion of the PWR or BWR infrastructure contribute greatly to the overall radiation level. Controlling the pH of the primary water coolant is one method for reducing corrosion of metal surfaces. Pourbaix diagrams can contribute to this effort by identifying the ideal pH for metal or metal oxide stability.

References: Cubicciotti, D., "Potential-pH diagrams for alloy-water systems under LWR conditions," *Journal of Nuclear Materials*, Vol. 201, p. 176-183, 1993.

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