The thickener underflow, containing ore ground to minus 65 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, sodium chlorate, was added to the slurry in order to oxidize the ferrous iron in solution to ferric. The ferric iron, in turn, will oxidize the uranous oxide in pitchblende to uranic oxide and thus render it soluble as a uranyl sulphate in the leach solution.

Arsenic 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 arsenic inactive by complexing.

The leach agitators were of conventional airlift-rake type as used in gold milling, except that rubber-lined and stainless steel parts were used. The volume of the agitators was such that the ore was leached for 24 hours.

The leached slurry was fed continuously to drum-type vacuum filters with string-type discharge.

The filtrate was further clarified and pumped to the surge tank ahead of the precipitation circuit. The filter cake was repulped with very weak acid and refiltered. Wash acid was used on both stages of filtration. The combined filtrates and wash solution constituted the feed to 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 kerosene solution of tri-fatty-amine. The latter organic compound combined with the uranium and the kerosene-amine-uranium phase was allowed to separate from the barren aqueous solution. The uranium-bearing kerosene was then contacted with an aqueous solution of sodium carbonate, which re-extracted the uranium as a concentrated solution. The final step in recovery was the precipitation of uranium as sodium diuranate or "yellowcake". This yellowcake was separated by double filtration, dried and packed in drums.

The Port Radium "yellowcake" was exceptionally pure, containing 84%-86% U_3O_8 and only very small amounts of those impurities which are objectionable to refining. The solvent extraction recovery process was a recent (1958) addition to the Port Radium flowsheet and replaced the original method of precipitation as uranous phosphate-arsenate by reduction with aluminum powder.

The recoveries in the Port Radium leaching plant increased steadily from 90% to 96% over the years of operation, through many improvements in all phases of operation. The overall recovery in combined milling and leaching was 97%-98% of the uranium present in mine ore plus dump tailings.

A plant for production of sulphuric acid was operated at Port Radium. The raw material for acid production was sulphur, shipped from Alberta.

The operation of both the leaching plant and mill was essentially continuous with an average of 98%-99% operating time.