

# SIEMENS

December 7, 1992

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington DC 20555

Gentlemen:

Re: Follow-up to NRC Bulletin 91-01 Report No. 24514 - UNH Dissolver 901 Material Hold Up

On 10/27/92 Siemens Power Corporation (SPC) reported a criticality safety incident to the NRC Operations Office per NRC Bulletin 91-01. SPC internal procedures require a written follow-up report of the initial telephone report. This letter fulfills this requirement.

## Background

SPC has two dissolvers, 901 and 902, used to dissolve  $U_3O_8$  or  $UO_2$  with nitric acid ( $HNO_3$ ), thereby producing uranyl nitrate hexahydrate (UNH). Each dissolver tank is made of a 10-inch schedule 40 pipe about 3 feet long below an 8-inch schedule 40 pipe section about 4 feet long. At the top of the tank is a perforated steel basket used to mix the powder from a screw conveyor with solution recycled from the tank. Between the screw feeder and the basket is a butterfly valve. This valve is in place to isolate process off-gases from the powder feed hood and direct them to the POG scrubber system. The basket is in the nominal 8-inch diameter section. Because the lower portion of the dissolver is not a favorable diameter, the dissolver is operated on a batch basis and is limited to one safe batch (45% of a minimum critical mass). The dissolvers are required to be operated in a manner that provides reasonable assurance that powder does not accumulate in the dissolvers from batch to batch.

The criticality safety analysis for this system demonstrates that  $k_{eff}$  is less than 0.92 when the dissolver contains two safe batches plus 10 kg of  $UO_2$  at optimum moderation and full water reflection.

## Description

SPC has committed to upgrading its criticality safety analyses for plant operations. As part of this effort SPC engineers were requested to determine the amount of heel, if any, that could remain in the dissolver after pumping the dissolvers empty.

While preparing to run tests to determine the size of any potential heels left after tank pump out, a 6.5 kg accumulation of  $UO_x$  was found in Dissolver 901 in the 7670 cc volume between

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the butterfly valve and the screw feeder discharge. If this entire volume had been filled with powder, it could have contained 13 kgs of  $UO_x$ , assuming a density of 1.7 g/cc.

SPC Process Engineering determined that each dissolver has a heel left in the tank after each batch. The volume of this heel varied from 5.5 to 7.5 gallons. The dissolution parameters generate a uranium concentration of approximately 300 gU/liter UNH. Assuming a maximum heel of 7.5 gallons, and a maximum concentration of 350 gU/liter, the heel could contain up to 10 kgs of uranium.

Based on the discovery of U holdup in the system which was not adequately addressed in the criticality safety analysis, SPC reported the situation to the NRC Operations Office via telephone at 1725 hours on 10/27/92 (NRC Report No. 24514).

#### Cause

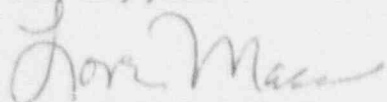
The potential for powder accumulation at this location in the dissolver exists whenever the screw feeder operates for any period of time with the butterfly valve in the closed position. The criticality safety analysis did not prescribe the specific methods of assuring that powder accumulation did not occur. Also, the operating procedure did not require an inspection to detect powder accumulation in this area when successive batches were of the same U-235 enrichment.

#### Corrective Actions

An addendum was added to the criticality safety analysis for the dissolvers and the required limits and controls were changed to address the potentials for U holdup in the system. These changes included reducing the allowed batch size by 10 kg to compensate for the potential of a 7.5 gallon heel, limiting the UNH concentration resulting from dissolution to 330 gU/liter, and inspecting the dissolver basket to ensure the entire batch has been dissolved and pumped out before processing another batch, even when the next batch is of the same U-235 enrichment level. The SOP was changed to require a visual inspection of the dissolver basket after each run to detect any accumulation above the butterfly valve.

Questions regarding SPC actions in response to this situation can be directed to me on (509)-375-8537.

Very truly yours



Loren J. Maas, Manager  
Regulatory Compliance

LJM:pm

cc: J. W. N. Hickey, NRC  
J. B. Martin, NRC