Orange oxide must meet rigid specifications for nuclear purposes. Impurities are measured in parts per million, and analysis at this low range is accomplished by spectrographic methods. The spectrographic laboratory at Port Hope carries out these analyses on a routine basis.

Acid Recovery

The aqueous slurry removed from the bottom of the first extraction column contains excess nitric acid and metal nitrates from which nitric acid can be recovered and re-used in the digestion process.

The waste aqueous slurry from the first column is pumped to storage tanks and a small amount of sulphuric acid is added to "spring" the acid from the metal nitrates. This solution is then evaporated under vacuum and the nitric acid, combined with water, is flashed into a distillation column where the acid is concentrated. From the bottom of the column nitric acid of approximately 50% strength is pumped to storage. The water vapor, originally associated with the acid, is drawn from the top of the concentrator and condensed.

In addition to the acid recovery from the slurry, all gases released during digestion and thermal decomposition of uranyl nitrate are collected and passed through an absorber. These gases consist mainly of the oxides of nitrogen which are absorbed in water to form nitric acid. The absorber operates on the principle of a bubble cap column, in which gases are introduced at the bottom and water at the top. By intimate contact with the water, the gases are converted to nitric acid, and the acid so produced is pumped from the bottom of the column to storage.

Approximately 80% of the acid contained in waste products is recovered for re-use in the digestion circuit.

Tailings Disposal

The raffinate slurry from which the nitric acid has been removed is neutralized with lime to reduce excess acidity and this mixture is then filtered.

The filtrate or water is directed to the lake and meets all specifications for disposal into international waters.

The solids from the filter, in the form of a filter cake, are discharged into a bin. The bin is in turn discharged to dump trucks and the residues are transported to a remote residue area.

Samples are obtained from both the aqueous waste and solid residue for the purpose of accountability. It will be interesting to note that a recovery of uranium in excess of 99.5% is accomplished in the solvent extraction process.

Ceramic Oxide—UO_2

Over the past three years the company has been conducting research on the production of a ceramic grade uranium dioxide, and is now marketing a product which fulfils the requirements of sound, high density pellets for power reactor projects.

The starting product is a partially concentrated uranyl nitrate which is precipitated with ammonia, to form ammonium diuranate (A.D.U.).

The A.D.U. is dried and subsequently reduced to UO_2 by means of hydrogen (cracked ammonia) gas.

Conditions during precipitation are carefully controlled to regulate particle size to ensure a final product of maximum density.

The reduction cycle is also precise in order to produce a UO_2 which will press and sinter, under a given set of conditions, to form sound pellets with a density range of 10.3 to 10.5.