

which involved air oxidation at atmospheric pressure and lower temperatures. This method was pilot plant tested at the mines branch and later on a larger scale by Eldorado. It was used in both stages of the plant expansions. Verna ore contains sulphide minerals which consume sodium carbonate reagent, consequently methods were developed for the separation of sulphides by flotation and separate acid leaching of sulphides. Many other cost-saving features have been included in the present process. These include heat exchange by splash towers, steam stripping of solution to save reagents and reduce soluble loss of uranium, the use of cheaper lime as a partial substitute for soda ash, better leaching conditions, and control of corrosion.

By the combined efforts of the research and development division and the operating staff, very substantial improvements have been made in efficiency and in costs, as indicated in the graph (Fig. 2).

A description of the Beaverlodge mill is given following this appendix. It is of interest that many United States uranium mills have used the Beaverlodge process as a base for processing.

### *Port Hope Refined Products*

#### *Refined Oxide*

Prior to 1955 semi-refined uranium oxide was produced at Port Hope by a process devised for the recovery of radium. The recovery of uranium was not satisfactory and the product did not meet specifications for nuclear fuel material.

Research was initiated at Port Hope in 1949 towards the production of "metal grade" oxide. Several variations of the solvent extraction process were tested, based on information obtained in the United Kingdom and France. The laboratory work was followed by pilot plant runs in 1951 to 1954.

The process which was developed differed in several points from other processes in operation. The extraction of uranium from nitric acid slurry was a new method particularly suited to Eldorado feed materials. The process was designed to eliminate the large amounts of impurities in Port Radium products, particularly copper, silver and arsenic, and to control thorium in feeds from the Blind River and Bancroft areas.

When the process flowsheet had been developed, arrangements were made with the United States Atomic Energy Commission to engage Catalytic Construction Company for the design of the plant in co-operation with Eldorado staff. Plant operation commenced in June 1955.

The thorough pilot plant testing resulted in high efficiency of operation at the start. Subsequent development by the research and development division and the operating staff has resulted in even higher degree of efficiency, capacity and economy.

#### *Green Salt and Metal*

Eldorado Mining and Refining Limited was instructed in 1955 to produce uranium metal in Canada to meet the requirements of the Chalk River reactors. The research and development division made a thorough survey of production methods through visits and discussions with United Kingdom and United States groups, and through such small-scale development work as was practical.

The conventional "screw reactor" plant then in use in the United States was not considered economic for the small tonnage operation. Consequently two other processes were studied—the fluo-solids technique and the moving bed reactor for reduction hydrofluorination. The latter process was chosen and a large-scale pilot plant run was carried out in 1957-58. The process has proved to be very successful with respect to costs and quality of products. In fact the quality is believed to be superior to that of products from other producing plants.