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

November 1975

**Prepared for the U.S. Energy
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PACIFIC NORTHWEST LABORATORY
MONTHLY REPORT TO ADVANCED NUCLEAR
ENERGY SYSTEMS, SPACE AND SPECIAL
PURPOSES DIVISION FOR OCTOBER 1975

by
H. T. Fullam

November 1975

Battelle
Pacific Northwest Laboratories
Richland, Washington 99352

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

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.

LONG-TERM COMPATIBILITY STUDIES

ARHCO has begun processing fuel-grade ^{90}Sr . Analysis of the feed solution indicates the $^{90}\text{SrF}_2$ product should have a purity of 94 to 95 wt%, with barium (~ 2 wt%), calcium (~ 0.5 wt%) and sodium as the principal impurities. ARHCO should be ready to ship the $^{90}\text{SrF}_2$ to PNL near the end of November. The cask to be used for the shipment has been received and is now at ARHCO. Racks to hold the $^{90}\text{SrF}_2$ capsules in the cask during shipment and to facilitate their removal from the cask are now being fabricated.

Testing of two full-size WESF $^{90}\text{SrF}_2$ capsules will begin in January. The tests will last for 6 and 12 months. After testing, the capsules will be sectioned and specimens from various locations examined and analyzed for metal attack by the fluoride. Each capsule will be placed in a specially designed container that will allow the capsule to self-heat to $\sim 800^\circ\text{C}$ for the required time. Each container will be equipped with three movable thermocouples which will permit measurement of the capsule surface temperature at various locations. A prototype container has been designed and fabricated, and will be tested with an electrically heated dummy capsule to determine the capsule temperature that can be obtained.

SHORT-TERM COMPATIBILITY TESTS

The report summarizing the short-term compatibility tests has been revised, and the final draft is now being typed. The report will be issued as soon as it has been cleared for publication.

ADVANCED SCOUTING TESTS

Additional short-term compatibility tests are planned to evaluate potential containment materials not covered in the initial short-term tests. The tests will be carried out for 1500 and 4400 hr at 800°C using non-radioactive SrF_2 which is similar in composition to WESF-produced $^{90}\text{SrF}_2$. The materials to be tested include:

1. Hastelloy C-4	6. Ductile Cast Iron	11. W-25% R ₂
2. Hastelloy B	7. TDNi	12. Ir-2% W
3. Hastelloy W	8. TD Ni-Cr	13. Hastelloy C-276
4. Hastelloy S	9. Wrought 50 Ni-50 Cr	14. Haynes Alloy 25
5. Nickel	10. Mo-50% Re	15. TZM

Other materials will be added to the tests as potential candidates are identified. The last three materials listed (Hastelloy C-276, Haynes Alloy 25 and TZM) will be tested as references since these are the three materials being evaluated in the long-term compatibility tests. The materials needed for the tests have been ordered and the tests will start as soon as the materials arrive and the test couples fabricated.

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