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DOCKETING & SERVICE SECTION

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U. S. Nuclear Regulatory Commission
Office of Nuclear Material Safety & Safeguards
Division of Fuel Cycle and Material Safety
Washington, D. C. 20555

Attn: Mr. W. T. Crow
Fuel Processing and Fabrication Branch

Gentlemen:

Re: Proposed Solid Waste Fixation, Transportation and Burial,
SNM-1107, Docket 70-1151

Attached is a description of proposed operations to dispose of uranium bearing waste presently being stored in lagoons at the Columbia Site. The material consists of calcium fluoride ($CaF_2$), with trace quantities of uranium encapsulated in the $CaF_2$ matrix.

The present authorization to conduct solid radioactive waste disposal is described in subparagraph 2.2.8, page 210 of the existing license. Consequently, the attached represents only an information package supporting the safety demonstration and indicating compliance with existing license conditions, the 1975 Westinghouse Environmental Evaluation, and applicable regulations.

The initial efforts will be directed towards disposing of sludge in two lagoons, East Lagoon and Calcium Fluoride Lagoon #1 as shown in Figure 1.3.2.1 of the existing license. This will provide the opportunity to inspect the lagoon for integrity prior to their reuse as waste storage basins. Future fixation will be conducted as required by operational and storage needs.

If you have any questions, please contact me.

Very truly yours,
WESTINGHOUSE ELECTRIC CORP.

Edward K Reitler

E. K. Reitler
Fellow Engineer

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Attachment

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# SOLID WASTE FIXATION, TRANSPORTATION AND BURIAL

## Purpose of Fixation

Liquid waste treatment operations at Columbia have generated over 2 million gallons of sludge which is stored in lined lagoons. The sludge consists of calcium fluoride ($CaF_2$), with trace quantities of uranium encapsulated in the $CaF_2$ matrix.

Calcium fluoride is a relatively inert compound with a solubility product of 2.7 X $10^{-11}$. The uranium can have the stoichiometric form of any of the uranium compounds found in a fuel fabrication plant and has little or no aqueous solubility.

The purpose of fixation is to further transform these species into physically and chemically stable solids extremely resistant to groundwater leaching. Solidified sludge would then be transferred to a low level radioactive waste burial ground for disposal. This disposal should minimize the need for any additional on-site storage requirements.

## Description of Waste Materials

Sludge analyses are shown in Table I. The sludge resembles a slurry which can be pump transferred from the lagoons.

## Fixation Location

The fixation process will be performed in a diked area of approximately 65,000 $ft.^2$ located West of the sanitary lagoon shown in Figure 1.3.2.1 of the existing license. The area will be prepared by removing a layer of top soil and diking the soil to form a basin to contain the solidified sludge. Depending upon the exact dimensions of the basin, the diked walls will be approximately six to eight feet high.

The basin will be surrounded by a chain link fence at least equivalent to that surrounding the existing plant site. The total developed area remains less than 5% of the total site area as discussed in the Westinghouse Environmental Evaluation, March 1975.

## Fixation Operations

The fixation agent is an aqueous soluble sodium silicate with a cement setting agent. This material will be mixed with the $CaF_2$ sludge, then transferred to the above ground diked basin to harden. This process has been successfully used by Delaware Custom Material, Inc. in the fixation of radioactive waste and other toxic metal wastes.

The sludge will be pump transferred from the lagoons to a mixing tank where it will be combined with the fixation agents. Following complete mixing, the contents will be placed in the diked area to harden. Approximately one day is required for the material to set up; at this point, its physical characteristics resemble a concrete mixture. The initial fixation phase will take approximately twenty work days to complete.

## Transportation

The stabilized sludge will be transferred from the diked basin to an appropriate transport vehicle using traditional earth moving equipment. The contents of each vehicle will be determined by either net weight or by volume measurements. Transportation will be performed in accordance with the current DOT regulations and license conditions.

The material will be transported to the Chem Nuclear low level radioactive waste burial site in Barnwell, S. C. for disposal. This will be performed in accordance with applicable provisions of Chem Nuclear's federal and state licenses and internal procedures.

Transportation (Cont.)

Approximately nine months will be required to transport the entire contents of the East lagoon and Calcium Fluoride Lagoon #1 as shown in Figure 1.3.2.1 of the existing license.

Radiological Safety Control

As indicated in Table 1, the uranium con ent ranges from 330-800 ppm based upon solids, with an average of 600 ppm.

External radiation levels are at or near background. However, radiation surveys of fixation operations and the perimeter will be performed to verify the expected low exposure rates.

Internal exposures will be controlled by limiting airborne concentrations to well below maximum permissible concentrations. For soluble uranium the MPC for occupational exposure is 0.2 mgU/$m^3$ (10 CFR 20, Appendix B, Note 4). For insoluble uranium, the MPC for occupational exposure is 0.07 mgU/$m^3$ (based upon a specific activity of 1.4 uCi/g for 2.6% enriched uranium). Using the MPC for insoluble uranium and a sludge concentration of 800 ppm uranium, an airborne concentration of 87 mg sludge per $m^3$ is required to reach MPC. This value is considerably higher than the recommended Threshold Limit Values (TLV's) for fluorides (2 mg/$m^3$) and calcium oxide (5 mg/$m^3$). It is also, higher than the limit of 10 mg/$m^3$ for normal nuisance type dusts such as paper fibers, portland cement, starch, etc. Thus, the limiting factor is the chemical nature of the dust, not that it is contaminated with uranium; and routine dust control measures should be sufficient.

No airborne problems are expected from the sludge removed from the lagoons since the material is in an aqueous form. Following fixation, some drying of the material may occur; however, at this point, both the fluorides and uranium are physically and chemically bonded.

Air sampling will be performed where there is a potential for airborne uranium and/or fluorides. Typically, continuous air sampling will be established to monitor the area surrounding the diked basin. In addition, air sampling will be performed to monitor the transfer of fixed sludge from the basin to the transport vehicles. Air sampling may be reduced if experience shows that the potential for airborne is minimal. Any such modifications in the surveillance program will be based on an evaluation by the Radiation Protection Component based upon criteria in subparagraph 3.1.2 of the existing license.

Nuclear Safety Control

The results of detailed sampling of the lagoons have shown that the uranium is rather uniformly mixed with the $CaF_2$. Based upon sampling at various depths in the lagoons, no settling of the uranium has been detected. Due to the complete mixture of uranium within the sludge, criticality is considered impossible. The fixation process should further immobilize the uranium.

The nuclear safety of the sludge is assured by the following (1) the concentration of uranium is less than 0.002 uCi/gram which is the upper limit for "radioactive material" as defined in DOT regulations 49 CFR 173.389 (e) and (2) the water content assures that the sludge will always be over moderated (H/U-235 >>10,000).

Environmental Safety Controls

Prior to basin excavation, representative soil samples will be taken and analyzed for uranium and fluorides to establish the baseline conditions. Following removal of the treated sludge from the basin, the soil will be sampled for both uranium and fluorides to determine the extent of leaching into the soil. An evaluation will then be made to determine the impact of the residual uranium and fluoride on the environment. The evaluation will include the potential leaching of these components into the water table and the dispersion into the atmosphere under drying conditions.

Typically, the evaluations will use conservative assumptions for movement of the contaminants through the soil and into the water table. Decontamination will be conducted to maintain average ground water concentrations below 5 mg per liter for fluorides and less than MPC for unrestricted areas for uranium. For airborne, resuspension of the material into atmosphere will be calculated under unusual drying conditions accompanied by high wind conditions. Decontamination will be conducted to maintain air concentrations below 2 mg per $m^3$ fluorides and less than MPC a for unrestricted areas for uranium.

Samples of treated sludge have been subjected to leaching studies in which deionized water was passed through the sludge and filtered. The leachate was subjected to delayed neutron analysis with uranium concentration below the detection limit of 0.003 ppm. Consequently, no leaching problems are expected.

Test wells "downstream" of the diked basin will monitor any migration of fluorides and uranium into the water table. Typically, the wells are 60 feet deep and extend into the water table. In addition, ground water samples will be collected from a ditch which is located "downstream" of the basin. Well water and groundwater samples will be collected quarterly and analyzed for fluorides and gross alpha. Action levels will be consistent with the limits described above for water concentrations.

No environmental airborne problems are anticipated. The air sampling program described under "Radiological Safety Control" above should be adequate to verify the expected low airborne levels. If residual levels dictate, continuous environmental air sampling will be established to monitor any material resuspended into the air. Action levels will be consistent with the limits described above for airborne concentrations. It is expected that the basin area will be retained as the area for future fixation operations. Consequently, the site will be maintained as a "Restricted Area" as defined in subparagraph 2.1.1 of the existing license.

Table 1

| Parameter | Range |
|---|---|
| Total Uranium Content, Dry Basis | 330-800 ug U/g (600 ug U/g average) |
| % Solids | 33-50% Average 40% |
| Approximate U-235 Enrichment | 2.6 |
| Specific Gravity Raw Sludge | 1.3 |