Pu-238 FUEL FORM ACTIVITIES

JANUARY 1-31, 1981

Published: February, 1981

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**E. I. du Pont de Nemours & Co.
Savannah River Plant and Laboratory
Aiken, SC 29808**

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PREPARED FOR THE U. S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09-76SR00001

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FOREWORD

This monthly report for ^{238}Pu Fuel Form Activities has two main sections: SRP-PuFF Facility and SRL Fuel Form Activities. The program status, budget information, and milestone schedules are discussed in each main section.

The SRP portion of this monthly report summarizes production of $^{238}\text{PuO}_2$ fuel forms for use in radioisotopic thermoelectric generators (RTGs) in the Plutonium Fuel Form (PuFF) Facility at the Savannah River Plant. The PuFF Facility was started up in December 1978 producing iridium-encapsulated, 100-watt $^{238}\text{PuO}_2$ spheres for MHW (multihundred watt) RTGs. This program was completed in April 1980. The PuFF Facility is now producing iridium-encapsulated, 62.5-watt $^{238}\text{PuO}_2$ right circular cylinders for GPHS (General Purpose Heat Source) RTGs.

The SRL portion of this program is aimed at the development of technology to support production in the PuFF Facility of ^{238}Pu fuel forms for isotopic heat sources. Components of the program include direct technical support to the production effort, improvement and refinement of existing processes to manufacture fuel forms, and demonstration and adaptation of processes for new isotopic heat sources in the PuFF Facility. In support of these development efforts, the Alpha Materials Facility (AMF) is operated to conduct small-scale fabrication and characterization studies of ^{238}Pu materials. In addition, the Plutonium Experimental Facility (PEF) is operated to conduct fabrication studies of full-scale fuel forms. Areas of emphasis in the experimental program include technical support of PuFF for the production of GPHS fuel forms, development of an alternative GPHS flowsheet, development of a process to hot-press fuel forms directly from as-calcined powder, development of processing techniques to minimize fracture in fuel forms, and characterization of the behavior of impurities in fuel forms.

The Work Breakdown Structure (WBS) for this program is shown in Figure 1.

This program is funded under B&R AE-15-20. Starting with the January 1981 issue, the number of the Pu-238 Fuel Form Activities monthly report was changed to DPST-year-133-month from DPST-year-129-month.

FIGURE 1 Work Breakdown Structure for Pu-238 Fuel Form Activities

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HIGHLIGHTS

SRP-PuFF FACILITY

Event 1.1.1.1.1D was modified to supply three GPHS fuel clads to the Los Alamos National Scientific Laboratory (LANSL) instead of the Mound Facility.

Lack of flight quality GPHS iridium cups continues to delay the completion of events 1.1.1.1.1A, B, and C.

SRL FUEL FORM ACTIVITIES

SRL is metallographically examining a number of product pellets.

160 grams of SRL type shards have been fabricated for shipment to the LANSL.

HB-Line has successfully completed the Pu(III) direct-strike precipitations.

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SRP-PuFF FACILITY (WBS 1.1)

PuFF FACILITY PRODUCTION (WBS 1.1.1)

GPHS Production (WBS 1.1.1.1)

Objective

The objective of this work is to produce 62.5-watt GPHS fuel forms for use in space and/or terrestrial energy systems.

Narrative

Summary

Event 1.1.1.1.1D was modified to supply three GPHS fueled clads to the LANSI instead of the Mound Facility. When event 1.1.1.1.1D was added to the milestone log, the three GPHS fueled clads were not included in the total requirement stated in event 1.1.1.1.1L. To reflect this increase, the total number of fueled clads required was changed from 546 to 549. These changes are shown in Table 1. The modifications to the milestone log were requested by DOE (letter of December 2, 1980, from C. G. Halsted to J. L. Womack).

Lack of flight quality GPHS iridium cups continues to delay the completion of events 1.1.1.1.1A, B, and C. These events will be completed about three months after receipt of sufficient flight quality iridium hardware.

GPHS Fabrication

Production. 1.02 kg of ^{238}Pu feed powder was received from the HB-Line for processing during January 1981. 0.48 kg of scrap PuO_2 was returned to the HB-Line for recovery. Throughout the report period, 15 runs were oxygen-exchanged, 15 runs were ball milled, 15 runs were sintered, 5 pellets were hot pressed, 9 pellets were final heat treated, and 6 pellets were vacuum outgassed.

Cell 1 powder operations continued at a reduced rate during the month because of the failed final heat treatment furnace, see December monthly report. Hot pressing and vacuum outgassing of pellets resumed during January after repairs to the hot press induction coil were completed (further details are included in the Equipment Section).

The PuFF GPHS fabrication line began four-shift operation on January 26, 1981.

Process. Five GPHS pellets were pressed during this report period (1-GF-039 thru 1-GF-043). Forty-three pellets have been pressed to date.

All pellets pressed in January were pressed utilizing the automatic digital function generator installed in August to automatically control ram velocity during the preload. All pellets except 1-GF-040 were within specification limits for hot pressing. During the pressing of Pellet 1-GF-040, the ram velocity exceeded the maximum specified when the radio-frequency signal generated by welding operations in Cell 6 caused uncontrolled movement of the hot press rams. Pellets 1-GF-042 and 1-GF-043 were ejected from the dies with a new hydraulic jack.

Only 40% of all pellets pressed have remained integral without severe cracking through final heat treatment and vacuum outgassing. The cause of pellet breakage is being investigated. Process changes made to reduce pellet breakage include additional outgassing of shards prior to pressing, ejection of pellet from the dies instead of cutting the die, and storage of pellet in platinum-lined graphite canisters to prevent oxide reduction and subsequent stresses caused by reoxidation. These changes were implemented with GPHS pellet 1-GF-042.

Equipment

Sintering Furnace. Checkout of the sintering furnace with a shorter heat zone (see December monthly report) was completed in January. A temperature profile of the installed furnace with the sintering rack was completed. Only three furnace trays could be used for sintering shards compared to five trays used with the extended heat zone design furnace. Sintering of high-fired shards and final heat treatment of pellets were run successfully several times during January. A temperature profile of the furnace was made with the final heat treatment rack loaded with three pellets. The profile showed that three pellets can be final heat treated if the nominal control temperature is increased about 10°C to ensure that the final heat treatment temperature is within specification limits.

Hot Press. Repairs to the hot press induction coil after it had been bent slightly (see December monthly report) were completed, and the induction coil was returned to service. The induction coil was bolted to the support bracket with three bolts, two of which were safety-wired together. The induction coil is working satisfactorily and is producing the same heat load at the same power input prior to damage of the induction coil.

The top clamp ram was installed and was used for the pressing of all five GPHS pellets in January. The top clamp ram was removed at the end of the month to permit vacuum outgassing of the pellets.

The oil in the hot press mechanical pumps and the diffusion pump was changed in January. The hot press safety related system interlocks were checked and functioned properly. The hot press blowdown line was reset to relieve at -0.10 inch of vacuum instead of -0.20 inch of vacuum. Thermocouples with digital readouts in the PuFF operating room were installed in the hot press cooling water system loops to replace the capillary bulbs previously in use.

Pellet Encapsulation, Decontamination, Packaging, and Shipping

Process. Six iridium encapsulated GPHS pellets were transferred to Building 772-F for neutron counting and calorimetry. Four pellets (8007-HF-2, 8007-HF-5, 8007-HF-12, 8007-HF-13) had neutron rates that exceeded the ^{238}Pu limit of 6000 n/s/g. These four pellets were recounted and the recount confirmed the initial readings. The cause for the high neutron count is attributed to back-exchange of natural oxygen ($^{17,18}\text{O}_2$) by the low-fired shards prior to hot pressing. Elapsed time between oxygen exchange and hot pressing for the low-fired shards was 54 days for the highest neutron-emitting pellet and only 18 days for the lowest neutron-emitting pellets. The pellets will be shipped to the Mound Facility and used in the Qualification thermoelectric generator ("Qual" Unit).

Two production weld runs scheduled for January 12, 1981, and January 14, 1981, were aborted because of unacceptable example welds. During the first production run, the first example weld was made at centerline conditions but failed to attain adequate penetration. The weld current was raised from 90 to 92 amps for the second example weld in an attempt to increase penetration. Adequate penetration was achieved. However, a small crack was observed at the arc quench extending from the weld overlap region. This anomaly was also observed on the first example weld but at the time was believed to be associated with the lack of penetration. Both example welds were made on hardware that contained the old style weld shield. For the second production run, the example weld was made with a set of evaluation use only (EUO) hardware that contained the new style weld shield. This weld also failed because of a crack at the overlap region.

Since the emergence of the welding problem, seven test welds have been made at varying weld currents, arc gaps, preheat schedules, and taper schedules with only limited success. Over the

range of variables tested, the cracking problem is statistical with no direct correlation to the weld settings. A committee has been appointed to study this problem and to formulate a solution. Additionally, representatives from the Mound Facility and Oak Ridge National Laboratory have been requested to assist in resolving the problem.

Iridium Weld Shield Development. Two weld development tests were completed on hardware that contained the new style weld shield. The first weld was made with a lava simulant at high (93.5 amps) weld current. The purpose of this weld was to make a large inner weld bead and determine the effects of the weld bead on the weld shield. Destructive analysis of the capsule revealed that the weld shield was not damaged and showed no weld indications. The second weld was made with a plutonia pellet (Pellet 32) at centerline conditions to duplicate normal processing conditions. No adverse effects were detected that could be attributed to the new style weld shield. The pellet was removed from the capsule and returned to Cell 6. The new style weld shield is now considered the optimum style and will be installed in future sets of prime hardware.

QA/QC Program

Shipping Casks. Accurate Machine Products Corp. continues to repair deficient welds in the inner containers (EP62) of the twenty new shipping casks. Some of the inner containers are being reworked to correct various deviations in dimensions.

Process Equipment: Hot Press Induction Coil. A formal request has been issued through Purchasing for LANSRL to perform the modifications required to correct the design deficiencies for the induction coil.

Process Equipment: Furnace Hearths. An order for six furnace hearths of the new high density alumina design is in progress. The vendor has requested a casting and firing procedure.

Process Equipment: Furnace Heater Tubes. Five ceramic tubes were received from McDanel Refractory Co. on December 19, 1981, and were QC inspected. The tubes were then sent to Astro Industries, Inc., where they will be wound with tungsten heater wire. At this time Astro Industries, Inc., is awaiting receipt of the tungsten heater wire.

Hydrostatic Test Facility. Drawings of the hydrostatic test facility for testing 5320-1 casks have been approved by the Project Department. A work request for Maintenance to fabricate the test facility has been issued and approved. Materials required to fabricate the facility have been ordered.

Process Deviations. Deviation 101-DN-93 was written and approved to use iridium encapsulated Pellet 8007-HF-5 in the qualification generator. The pellet was pitted in two places by stray arcs during the welding process. The pits will not compromise its use.

Deviation 101-DN-94 was written and approved to use iridium encapsulated Pellet 8007-HF-12 in the qualification generator. The pellet was inadvertently dropped causing a dent on the edge of the bottom cup. The dent will not compromise its use.

Deviation 1010-DN-95 was written and approved to use GPHS iridium cups with weld shields, LR231-3 and LR231-8, as EUO hardware. These cups have small black spots that are almost perfectly aligned with a weld shield tack weld. These spots will not affect weld behavior.

Deviation 101-DN-96 was written and approved to resinter low-fired shard Batches 11LP93, 10LP94, and 10LP95 that had been run through two low-fired sintering runs. Resintering the batches as high-fired shards erased the thermal history of the shards.

EFFRB Actions. EFFRB Action Number 22GPH80SR was written to use $^{238}\text{PuO}_2$ shard Batches 79, 80, and 81 as high-fired shards in EUO pellets. The shards were inadvertently sintered above the product specification limit. This should not compromise the function of the high-fired shards.

EFFRB Action Number 047GPH81SR was written to use Pellets 8007-HF-2, 5, 12, and 13 for EUO pellets. These pellets exceeded the neutron emission specification which will not affect the use of the pellets in the qualification generator.

Safety Related Systems. The 235-F emergency diesel generator performed satisfactorily during a load test January 23, 1981.

The 235-F exhaust damper interlocks performed satisfactorily during a test performed January 19, 1981.

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U. S. DEPARTMENT OF ENERGY
SAVANNAH RIVER OPERATIONS OFFICE
CONTRACT MANAGEMENT SUMMARY REPORT

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TABLE 1

Milestone Log for GPHS Production

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.1.1.1	GPHS Production		
1.1.1.1.1	GPHS Flight Quality Production		
1.1.1.1.1A	Supply 4 GPHS fueled clad (FC's) to MF (Mound Facility). (Initial Production Flight Quality Shipment in GPHS Production Program.)	9/80	7/80
1.1.1.1.1B	Supply 14 process certification GPHS FC's to MF, including the 4 in WBS 1.1.1.1.1A.	10/80	8/80
1.1.1.1.1C	Begin rate of 14 GPHS FC's per month due to start of four-shift seven-day operation.	1/81	1/81
1.1.1.1.1D	Supply 3 GPHS fuel clads (FC's) to LANSL for Impact Attitude Series Tests.	2/81	2/81
1.1.1.1.1E	Begin rate of 16 GPHS FC's per month due to installation and operation of vacuum outgas furnace.	10/81	10/81
1.1.1.1.1F	Supply 88 flight quality GPHS for GPHS/Galileo orbiter flight RTG (F-1).	1/82	5/82
1.1.1.1.1G	Supply 88 flight quality GPHS FC's for GPHS/Galileo orbiter flight RTG (F-2).	7/82	9/82
1.1.1.1.1H	Supply 88 flight quality GPHS FC's for GPHS backup RTG (F-3).	12/82	1/83
1.1.1.1.1J	Supply 88 flight quality GPHS FC's for GPHS/ISPM flight RTG (F-4).	6/83	5/83
1.1.1.1.1K	Supply 92 flight quality GPHS FC's for GPHS/ISPM flight RTG (F-5).	11/83	8/83
1.1.1.1.1L	Complete Galileo and ISPM GPHS-FC requirements, total required = 549.	11/83	8/83
1.1.1.1.2	GPHS Evaluation Use Only Production		
1.1.1.1.2A	Supply 88 GPHS FC's (72 EUO and 16 flight quality) for GPHS qualification RTG (Q-1).	6/81	6/81

NASA Reimbursable Fund W-14,776 (WBS 1.1.1.2)

Objective

This fund will be used to augment General Purpose Heat Source production in PuFF to meet the increased requirements of the Galilia and Solar Polar Missions.

Narrative

The milestone schedule and status report for this activity is the same as that shown in Figure 2. Refer to Table 1 for the milestone log for this activity and to Figure 4 for the Contract Management Summary Report.

The NASA Reimbursable Fund W-14,776 allocated \$350,000 to be spent between July and December 1980. The December Contract Management Summary Report showed an underexpenditure of \$26,000. Late costs of \$26,000 were charged to the December costs and the fund was closed out.

Another fund totaling \$530,000 was allocated for expenditure between January and September 1981. The Contract Management Summary Report, given in Figure 4, will track planned and actual costs of this fund.

FORM DOE 536
(1/78)

U. S. DEPARTMENT OF ENERGY
SAVANNAH RIVER OPERATIONS OFFICE
CONTRACT MANAGEMENT SUMMARY REPORT

1. CONTRACT IDENTIFICATION		2. REPORTING PERIOD		3. CONTRACT NUMBER											
NASA Reimbursable Fund		01 JAN 81 THROUGH 31 JAN 81		1.1.1.2											
4. CONTRACTOR NAME AND ADDRESS		5. CONTRACT START DATE		6. CONTRACT COMPLETION DATE											
E. I. du Pont de Nemours & Co. Aiken South Carolina		January 1981		September 1981											
7. MONTHS	O	N	D	J	F	M	A	M	J	J	A	S	TOTALS	8. FY	81
9. COST STATUS															
														10. COST PLAN DATE	
														Jan. 81	
11. PLANNED COSTS PRIOR FY: N/A 12. ACTUAL COSTS PRIOR FY: N/A 13. TOTAL ESTIMATE FY COSTS FOR CONTRACT: 530 14. TOTAL CONTRACT VALUE: N/A 15. UNFILLED ORDERS OUTSTANDING: N/A														16. ESTIMATE FOR SUBSEQUENT REPORTING PERIOD	
														43	
17. ACCRUED COSTS		18. CUM. VARIANCE		19. CUM. VARIANCE		20. CUM. VARIANCE		21. CUM. VARIANCE		22. CUM. VARIANCE		23. CUM. VARIANCE		24. CUM. VARIANCE	
43		0		0		0		0		0		0		0	
13. SIGNATURE OF CONTRACTOR'S PROJECT MANAGER AND DATE															
14. SIGNATURE OF THE GOVERNMENT TECHNICAL REPRESENTATIVE AND DATE															

FIGURE 4 Contract Management Summary Report
for NASA Reimbursable Fund-14,776

SRP CAPITAL EQUIPMENT (WBS 1.1.2)

Capital costs for the SRP Pu-238 program are shown in Table 2.

TABLE 2

SRP Pu-238 Capital Costs

	<u>Project Number</u>	<u>Budget Amount, \$</u>	<u>Project Approval</u>	<u>Project Amount, \$</u>
FY-1977 Projects				
Miscellaneous Small Projects (<50,000)	S-1711	193,000	12/77	147,000
FY-1978 Projects				
Miscellaneous Small Projects	S-1919	246,000	9/78	246,000
	S-1919-2	-	8/79	166,000
Install Calorimeter	S-2023	65,000	9/78	65,000
Metallograph for AMF (SRL)	S-2032	113,000	9/78	130,000
FY-1979 Projects				
Miscellaneous Small Projects (<50,000)	S-2065	279,000	11/78	279,000
GPHS Welder, PuFF	S-2163	117,000*	7/79	177,000*
Pump Decontamination Control Cabinets	S-2162	65,000	8/79	65,000
FY-1980 Projects				
Minor Projects (<50,000)	S-2211	115,000	11/79	
Water Monitors	S-2199	110,000	11/79	
Furnace Racks	S-2284	75,000	4/80	
Heat Source Transfer	S-1971	- Canceled -		14,500
PuFF Vacuum Furnace	S-2348	250,000	9/80	
FY-1981 Capital Equipment Funds				
Total capital funds available for FY-1981 are \$505,000.				
Miscellaneous Small Projects (<50,000)	S-2404	55,000	10/80	55,000

* Includes adjustments of \$17,000 authorized 3/80.

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SRL FUEL FORM ACTIVITIES (WBS 1.2)

SRL PRODUCTION SUPPORT ACTIVITIES (WBS 1.2.1)

The milestone log for this section is shown in Table 3. The milestone schedule and status report and the contract management and summary report are given in Figures 5 and 6, respectively.

Technical Support - GPHS (WBS 1.2.1.1)

Objective

SRL has developed a process flowsheet based on technology originally developed at LANSL for the production of full-scale GPHS fuel forms with a uniform, nearly crack-free microstructure. The objectives of this program are: (1) to support fuel form production operations in the PuFF Facility and (2) to develop technology to help optimize those operations.

Narrative

The yield of GPHS production pellets in PuFF has decreased because of pellet fracture during storage, heat treatment, vacuum outgassing, and handling. SRL is assisting Separations Technology in dealing with this situation.

SRL has completed metallography on three of the fractured PuFF GPHS pellets. A quantitative analysis of the micrographs is now being done to compare the microstructure of LANSL, PEF, and PuFF pellets. Two additional PuFF-GPHS pellets have been sectioned in the PEF for microstructural analysis at SRL.

SRL is investigating the sintering of shards in $N_2/5\% O_2$, $Ne/5\% O_2$, and/or $He/5\% O_2$ rather than in $Ar/5\% O_2$. These other atmospheres will help to densify the shards and should improve the integrity of the pellets. After the initial tests are completed in the AMF, GPHS pellets will be fabricated in the PEF from shards sintered in different atmospheres.

GPHS Pellet 38 was hot pressed previously using PuFF shards and SRL centerline conditions. Scanning electron microscope analysis of the shards and microstructural analysis of a section of the pellet indicated that large aggregates ($\sim 2000 \mu m$) of high-fired shards created low density regions in the pellet. These aggregates were present because the shards were not screened prior to hot pressing in the PEF. These aggregates are not found in PuFF shards used in production hot pressing and, therefore, the results of this test did not provide a useful comparison between the PEF and PuFF fuel pellets.

GPHS Pellet 39, which was hot pressed using shards sintered in Ar/5% O₂, has been sectioned and mounted for metallographic analysis.

Alternative GPHS Flowsheet (WBS 1.2.1.2)

Objective

DOE has requested SRL to develop an alternative GPHS fuel fabrication flowsheet for production of fuel forms with a modified impact response compared to pellets fabricated with the current SRL flowsheet. The objective of this program is to develop a process for producing fuel pellets with a nonuniform, microcracked microstructure similar to that found in GPHS pellets fabricated at LANSL.

Narrative

The fabrication of about 160 grams of SRL type shards intended for shipment to LANSL has been completed. These shards will be hot pressed at LANSL according to the LANSL hot press procedure as part of the alternative process flowsheet development effort.

Direct Fabrication Process (WBS 1.2.1.3)

Objective

Direct fabrication of ²³⁸PuO₂ powder feed into fuel forms would simplify production operations in the Plutonium Fuel Form (PuFF) Facility and would improve safety by eliminating a number of powder conditioning steps. Tests at SRL have shown that the key step in making direct fabrication workable is the precipitation of feed powder with the correct particle morphology. Consequently, SRL is studying different precipitation techniques in an effort to develop processing conditions that HB-Line can use to precipitate feed powder acceptable for direct fabrication.

Narrative

HB-Line has completed the Pu (III) direct-strike precipitation tests that SRL requested. Two 100 gram batches of ²³⁸PuO₂ were produced using the 2-step process, and two 100 gram batches were produced using the simplified 1-step process. The process water temperature was <21.5°C during these tests.

Examination with the scanning electron microscope indicated that the two 100 g precipitations made with the two-step process produced well developed rosettes, approximately 50 μm in diameter with some fragments of rosettes and very few fines. The size and morphology of this feed generally appears more suitable for fabrication than the " $^{242}\text{PuO}_2$ " simulant rosettes which have been successfully hot pressed in the PEF.

The first one-step Pu (III) direct-strike precipitation test produced unsatisfactory feed. This feed consisted primarily of 1 micron size particles with no indication of a rosette morphology. The size and morphology of this powder is very similar to that of ball-milled powder. The second one-step precipitation test produced a rosette morphology (~50 μm diameter), although many fragments of rosettes were also observed in the sample.

It was demonstrated in the AMF that these rosettes could be densified to >95% theoretical density by sintering to 1600°C for six hours.

Impurities in $^{238}\text{PuO}_2$ (WBS 1.2.1.4)

Objective

Sulfur and phosphorus impurities have been found at the grain boundaries of the iridium cladding of encapsulated $^{238}\text{PuO}_2$ fuel forms. These impurities are considered to be detrimental to the impact behavior of iridium. Efforts are being made at SRL to characterize the concentration and transport of these impurities in $^{238}\text{PuO}_2$.

Narrative

SRL is coordinating a program to use SSMS at ORNL to characterize phosphorus and sulfur concentrations in PuFF GPHS feed powder, shards, and pellet pieces. About 30 samples will be characterized to limit statistical uncertainties. The work is 80% complete currently, and the remaining critical portion will be completed in February. Results of these analyses will be given in the February report.

Improved Strength Fuel Forms (WBS 1.2.1.5)

Objective

A significant improvement in the impact behavior of GPHS fuel forms could lead to an increase in the safety factor of space missions that use these fuel forms. The objective of this program

is to improve the strength of GPHS fuel forms by eliminating the reoxidation-induced cracking that occurs during fabrication of stoichiometric $^{238}\text{PuO}_2$ forms in graphite dies. Two methods are being tried: (1) eliminate the carbothermic reduction of $^{238}\text{PuO}_2$ that occurs during hot pressing in graphite dies by using a non-interacting die (NID) and (2) maintain fuel forms substoichiometric after hot pressing.

Narrative

A GPHS pellet will be fabricated with a W/2% ThO_2 hot press die in the PEF during March 1981.

Helium Aging Studies (WBS 1.2.1.6)

Objective

DOE has requested that SRL participate in a coordinated effort with the Mound Facility and the LANSL to characterize the release of helium from GPHS pellets. The objective of the SRL program is to characterize the microstructure of sections of GPHS pellets that have been aged at ambient temperature for times up to 48 months and then heated at different temperatures to release stored helium.

Narrative

Metallography is in progress on 4 and 6 month aged specimens.

Safety Analyses (WBS 1.2.1.7)

Objective

SRL has the responsibility for carrying out safety analyses of both production and laboratory facilities. In addition, SRL has the responsibility for writing technical standards to ensure the safe operation of these facilities. The objective of this program is to prepare safety analyses and technical standards for facilities involved in the ^{238}Pu Fuel Form Program.

Narrative

There is no activity to report this month.

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FORM DOE 536
(1/78)

1. CONTRACT IDENTIFICATION		2. REPORTING PERIOD		3. CONTRACT NUMBER																																																																																																																					
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TABLE 3

Milestone Log for SRL Production Support Activities

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.1	Technical Support - GPHS		
1.2.1.1B	Determine centerline GPHS fuel form process conditions.	Completed 11/79	
1.2.1.1C	Establish process limits.	Completed 2/80	
1.2.1.1D	Transfer fuel form fabrication technology to the PuFF Facility.	Completed 4/80	
1.2.1.1E	Fabricate 8 centerline pellets for design verification tests at LANSL.	Completed 6/80	
1.2.1.1F	Develop technology for vacuum outgassing pellets using the hot press and transfer technology to the PuFF Facility.	Completed 7/80	
1.2.1.1H	Optimize GPHS production operations in the PuFF Facility.	Continuous	12/80
1.2.1.2	Alternative GPHS Flowsheet		
1.2.1.2A	Determine effect of variation in hot press conditions on pellet microstructural uniformity.	Completed 7/80	
1.2.1.2B	Hot press a GPHS pellet in the PEF using LANSL shards.	Completed 10/80	
1.2.1.2D	Determine process conditions for fabrication of pellets with nonuniform microstructure and modified impact performance.	6/81	1/81

TABLE 3 (Continued)

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.3	Direct Fabrication Process.		
1.2.1.3B	Test $^{238}\text{Pu}(\text{III})$ direct-strike precipitation process on small scale in SRL.	Completed 4/80	
1.2.1.3C	Fabricate full-scale GPHS pellets using simulant of $^{238}\text{Pu}(\text{III})$ direct-strike material.	Completed 8/80	
1.2.1.3D	Test $^{238}\text{Pu}(\text{III})$ direct-strike precipitation process in HB-Line.	Completed 1/81	
1.2.1.3E	Determine acceptability of HB-Line $^{238}\text{Pu}(\text{III})$ direct-strike material for fabrication of full-scale GPHS fuel forms.	10/81	2/81
1.2.1.3F	Complete HB-Line continuity tests.	2/82	2/82
1.2.1.3G	Characterize HB-Line feed.	10/82	10/82
1.2.1.3H	Initiate qualification tests at LANSL.	6/83	6/83
1.2.1.3I	Establish fuel form process limits.	10/83	10/83
1.2.1.3J	Complete qualification tests at LANSL.	12/83	12/83
1.2.1.3K	Begin production in the PuFF Facility	4/84	4/84
1.2.1.4	Impurities in $^{238}\text{PuO}_2$		
1.2.1.4A	Determine P and S concentration in production MHW materials using SSMS.	Completed 3/80	

TABLE 3 (Continued)

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.4B	Characterize P and S concentration in production GPHS materials using SSMS.	1/81	9/80
1.2.1.4C	Provide technical basis for setting impurity levels in $^{238}\text{PuO}_2$ fuel forms.	8/82	2/82
1.2.1.4D	Provide recommendations for SRP to control impurity levels in $^{238}\text{PuO}_2$ fuel forms.	10/82	4/82
1.2.1.5	Improved-Strength Fuel		
1.2.1.5B	Demonstrate feasibility of noninteracting dies (NID) for full-scale GPHS pellets.	Completed 11/79	
1.2.1.5C	Test metal die as a noninteracting die (NID) for full-scale GPHS pellet fabrication.	Completed 9/80	
1.2.1.5F	Fabricate GPHS pellets using metal NID for impact testing at LANSL.	8/81	8/81
1.2.1.6	Helium Aging Studies		
1.2.1.6A	Set aside samples for aging at ambient temperature.	Completed 6/80	
1.2.1.6B	Develop test matrix in consultation with LANSL and Mound Facility.	Completed 8/80	
1.2.1.7	Safety Analyses		

TABLE 3 (Continued)

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.7A	Complete revised SAR and revised Technical Standards for 235-F first-level storage vault.	2/81	12/80
1.2.1.7AA	Obtain Du Pont approval of revised SAR and Technical Standards for 235-F first-level storage vault.	5/81	5/81
1.2.1.7B	Complete update of PuFF SAR	6/82	6/82
1.2.1.7C	Complete update of PEF SAR	9/82	9/82

SRL CAPITAL EQUIPMENT (WBS 1.2.2)

The milestone schedule and status report for this section is given in Figure 7. The milestone log for AMF renovations is given in Table 4.

AMF Renovations (WBS 1.2.2.1)

Objective

The Alpha Materials Facility (AMF) has been in operation for more than 13 years. To ensure the continued operation of this facility, a general upgrading of the glove box trains in the AMF is essential. The objective of this program is to renovate the MM5 metallograph in the AMF in conjunction with the AMF upgrading activities being funded by other SRL programs.

Narrative

The Stainless Equipment Co. has been selected as the vendor for fabrication of the glove boxes. A purchase order for the glove boxes has been written and is circulating for approval. SRL personnel will visit the vendor in February to discuss glove box fabrication.

[illegible]

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TABLE 4

Milestone Log for AMF Renovation

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.2.1	AMF Renovation.		
1.2.2.1.A	Approval of P Work Order for Metallograph Project.	Completed 6/80	
1.2.2.1.B	Complete renovation of MM5 Metallograph.	9/81	9/81
1.2.2.1.C	Complete acceptance testing of upgraded facilities.	1/82	1/82

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