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**Pacific Northwest Laboratory
Monthly Report to
Advanced Nuclear Energy
Systems, Space and Special
Purposes Division
for August 1975**

September 1975

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PACIFIC NORTHWEST LABORATORY MONTHLY REPORT
TO ADVANCED NUCLEAR ENERGY SYSTEMS, SPACE
AND SPECIAL PURPOSES DIVISION
FOR AUGUST 1975

by
H. T. Fullam

September 1975

Battelle
Pacific Northwest Laboratories
Richland, Washington 99352

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STRONTIUM HEAT SOURCE DEVELOPMENT PROGRAM

At Hanford, strontium will be separated from the high-level waste, then converted to the fluoride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation and storage will take place in the Waste Encapsulation and Storage Facilities (WESF). This encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat source applications under anticipated use conditions. The objectives of this program are to obtain the data needed to license $^{90}\text{SrF}_2$ heat sources and specifically the WESF $^{90}\text{SrF}_2$ capsules. The information needed for licensing can be divided into three general areas:

- 1. Long-term SrF_2 compatibility data.*
- 2. Chemical and physical property data on $^{90}\text{SrF}_2$.*
- 3. Capsule property data such as external corrosion resistance, crush strength, etc.*

The current program is designed to provide the required information.

COMPATIBILITY STUDIES

The topical report summarizing the results of the short-term compatibility tests has been submitted to DANES for review.

A meeting was held in August with DANES personnel at ERDA headquarters to discuss the long-term compatibility testing program. At the meeting it was decided to reassess the planned long-term tests to see if an expanded testing program will be required. Redefinition of the testing program will be completed by the end of September. It was also decided to institute additional short-term scouting tests to evaluate potential containment materials not covered in the original short-term tests.

Thermal aging tests on Hastelloy C-4 have been initiated. The Hastelloy C-4 is being considered as the outer strength member of a double-walled capsule to contain $^{90}\text{SrF}_2$; it is reported that the Hastelloy C-4 does not suffer the severe thermal aging effects observed with alloys such as Haynes 25. Charpy V-notch test specimens are being tested at 600, 800, 900 and 1000°C for periods up to 30,000 hr.

A suitable licensed shipping cask (NRBK-43) has been identified for transferring WESF $^{90}\text{SrF}_2$ from ARHCO to PNL. The cask has been ordered and should be available in October. The fuel-grade WESF $^{90}\text{SrF}_2$ should be available for shipment in November.

SOLUBILITY OF STRONTIUM FLUORIDE

The solubility of strontium fluoride in demineralized water (2 megohm resistivity) and seawater at 23°C was measured. Three grades of strontium fluoride were used in the tests:

- a. high-purity strontium fluoride containing less than 1000 ppm total impurities (Na and Ca were the principal impurities),
- b. commercial strontium fluoride containing about 0.5 wt% impurities (Na, Ca, Ba and $\text{SO}_4^{=}$ were the principal impurities),
- c. WESF-grade strontium fluoride containing about 4.5% impurities and corresponding to the composition of WESF-produced $^{90}\text{SrF}_2$ (Na, Ca, and Ba being the major impurities).

In the tests the various grades of SrF_2 were contacted with water for extended periods of time (up to 6 months), and the mixtures sampled periodically, filtered and analyzed for dissolved strontium and fluorine. The strontium and fluorine concentrations reached their equilibrium levels (within experimental error) after approximately 30 days exposure. The equilibrium concentrations for the three grades of SrF_2 in the demineralized water and seawater are given in Table 1. The low strontium and high fluorine concentrations in the mixture of demineralized water and WESF-grade SrF_2 resulted from the rapid dissolution of sodium fluoride (which is present in the WESF-grade SrF_2 as an impurity).

TABLE 1. Solubility of SrF_2 in Demineralized Water and Seawater at 23°C

	Concentration, M ^(a)			
	Demineralized Water		Seawater	
	Sr	F	Sr	F
High-Purity SrF_2	0.0010 ± 0.00013	0.0019 ± 0.00021	0.0011 ± 0.00003	0.0026 ± 0.00015
Commercial SrF_2	0.0006 ± 0.000061	0.0045 ± 0.00024	0.0013 ± 0.00027	0.0032 ± 0.00020
WESF-Grade SrF_2	0.000093 ± 0.000017	0.011 ± 0.00042	0.0012 ± 0.00008	0.0024 ± 0.00031

(a) Each value represents the average of at least four values obtained over a 4-month period.

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