

Acid Side Solvent Extraction

The basic principle of solvent extraction (liquid-liquid extraction) is to use a sparingly soluble diluent material that carries an extractant that will complex with cesium ions in an acid solution. The separated cesium can then be stripped back into an aqueous phase ready for transfer to DWPF. The solvent is contacted in a countercurrent fashion with the acidic waste solution (in the Extraction Stages). Following cesium extraction, the diluent is scrubbed with dilute caustic to remove other salts from the solvent stream (in the Scrub Stages). The solvent is then contacted in a countercurrent flow with a concentrated acid stream to transfer the cesium to the acid stream (in the Strip Stages). The solvent will then need to be scrubbed or purged to remove degradation products prior to recycling to the front of the process. The other two resultant streams are a raffinate stream depleted of cesium and a strip effluent containing the separated cesium ions.

The proposed process has the following characteristics: a) the feed solution will be clarified prior to solvent extraction, probably through a filtration process that returns the solid phase to the Tank Farm, b) acidification of the waste will result in significant NO_x production, c) 3 extraction stages, 1 scrub stage and 3 strip stages using an appropriate diluent (e.g., Nitrobenzene) and extractant (e.g., cobalt dicarbolyde), d) the raffinate stream will likely contain at least trace concentrations of both the organic solvent and its degradation products, these organics may require removal to meet Saltstone feed requirements, e) an additional Hg removal stage would be required for some tank wastes, f) the use of large quantities of acid to strip the diluent may result in a redox imbalance in the melter requiring additional chemicals, g) the solvent extraction process may not remove actinides, in which case the addition of monosodium titanate to the waste prior to filtration could be employed.

Variations:

- 1) Calicorene crown ether is an alternate extractant
- 2) Replace MST with phosphine oxide extractant

Merits:

- 1) Full scale radioactive operations in Russia (cobalt dicarbolyde)
- 2) Reduced volume of glass based on potassium going to Saltstone

3) Potential use of existing solvent extraction canyons

