Disposal of LLW and GTCC in Salt Mines
Information Summary

I. CURRENT STATUS IN U.S.

A. Commercial Low-Level Waste (LLW) Disposal

10 CFR 61 provides "Licensing Requirements for Land Disposal of Radioactive Waste." The regulation provides specific technical requirements for "near-surface disposal" (i.e. radioactive waste is disposed of in or within the upper 30 meters of the earth's surface), and also provides procedural requirements and performance objectives applicable to any method of land disposal.

Currently, all proposed and operating LLW disposal sites are regulated by Agreement States. They are all near-surface disposal facilities. The operating facilities are the U.S. Ecology site in Hanford, Washington; the Chem-Nuclear facility in Barnwell, South Carolina; and the Envirocare facility in Clive, Utah. In addition, Texas is currently reviewing an application to operate a near-surface low-level radioactive waste disposal facility in Andrews County. Salt is not the medium for disposal at any of these sites.

Staff has considered technical requirements for alternative methods for LLW disposal including Mined Cavity disposal (NUREG/CR-3774, Volume 6). This report looked at mined cavity disposal in general, and did not specifically examine salt mines.

The Department of Energy also operates low-level radioactive waste disposal sites for waste generated from defense activities. None of these facilities uses salt as the disposal medium.

B. Greater-Than-Class-C (GTCC) Disposal

The U.S. Department of Energy (DOE) is preparing to develop an Environmental Impact Statement (EIS) to address disposal of GTCC waste (see SECY 05-0104). According to DOE's Advance Notice of Intent, the EIS will evaluate alternative locations and methods for disposal of these wastes, including deep geologic disposal (70 FR 24775). Currently, there are no domestic GTCC disposal facilities.

C. Salt Mine Disposal of Radioactive Waste

The DOE is currently disposing of transuranic waste (TRU) in a deep geologic disposal site made up of salt beds. The Waste Isolation Pilot Plant (WIPP) in New Mexico is regulated by the U.S. Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act (RCRA), and disposal there is limited to DOE defense related waste. (For more information see http://www.wipp.ws/index.htm, or "Nuclear Reactions," Chuck McCutcheon, University of New Mexico Press, 2002.)

One of the bases for the WIPP project was a study the National Academy of Sciences (NAS) completed in 1957 on "Disposal of Radioactive Waste in Salt Cavities." Following the NAS study, an underground salt bed near Lyons, Kansas was investigated for use as a repository, but was later abandoned due to technical concerns and public misgivings.

II. CURRENT STATUS - INTERNATIONAL

A. Low-Level Waste Disposal in Salt Mines

1. Germany[1]
   a. Disposed of low- and medium-level radioactive waste[2] on an experimental basis in a salt dome (the ASSE research mine) until the end of 1978.
   b. Began exploration of a salt dome at Gorleben to determine whether it is suitable for the disposal of radioactive waste, including high-level waste. The exploration began in 1986, and was interrupted in 2000 to clarify conceptual and safety-related issues regarding disposal.
   c. Disposed of low- and medium-level radioactive waste from 1986 until 1998 in a salt mine at Morsleben.

2. Netherlands[3, 4]
   a. Focused research into final disposal of primarily high-level waste in rock salt formations from 1984-1992. Concluded that final disposal in rock salt was technically feasible and in all probability could be achieved safely.
   b. Later added "retrievability"criterion; but continued to study rock salt formations among other disposal options.

3. From a quick internet and literature search, it appears that South Africa, Spain, Japan and the Ukraine may also be considering salt bed disposal of radioactive waste; however, no details are available.

III. TECHNICAL ADVANTAGES AND DISADVANTAGES OF RADIOACTIVE WASTE DISPOSAL IN SALT

A. Potential Advantages
   1. Rock salt can creep or collapse around wastes to naturally seal them off.
   2. Includes natural advantages of deep geologic disposal (isolation, shielding, etc.).
   3. Salt tends to be impervious to the passage of water, resulting in a dry environment.

B. Potential Disadvantages
   1. Water seepage could corrode waste drums and result in waste transport. Note that some of the experimental salt mine spaces in Germany have flooded.
   2. Wastes may need pre-treatment to modify chemical and physical properties for salt disposal.
   3. In some cases, underground cracks and ceiling collapses have occurred at a faster rate than anticipated.

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[1] Google search, http://www.nrg-nl.com/product/re/radwaste/policy/; accuracy of information not validated.

[2] Note that other countries' classification systems for low-level waste differ from ours; however, for the purposes of this summary, they are sufficiently similar.

[3] "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste: Report of the Federal Republic of Germany for the First Review Meeting in November 2003"; accuracy of information considered high.

[4] Http://www.nitg.tno.nl/eng/pubrels/infor_mation/nr8art4.pdf; accuracy not verifiable.