Pu-238 FUEL FORM ACTIVITIES

JUNE 1-30, 1980

Published: July 18, 1980

MASTER

DO NOT MICROFILM
COVER

Patent Status

THIS INTERNAL MANAGEMENT REPORT IS BEING
TRANSMITTED WITHOUT DOE PATENT CLEARANCE,
AND NO FURTHER DISSEMINATION OR PUBLICATION
SHALL BE MADE OF THE REPORT WITHOUT PRIOR
APPROVAL OF THE SR-DOE PATENT COUNSEL

MASTER

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

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

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

DO NOT MICROFILM
THIS PAGE

DISCLAIMER

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, mark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DPST-80-129-6

Pu-238 FUEL FORM ACTIVITIES

JUNE 1-30, 1980

Published: July 18, 1980

DPST--80-129-6

DE84 009026

NOTICE
OF THIS REPORT
It has been reproduced for the public
available copy to permit the widest
possible availability.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

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

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

page blank

FOREWORD

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.

This program is funded under B&R AE-15-20.

CONTENTS

HIGHLIGHTS	6
INTRODUCTION	7
SRP PROGRAM STATUS	9
SRP-PuFF	9
PuFF Fuel Form Production	10
SRP Capital Equipment	13
SRL PROGRAM STATUS	15
Savannah River Laboratory	15
SRL Production Support Activities	16
SRL Capital Equipment	26

HIGHLIGHTS

PuFF FUEL FORM PRODUCTION

Transition from the multihundred watt process (spheres) to the GPHS process (cylindrical pellets) is under way. Page 10

SRL PRODUCTION SUPPORT ACTIVITIES

SRL completed current commitments to supply centerline GPHS fuel pellets for encapsulation and impact testing at LASL. Page 16

A test authorization is circulating for approval to provide for vacuum outgassing of GPHS fuel pellets fabricated in the PuFF Facility. Page 16

Development of an alternative process flowsheet was initiated in the PEF. Page 17

Spark Source Mass Spectrometry analysis at ORNL confirmed that heating in oxygen is more efficient in removing molybdenum and sulfur from a $\text{PuO}_2/\text{MoS}_2$ powder blend than heating in hydrogen or argon. Page 18

SRL CAPITAL EQUIPMENT

A modification of the project for renovating the MM5 Metallograph in the AMF was approved by DOE-SR. Page 26

INTRODUCTION

DOE-HQ has requested that SR begin reporting Pu-238 fuel form activities according to the Uniform Contractor Reporting System (UCRS). This is the first report to be issued that follows UCRS guidelines.

This monthly report for Pu-238 Fuel Form Activities has two main sections: SRP-PuFF Pu-238 Fuel Form Production Processes and SRL Pu-238 Fuel Form Research and Development. The program status, budget information, and milestone information are discussed in each main section.

The Work Breakdown Structures (WBS) for this program is outlined on page 8. Program status and milestone information are discussed at the fourth level while budget information is discussed at the third level.

SRP PROGRAM STATUS

SRP-PuFF (WBS 1.1)

PuFF FUEL FORM PRODUCTION (WBS 1.1.1)

GPHS Production (WBS 1.1.1.1)

Objective

To produce 62.5 watt GPHS fuel forms for use in space and/or terrestrial energy systems.

Narrative

There were no milestone variances through June. The milestone log is shown in Table 1. The milestone schedule and status report and the contract management summary report are given on page 11.

Transition from the multihundred watt (MHW) process (spheres) to the GPHS process (cylindrical pellets) is under way. Process steps through hot processing (Cell 4) have been started and are in production. The final heat treatment step will soon be started. Removal of the MHW welder and installation of the GPHS welder in Cell 6 are in progress. No unusual problems are anticipated in completing the installation of the GPHS welder and the installation of special tools and equipment necessary to convert Cells 7, 8, and 9 to the GPHS process.

[illegible]

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

- 11 -

TABLE 1

Milestone Log for SRP Pu-238 Fuel Form Processes

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.1.1.1	GPHS Production		
1.1.1.1A	Supply 4 GPHS fueled clad (FC's) to MF (Mound Facility). (Initial Production Flight Quality Shipment in GPHS Production Program.)	7/80	7/80
1.1.1.1B	Supply 14 process certification GPHS FC's to MF, including the four in WBS 1.1.1.A.	8/80	8/80
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
1.1.1.1D	Supply 88 flight quality GPHS FC's for GPHS qualification RTG (Q-1).	6/81	6/81
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
1.1.1.1F	Supply 88 flight quality GPHS FC's for GPHS/Galileo orbiter flight RTG (F-1).	5/82	5/82
1.1.1.1G	Supply 88 flight quality GPHS FC's for GPHS/Galileo orbiter flight RTG (F-2).	9/82	9/82
1.1.1.1H	Supply 88 flight quality GPHS FC's for GPHS back-up RTG (F-3).	1/83	1/83
1.1.1.1J	Supply 88 flight quality GPHS FC's for GPHS/ISPM flight RTG (F-4).	5/83	5/83
1.1.1.1K	Supply 92 flight quality GPHS FC's for GPHS/ISPM flight RTG (F-5).	8/83	8/83
1.1.1.1L	Complete Galileo and ISPM GPHS-FC requirements, total required = 546.	8/83	8/83

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 S-1919-2	246,000 -	9/78 8/79	246,000 166,000
Heat Transfer Facility	S-1971	120,000	6/78	120,000
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	<u>65,000</u>	8/79	65,000
		521,000**		

FY-1980 Capital Equipment Funds

Total capital funds available for FY-1980 are 350,000. The following projects have been authorized.

Water Monitors	S-2199	110,000
Furnace Racks	S-2284	75,000
Minor Projects (<50,000)	S-2211	48,000

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

** Includes adjustments of 84,000 during FY-1979 and FY-1980.

SRL PROGRAM STATUS

SAVANNAH RIVER LABORATORY (WBS 1.2)

SRL PRODUCTION SUPPORT ACTIVITIES (WBS 1.2.1)

Milestone logs for this section are shown in Table 3. The milestone schedule and status report and the contract manpower summary report are given on pages 21 and 22, respectively.

Technical Support - GPHS (WBS 1.2.1.1)

Objective

SRL is developing a process flowsheet based on technology originally developed at LASL for the production of full-scale GPHS fuel forms with a uniform, nearly crack-free microstructure. The objectives of this program are to (1) determine centerline conditions and process limits; (2) transfer fuel fabrication technology to the PuFF Facility and; (3) develop technology to help optimize fuel form production operations in the PuFF Facility.

Narrative

SRL completed its commitment to supply GPHS pellets to LASL to test the impact behavior of pellets fabricated using the current SRL flowsheet. The final pellet, GPHS Pellet 31, was hot pressed and heat treated using centerline conditions of the SRL flowsheet. The pellet was integral and well formed. The pellet was successfully vacuum outgassed in the PFF hot press with a three position, iridium-lined die designed for production operations. After final gaging, the pellet was packaged for shipment to LASL.

GPHS Pellet 31 completed the commitment to ship 8 GPHS pellets to LASL. The status of these pellets is as follows: two pellets (18 and 22) have been encapsulated and impact tested, Pellet 21 was lost at LASL because of an iridium clad failure, Pellets 25 and 27 are at LASL awaiting encapsulation and impact testing, and Pellets 28, 29, and 31 have been packaged for shipment to LASL. No impact tests were run at LASL this month.

A test authorization (TA), when approved, would authorize the vacuum outgassing of all $^{238}\text{PuO}_2$ pellets in the PuFF Facility prior to encapsulation as GPHS fuel. Initially, this process operation will be performed in the PuFF hot press until an appropriate vacuum furnace capability is procured and installed. Vacuum outgassing of GPHS fuel was successfully demonstrated in the PEF hot press. Seven GPHS pellets were individually vacuum outgassed at about 1500°C for one hour. All pellets remained integral with little change in physical characteristics. In the Plutonium Experimental Facility (PEF) tests, the vacuum at temperature was about 10^{-4} torr instead of $\leq 10^{-5}$ torr as recommended by

LASL. Although the larger diffusion pump on the PuFF hot press may permit a better vacuum during production runs, control of vacuum at temperature will be done on a "best effort" basis, provided that the pressure is low enough ($\leq 5 \times 10^{-4}$ torr) to assure that there are no major air leaks into the hot press. The TA does not affect Technical Standards related to operational safety.

Metallographic examination of GPHS Pellet 30 has been completed. This pellet was fabricated using centerline conditions and vacuum outgassed for impact testing at LASL; however, it was fractured when problems were encountered with the shipping containers. Microstructural analysis of a longitudinal section of this pellet indicated that it was typical of SRL-GPHS "centerline" pellets. It had a uniform density and microstructure and only one radial surface crack (< 0.2 " long) in the section which was examined. Other pellets which have been successfully fabricated by SRL and shipped to LASL for impact testing probably had microstructures similar to GPHS Pellet 30.

Alternative GPHS Flowsheet (WBS 1.2.1.2)

Objective

DOE has requested that SRL develop an alternative GPHS fuel fabrication flowsheet for production of fuel forms with a modified impact response compared to pellets fabricated using 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 LASL.

Narrative

Powder processing was initiated to supply shards for alternative process flowsheet fabrication tests. The objective of these tests will be to produce GPHS fuel pellets with nonuniform microstructures and a modified impact response. In the first two fabrication tests, only the hot press conditions will be varied in an attempt to reproduce density variations previously observed in GPHS pellets fabricated by LASL.

Arrangements have been made with LASL to obtain both green shards and shards sintered at 1100°C and 1600°C . The sintered LASL shards will be blended and hot-pressed into a GPHS pellet in an attempt to reproduce the LASL microstructure. The green LASL shards will be used as control samples in sintering tests to compare with shards fabricated in the PEF.

Direct Fabrication Process (WBS 1.2.1.3)

Objective

Direct fabrication of $^{238}\text{PuO}_2$ 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

A letter requesting a test of the ^{238}Pu (III) direct-strike precipitation process in HB-Line has been drafted and is circulating for comments.

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

The stability of phosphorus and sulfur is being studied in PuO_2 . The study is to determine what treatments, if any, will reduce the level of these two elements below 1 ppm by weight in PuO_2 .

The first set of experiments reacted PuO_2 with MoS_2 . MoS_2 was used as a cold press die lubricant during fabrication of most MHW spheres and was suspected of being the major source of sulfur contamination. The mixture (75% PuO_2 and 25% MoS_2) was reacted in wet and dry hydrogen, argon, and oxygen at 1100°C for 1 hr. Results of preliminary Spark Source Mass Spectrometry (SSMS) analyses performed at ORNL confirmed earlier x-ray results that heating in oxygen is substantially more efficient in removing molybdenum and sulfur than heating in any of the other atmospheres.

It also confirmed that sulfur is more readily removed than molybdenum. However, the lowest sulfur level achieved in these tests was about 500 ppm.

Additional tests are planned at higher temperatures and for longer times to determine the minimum level of sulfur that can be obtained. Vacuum outgassing will also be explored.

Material is now available to begin similar tests for phosphorus doped PuO_2 .

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 $^{238}\text{PuO}_2$ fuel 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 noninteracting die (NID) and (2) maintain fuel forms substoichiometric after hot pressing.

Narrative

A full-scale metal (W-2% ThO_2) GPHS dieliner and punch set has been fabricated and delivered to the PEF. This hardware will be used to test the feasibility of an all metal NID design for fabrication of GPHS pellets.

Helium Aging Studies (WBS 1.2.1.6)

Objective

DOE has requested that SRL participate in a coordinated effort with Mound Facility (MF) and LASL 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

Half of GPHS Pellet 30 will be used for this aging study. This pellet was fabricated according to the current SRL flowsheet and was vacuum outgassed on May 20, 1980. This pellet fractured during preparation for shipment to LASL for impact testing.

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

An updated safety analysis report (SAR) and technical standards for the 235-F first-level storage vault are in preparation. These documents will increase the types of nuclear materials that can be stored in this facility and will upgrade the ability to process these materials in 235-F.

U S DEPARTMENT OF ENERGY
SAVANNAH RIVER OPERATIONS OFFICE
MILESTONE SCHEDULE AND STATUS REPORT

1 Contract Identification		SRL Production Support Activities												2 Reporting Period				3 Contract Number							
														01 June 80 through 30 June 80				1,2,1							
4 Contractor (name, address)		E. I. du Pont de Nemours and Co. Inc. Aiken South Carolina												5 Contract Start Date				6 Contract Completion Date							
7 Identification No.		8 Reporting Category (e.g. contract line item or work breakdown structure element)												9 FY				10 Percent Complete							
														FY80				FY81				FY82			
														79 O N D J F M A M J J A S O N D J F M Q3 Q4 III I12											
.1 Tech Support-GPHS		▽A ▽B ▽C ▽D ▽E ▽F ▽G ▽H																							
.2 Alt GPHS Flowsheet		▽A ▽B ▽C ▽D ▽E ▽F																							
.3 Dir Fabrication Process		▽A ▽B ▽C ▽D ▽E ▽F																							
.4 Impurities in ²³⁸ PuO ₂		▽A ▽B ▽C ▽D ▽E ▽F																							
.5 Improved Strength Fuel		▽A ▽B ▽C ▽D ▽E ▽F																							
.6 Helium Aging Studies		▽A ▽B ▽C ▽D ▽E ▽F																							
.7 Safety Analyses		▽A ▽B ▽C ▽D ▽E ▽F																							
11 Remarks																									
12 Signature of Contractor's Project Manager and Date										13 Signature of Government Technical Representative and Date															

FORM DOE 536
0/78)
VPI MODIFICATION

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

1 CONTRACT IDENTIFICATION SRL Production Support Activities													2 REPORTING PERIOD 01 June 80 THROUGH 30 June 80		3 CONTRACT NUMBER 1.2.1																																																							
4 CONTRACTOR NAME AND ADDRESS E. I. du Pont de Nemours and Co. Inc. Aiken South Carolina													5 CONTRACT START DATE																																																									
7 MONTHS O N D J F M A M J J A S													8 CONTRACT COMPLETION DATE																																																									
9 COST STATUS													TOTALS \$ 80																																																									
													10 COST PLAN DATE 11 July 80																																																									
11 ESTIMATED COSTS PRIOR TO S													12 TOTAL ESTIMATE BY COSTS FOR CONTRACT 1282																																																									
13 TOTAL CONTRACT VALUE													14 ESTIMATE FOR CHANGE OUT REPORTING PERIOD																																																									
<table border="1"> <tr> <td>15 PLANNED</td> <td>106</td><td>106</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>107</td><td>1282</td> </tr> <tr> <td>16 ACTUAL</td> <td>105</td><td>109</td><td>94</td><td>87</td><td>116</td><td>120</td><td>97</td><td>108</td><td>104</td><td></td><td></td><td></td><td>940</td> </tr> <tr> <td>17 VARIANCE</td> <td>1</td><td>-3</td><td>13</td><td>20</td><td>-9</td><td>-13</td><td>10</td><td>-1</td><td>3</td><td></td><td></td><td></td><td></td> </tr> <tr> <td>18 CUM VARIANCE</td> <td>1</td><td>-2</td><td>11</td><td>31</td><td>22</td><td>9</td><td>19</td><td>18</td><td>21</td><td></td><td></td><td></td><td></td> </tr> </table>													15 PLANNED	106	106	107	107	107	107	107	107	107	107	107	107	1282	16 ACTUAL	105	109	94	87	116	120	97	108	104				940	17 VARIANCE	1	-3	13	20	-9	-13	10	-1	3					18 CUM VARIANCE	1	-2	11	31	22	9	19	18	21					19	
15 PLANNED	106	106	107	107	107	107	107	107	107	107	107	107	1282																																																									
16 ACTUAL	105	109	94	87	116	120	97	108	104				940																																																									
17 VARIANCE	1	-3	13	20	-9	-13	10	-1	3																																																													
18 CUM VARIANCE	1	-2	11	31	22	9	19	18	21																																																													

TABLE 3

Milestone Log for Technical Support - GPHS

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.1	Technical Support - GPHS		
1.2.1.1.A	Demonstrate GPHS process in the Plutonium Experimental Facility (PEF).	Completed 3/79	
1.2.1.1.B	Determine centerline process conditions.	Completed 11/79	
1.2.1.1.C	Establish process limits.	Completed 2/80	
1.2.1.1.D	Transfer fuel form fabrication technology to PuFF.	Completed 4/80	
1.2.1.1.E	Fabricate 8 centerline pellets for design verification tests at LASL.	Completed 6/80	
1.2.1.1.F	Develop technology for vacuum outgassing pellets using the hot press and transfer technology to PuFF.	7/80	7/80
1.2.1.1.G	Test two-hole die and develop special equipment to handle it.	11/80	11/80
1.2.1.1.H	Optimize GPHS production operations in PuFF.	12/80	12/80
1.2.1.2	Alternative GPHS Flowsheet		
1.2.1.2.A	Determine effect of variations in hot press conditions on pellet microstructural uniformity.	7/80	7/80
1.2.1.2.B	Hot press a GPHS pellet in the PEF using LASL shards.	8/80	8/80
1.2.1.2.C	Complete characterization of sintering atmosphere effects on LASL and PEF green shards.	9/80	9/80
1.2.1.2.D	Determine optimum process conditions for fabrication of pellets with nonuniform microstructure and modified impact performance.	1/81	1/81

TABLE 3 (Continued)

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.3	Direct Fabrication Process.		
1.2.1.3.A	Test $^{238}\text{Pu}(\text{IV})$ reverse-strike precipitation process in HB-Line.	Completed 3/79	
1.2.1.3.B	Test $^{238}\text{Pu}(\text{III})$ direct-strike precipitation process on small scale in SRL.	Completed 4/80	
1.2.1.3.C	Fabricate full-scale GPHS pellets using ^{239}Pu simulant of $^{238}\text{Pu}(\text{III})$ direct-strike material.	8/80	8/80
1.2.1.3.D	Test $^{238}\text{Pu}(\text{III})$ direct-strike precipitation process in HB-Line.	9/80	9/80
1.2.1.3.E	Determine acceptability of HB-Line $^{238}\text{Pu}(\text{III})$ direct-strike material for fabrication of full-scale GPHS fuel forms.	2/81	2/81
1.2.1.3.F	Determine pellet production process.	1/82	1/82
1.2.1.4	Impurities in $^{238}\text{PuO}_2$		
1.2.1.4.A	Determine P and S concentration in production MHW materials using SSMS.	Completed 3/80	
1.2.1.4.B	Characterize P and S concentration in production GPHS materials using SSMS.	9/80	9/80
1.2.1.4.C	Provide technical basis for setting impurity levels in $^{238}\text{PuO}_2$ fuel forms.	2/82	2/82
1.2.1.4.D	Provide recommendations for SRP to control impurity levels in $^{238}\text{PuO}_2$ fuel forms.	4/82	4/82

TABLE 3 (Continued)

Work Breakdown Structure Number	Description	Planned Completion Date	
		Current	Original
1.2.1.5	Improved-Strength Fuel		
1.2.1.5.A	Demonstrate feasibility of noninteracting dies (NID) on a small scale.	Completed 3/79	
1.2.1.5.B	Demonstrate feasibility of noninteracting dies (NID) for full-scale GPHS pellets.	Completed 11/79	
1.2.1.5.C	Test metal die as a noninteracting die (NID) for full-scale GPHS pellet fabrication.	9/80	9/80
1.2.1.5.D	Develop noninteracting die production process for use in PuFF.	4/82	4/82
1.2.1.5.E	Demonstrate feasibility of NID - Doped Fuel Process.	9/82	9/82
1.2.1.6	Helim Aging Studies		
1.2.1.6.A	Set aside samples for aging at ambient temperature.	Completed 6/80	
1.2.1.6.B	Develop test matrix in consultation with LASL and Mound Facility.	7/80	7/80
1.2.1.7	Safety Analyses		
1.2.1.7.A	Complete revised SAR and revised Technical Standards for 235-F first-level storage vault.	12/80	12/80

SRL CAPITAL EQUIPMENT (WBS 1.2.2)

AMF Renovations (WBS 1.2.2.1)

The milestone log for this work element is given in Table 4. The milestone schedule and status report is shown on page 27.

Objective

The Alpha Materials Facility has been in operation for more than 10 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

DOE-SR approved the P Work Order, which modified Project No. S-2032 (Metallograph, AMF, Building 773-A), authorizing renovation of the MM5 Metallograph and associated facilities. This project will be carried out in conjunction with Projects S-6409 (Calcining Furnace), S-6407 (Pellet Furnace) and S-1868 (Powder Compacting Press).

Together, these projects call for the removal of 12 old contaminated glove boxes from the AMF and their replacement by 7 new glove boxes as well as the renovation of the metallograph. In addition, these projects call for the installation of a number of high temperature furnaces in the new glove box train.

[illegible]

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.	6/80	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

DO NOT MICROFILM
COVER

DISTRIBUTION

B. J. Rock, DOE, Space and Terrestrial Systems Branch, Office of
Advanced Nuclear Systems and Projects Division, NE-50,
MS B-107, GTN, Washington, DC 20545 (5)

E. W. Johnson, Mound Facility, P.O. Box 32, Miamisburg, OH 45342

A. C. Shaffhauser, Oak Ridge National Laboratory, P.O. Box X,
Oak Ridge, TN 37830

W. J. Maraman, Los Alamos Scientific Laboratory, Mail Stop 756,
Los Alamos, NM 87545

D. L. Krenz, DOE Albuquerque Operations Office, P.O. Box 5400,
Albuquerque, NM 87115

H. N. Hill, DOE, Dayton Area Office, P.O. Box 66, Miamisburg, OH 45342

J. A. Lenhard, DOE Oak Ridge Operations Office, P.O. Box X, Oak
Ridge, TN 37830

R. J. Spehalski, Jet Propulsion Laboratory, California Institute
of Technology, 4800 Oak Grove Drive, Pasadena, CA 91103

A. J. Sattolo, ISPM Project Office, General Electric Company,
P.O. Box 861, Philadelphia, PA 19101

P. J. Dick, Teledyne Energy Systems, 110 W. Timonium Road,
Timonium, MO 21093

M. J. Sires, DOE-SR (2)
R. A. Caldwell

B. L. LaMunyon, DOE-SR
W. T. Goldston

F. E. Kruesi, Wilm.

J. E. Conaway, Wilm.

J. T. Granaghan - T. Hendrix, SRP
J. L. Womack, 703-A
H. J. Groh, 703-A
E. O. Kiger, 703-A
R. S. Swingle, 703-A
R. L. Varner, 703-A
E. M. Sampson, 703-A

J. K. Brown, 704-F, SRP
R. A. Brownback, 704-F
D. R. Boyd, 235-F
L. M. Papouchado, 704-F
D. S. Duarte, 235-F
L. C. Smoak, Jr., 704-F
S. G. Bagley, 235-F

S. Mirshak, SRL
I. B. New, Jr.
R. L. Folger
S. D. Harris
R. H. Tait
D. T. Rankin

A. B. Emrich, SRL
S. W. O'Rear
F. H. Springer
M. L. Holzworth
TIS Record Copy
TIS File Copies (20)