

The thickener underflow containing ore ground to minus 85 mesh and containing three parts of solids to two parts of water was fed to the leach agitators. Sulphuric acid was added by automatic control to maintain acidity within a narrow range. Excessive acidity will waste acid while insufficient acidity will cause poor recovery.

An oxidizing agent was added to oxidize the ferrous iron in solution to ferric iron. The ferric iron in turn will oxidize the uranium oxide in solution to ferric uranium oxide which is insoluble as a uranyl sulphate. Ferric minerals dissolve in the leach solutions and tend to combine with uranium to insoluble compounds. It was necessary to maintain sufficient ferric iron to render the uranium inactive by complexing.

The leach agitators were of conventional air-lift type as used in gold mining except that rubber-lined cells were used. The leach solution volume of the agitators was such that the ore was leached for 24 hours. The leached slurry was fed to a vacuum-type vacuum filter equipped with stator-type discharge.

The filtrate was further clarified and pumped to the surge tank ahead of the precipitation circuit. The filtrate was then pumped to the surge tank ahead of the precipitation circuit. The filtrate was then pumped to the surge tank ahead of the precipitation circuit. The filtrate was then pumped to the surge tank ahead of the precipitation circuit.

Uranium was recovered from the leach solution by solvent extraction. This process consisted of mixing the uranium bearing solution intimately with a ketone solution of triethylamine. The latter organic compound combined with the uranium and the ketone solution was then allowed to separate. The organic phase was allowed to separate and the uranium was then extracted with an aqueous solution which re-extracted the uranium as a concentrated solution. The final step in recovery was the precipitation of uranium as uranyl carbonate and packed in drums.

The Port Radium "yellowcake" was exceptionally pure, containing 84% U<sub>3</sub>O<sub>8</sub> and only very small amounts of thorium and other impurities which are objectionable to refining. The solvent extraction process was a recent (1938) addition to the Port Radium plant. The original method of precipitation as uranyl carbonate was replaced by double filtration and cake was separated by double filtration and packed in drums.

The recoveries in the Port Radium leaching plant increased steadily from 30% to 98% over the years of operation through many improvements in all phases of operation. The overall recovery in combined milling and leaching was 87%-88% of the uranium present in mine ore plus dump tailings.

### SIMPLIFIED FLOWSHEET - LEACHING PLANT

The raw material for acid production was shipped from Alberta. The operation of both the leaching plant and mill was essentially continuous with an average of 98%-99% operating time.

Grinding

Leaching

Filtration

Clarification

Solvent  
Extraction  
& Precipitation