**301e Inl Sbw Steam Reforming Model**

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Steam reforming has been evaluated over the years for treatment of various radioactive wastes throughout the DOE complex. Recently, steam reforming has been considered for solidification of radioactive acidic aqueous sodium-bearing waste (SBW) stored at the Idaho National Laboratory (INL). This waste was generated over several years from activities associated with the reprocessing of spent nuclear fuel. In April of this year, a contract was awarded to build a steam reforming waste treatment facility at the INL.

To assist in evaluating the feasibility of treating SBW via steam reforming, a steady-state ASPEN™ Plus simulation was developed and used to perform material and energy balance calculations. Development of the model was challenging due to the large number of chemical species present in the waste. In order to reduce model complexity and computer run time requirements, minor species were grouped together based on valence and represented as a single representative chemical species in the model. The steam reformer itself was simulated using ASPEN™'s stoichiometric reactor model. By using this approach, fractional conversion for each reaction could be easily tuned to match pilot-scale test results. In order to accurately predict emissions from the facility, ASPEN™'s Electrolyte Non-Random Two-Liquid (ENRTL) physical property method was selected for aqueous portions of the model such as the off-gas scrubber.

When the model was originally developed, only a limited amount of data was available from lab-scale steam reforming experiments. Hence, the model was used extensively to define a suitable process configuration, especially in regard to off-gas treatment needs. The model was subsequently refined and tuned based on experimental results. The model has been used to accomplish the following objectives:

- Provide detailed material and energy balances for the proposed process configuration;
- Predict emissions from the facility (CO, NOx, Cl, Hg, PM, etc.);
- Provide sizing information required to fabricate and assemble the steam reforming pilot plant;
- Provide sizing information needed to assemble a preliminary equipment list and cost estimate for the full-scale facility;
- Assess potential operational problems such as corrosion and plugging.

Due to the complex nature of the chemistry associated with steam reforming of SBW, some simplifications were required in developing this simulation. Nonetheless, the resulting model has proved to be a valuable tool for process design.