Ceramic grade UO_2 has been supplied for Canada's NPD-2 reactor and will be used for the larger CANDU reactor now under development. Shipments have also been made to the United States, Europe and Japan.

III. Green Salt Operations

Pelleting

To obtain a feed material suitable for processing in moving bed reactors, the orange oxide (UO_3) from solvent extraction operations must first be put in a pellet form. This is done by adding a measured amount of water to the orange oxide powder to form a paste which is spread over a slowly moving endless casting belt made of rubber which has indentations in its surface. The water and orange oxide paste or slurry fill the indentations and the mixture in a short time forms a hydrate and "sets" into a solid in much the same way that plaster hardens.

The "setting" process is hastened by heating coils positioned above the casting belt and at the end of the belt the orange hydrate has solidified into the shape of the indentations in the belt and the pellets are released and drop off onto a second curing belt. The pellets are roughly diamond shaped and about ½" in size along their long axis and about ¼" wide and ¼" in depth.

From the curing belt where the pellets dry and harden, the pellets are next screened to remove the fines which are crushed and recycled back to the feed end of casting belt.

The screened orange hydrate pellets are then ready for entry to the next step of the process, hydrogen reduction.

Hydrogen Reduction

Orange oxide reacts at a temperature of about 1000°F. with hydrogen gas to form brown oxide (UO_2) and water according to the following reaction:

$$H_2 + UO_3 \longrightarrow UO_2 + H_2O$$

This conversion is accomplished in a moving bed reactor. The reactor is essentially a vertical vessel made of a heat and chemically resistant alloy called inconel. The reactor is provided externally with electric heating jackets along its length and is insulated on the outside to preserve heat. The function of the equipment is to provide a means of efficiently contacting a solid, which can flow through it from top to bottom by gravity, with a hot reactant gas which is entered at the base of the reactor and which passes up the reactor, counter current to the solids flow.

Suitable nozzles are provided on the side, situated at the bottom and top of the reactor, to accommodate the gas flow. Seal legs are provided at the top and bottom of the column through which the solids enter and leave the reactor. These seal legs are purged with an inert gas kept at a slightly higher pressure than the reactor itself to prevent air from leaking into the reactor or the reactant gases from escaping out from the reactor.

With the reduction reactor, hydrated orange oxide pellets are hoisted to the top of the reactor in specially designed containers. The full container is attached to the top of the seal leg, is purged with an inert gas and its contents are then allowed to feed by gravity into the reactor. The solids flow rate through the reactor is controlled by the rate at which solids are taken off at the bottom by a variable speed feeder.

In the top section of the reactor, immediately below the seal leg, the pellets are heated by the hot gases coming up from below and the water in the pellets is driven off. This dehydration is further assisted by sparging in