

Monthly Progress Report
Heat Source Technology Programs

March 1995

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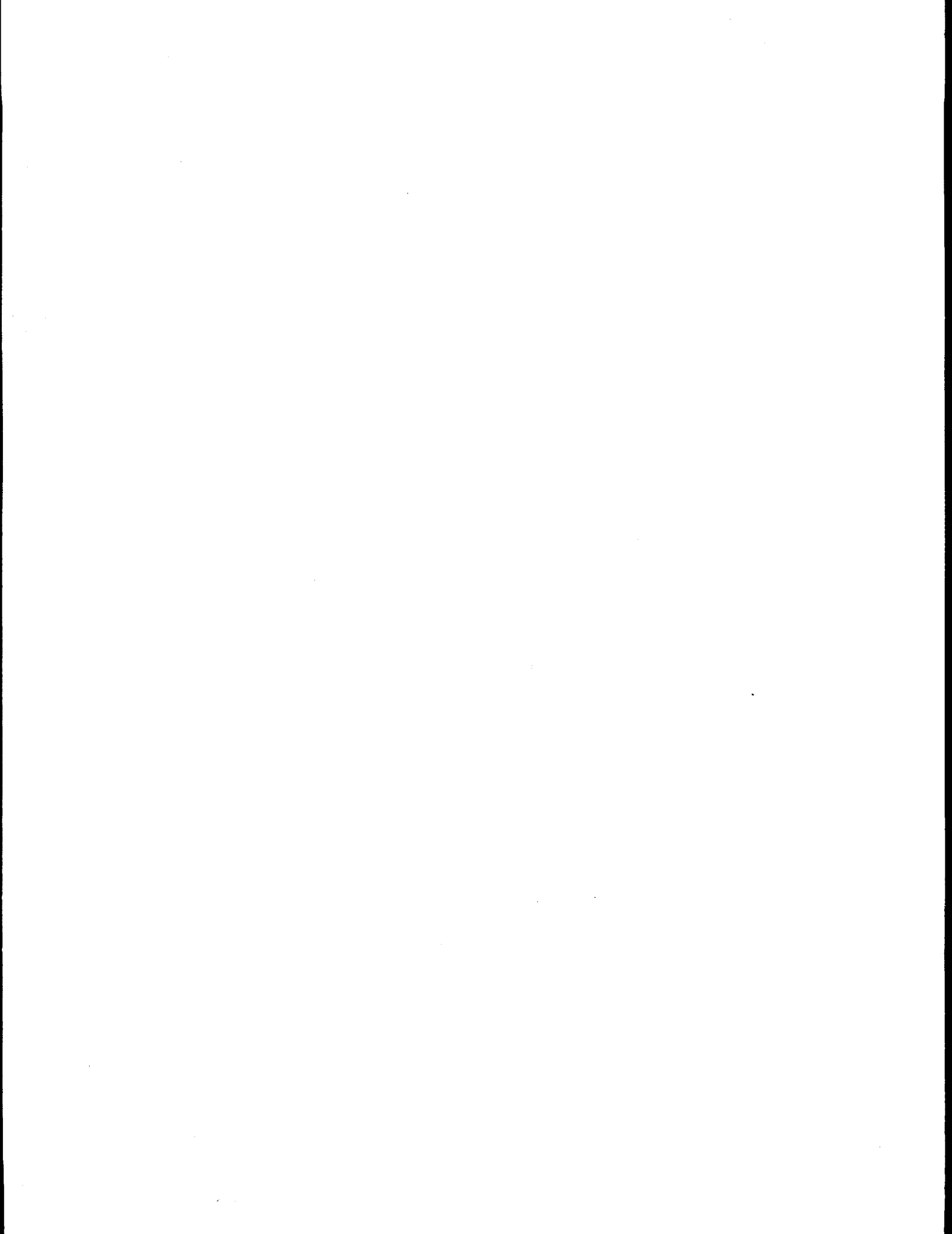
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Compiled by
L. J. Tomlinson

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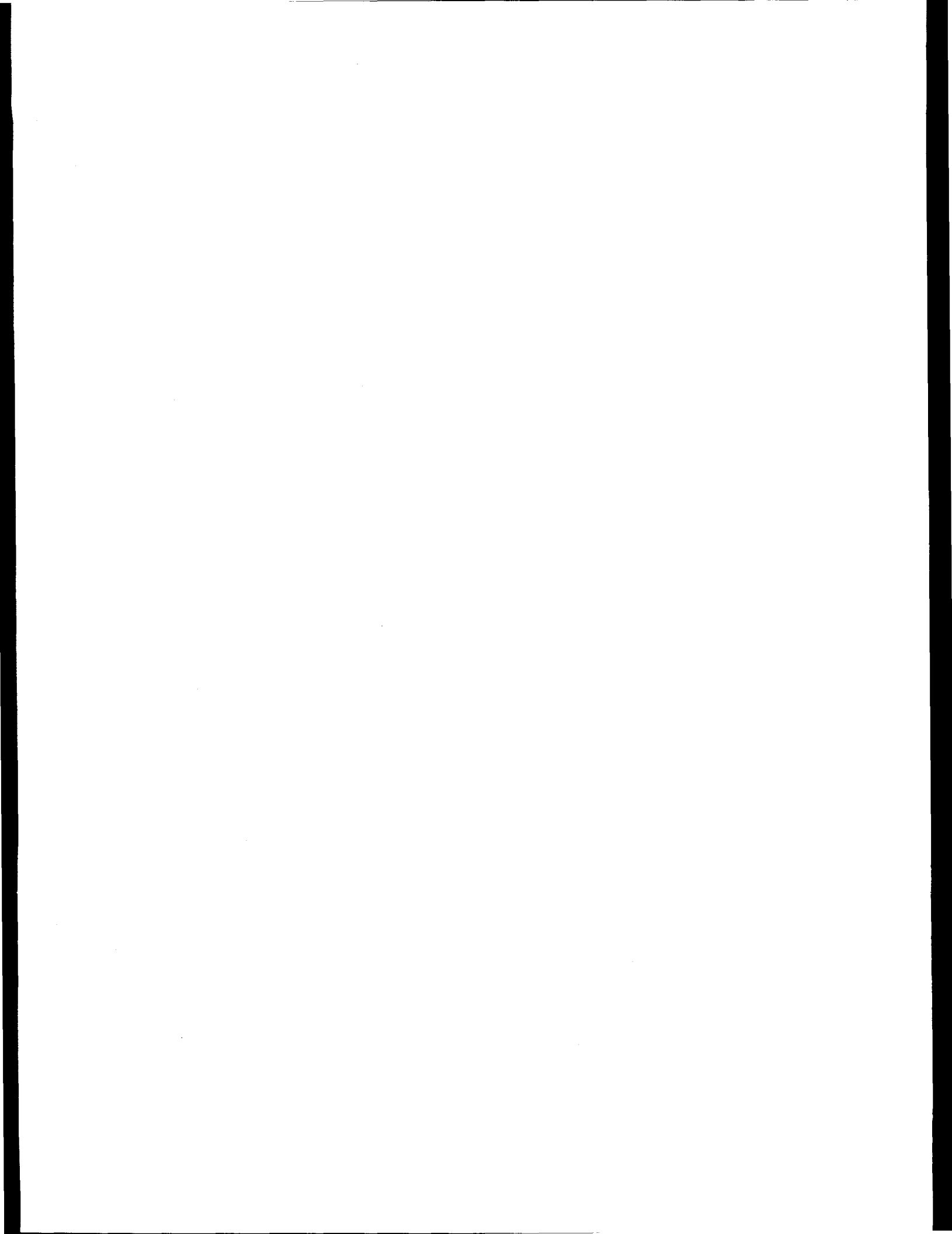
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MONTHLY PROGRESS REPORT

HEAT SOURCE TECHNOLOGY PROGRAMS

MARCH 1995

Compiled by

L. J. Tomlinson

ABSTRACT

This monthly report describes activities performed in support of Cassini fueled-clad production and studies related to the use of $^{238}\text{PuO}_2$ in radioisotope power systems carried out for the Office of Special Applications of the U.S. Department of Energy (DOE) by Los Alamos National Laboratory (LANL). Most of the activities described are ongoing; the results and conclusions described may change as the work progresses.

I. HEAT SOURCE AND FEED POWDER SHIPMENTS

Work continued throughout the month to prepare scrap fuel pellets for shipment to Westinghouse Savannah River Company (WSRC). Shipments of scrap returns and fueled clads were sent to WSRC and Mound, respectively.

At the beginning of the month, all of the items received in shipment 484 were calorimetered, and 14 (out of 15 received) were released for processing. Shipments 485 and 486 were also received and calorimetered during March.

Unpacking and calorimetry of a shipment of Russian fuel continued. By the end of the month, three of six casks had been opened.

II. IRIDIUM HARDWARE SHIPMENTS AND INVENTORY

No shipments of iridium hardware were received in this month. The LANL inventory of general purpose heat source (GPHS) hardware, as of 31 March, is shown in Table I.

Table I. LANL Inventory of GPHS Iridium Hardware as of March 31, 1995

<u>Type of Hardware</u>	<u>Category</u>	<u>Number of Items in Inventory</u>
PICS*	Prime	237
PICS	Restricted use	45
Type II weld shields	Prime	284

*PICS = postimpact containment shell.

III. FACILITIES

A. General

Radiological control technician (RCT) coverage for ^{238}Pu activities at TA-55 was generally consistent, and did not impede heat source production activities.

B. Launcher Relocation

1. Construction Activities

Mechanics relocated the bridge crane stop. Electrical power for the bridge crane, dumbwaiter, and lighting was extended into the launcher room. Power was also connected to the supervisory control system in the control room.

Work continued on the gas system in the control room, and on control elements for the chilled water system and breech gas system in the launcher room.

The supply line for ductwork in the addition was extended to the main intake for the facility. The intake sleeve to connect the PF-4 building air supply to the launcher supply duct was fabricated and a 14-in. core drill for penetrating the building supply stack was ordered.

Procedure specifications for conducting the leak test on the pressure doors were determined. Most of the crash hardware was ready for installation.

2. Design Activities

The seal design for the ducts running through the addition wall was revised. Wire for the digital control wiring, and details for the analog RS-232 wiring were approved by the architectural and engineering (A&E) contractor.

3. Procurements

Work continued on procuring materials to give the main work platform a one-ton forklift capacity. Material for the air intake sleeves on the HVAC system was received. Isolation dampers for the centrifugal fans were ordered.

An oxygen analyzer was ordered for placement inside the launcher room and was scheduled for delivery in early April. The analyzer will be monitored both inside the launcher room and over the supervisory control system. A load test was conducted on the launcher lifting yoke; posttest nondestructive inspection was expected to begin in the first week of April.

4. Administrative Activities

Work with facility configuration control on the facility startup plan was initiated. The role of the operating group will be the extensive checkout of the launcher control system and several test shots. Several refined drafts on chapters for the launcher facility SAR were received for editing and comments. A contractor was provided with details of impact test operations to be incorporated into a draft of the design basis accident. A final draft of the facility safety analysis was received and edited. Work on the launcher manuals for TA-55 and TA-35 continued. Personnel continued to work on facility construction documentation.

C. TA-35 Launcher Facility

The TA-35 procedure manual is in review and was given to the LANL readiness assessment (RA) team. The LANL RA team wrote an implementation plan and initiated their assessment. DOE/AL received authorization to conduct an RA of the operation.

The in-line filter in the muzzle room exhaust was replaced and a filter efficiency test was performed. Results of efficiency tests on the 2-stage filter train in the exhaust system were also received. Two projectile assemblies for plutonia fueled half modules and the standard inner catch tubes associated with these projectiles, were built. A projectile assembly for a simulant-fueled full module impact was also fabricated

IV. GENERAL-PURPOSE HEAT SOURCE (GPHS) PROGRAM

A. Cassini Fueled-Clad Production

Ten fuel lots were introduced into the glove box line during March. Additional fuel introductions were constrained by the need to avoid exceeding area limits for special nuclear material (SNM). A summary of Cassini production to date is presented in Table II.

B. Production Support Activities

1. Fueled-Clad Weld Evaluation

Metallography on GPHS girth welds rejected by UT continued. Capsule FC0024 was successfully defueled; the pellet was submitted for reencapsulation in a subsequent weld campaign. Grinding and polishing was initiated on weld sections removed from the FC0024 girth weld and on a section from an example weld fabricated during a recent weld campaign. As-polished weld sections from capsules FC0053 and FC0075 were examined and photographed.

2. Fueled-Clad Ultrasonic Test (UT) Development

Ultrasonic testing on all fueled clads from the mid-February weld campaign was completed. B-scans from FC0071, FC0076, FC0080, FC0081, and FC0089 were sent to ORNL. An additional three fueled clads were sent for radiography.

Table II. Cassini Production as of 31 March, 1995

<u>Activity</u>	<u>Number of Units</u>
GPHS	
Clads shipped to EG&G MAT*	29
Clads designated for other uses	12
Clads welded to date	94
Fuel pellets pressed to date	111
LWRHU	
Capsules shipped to EG&G MAT	0
Capsules welded to date	0
Fuel pellets pressed to date	180

*EG&G Mound Applied Technologies

3. Evaluation of Pellet GF-47

Ceramography of GF-47 continued. A fragment of the pellet was mounted in epoxy, polished, examined, and photographically documented.

C. Safety Test Program

1. End-on RTG Impact Tests

Films documenting the final conceptual test for the end-on impact tests were reviewed. The proposed coverage was expected to work well for the actual tests. A video that documented the final conceptual test was sent to Martin Marietta Aerospace (MMAS), and a Quick-Look report that described the test was issued in early March.

We continued to make progress in the design and operation of a module-stack furnace that will be used for the end-on impact tests. Furnace temperatures in excess of 1200°C were achieved.

Thermal drop tests to determine the cooling rate of a heated module stack were completed this month. The first thermal profile test gave temperatures of 1214°C (module #1), 1207°C (module #5), and 1158°C (module #9). During the first tests, the converter housing latches did not actuate, apparently due to thermal expansion of the stack. The longitudinal stack dimension of the cold assembly and results of furnace thermal profile tests were supplied to MMAS so they could calculate the required gap under the tie rod. It was later determined that the latch problem was related to the length of one of the stack components.

During the thermal drop tests it was apparent that the cooling rate of the module stack was acceptable. Approximately two minutes elapsed between opening the furnace door and the temperature of the stack dropping to 1090°C. Temperature and elapsed time data, for modules 1, 5, and 9, were reported to MMAS. The final Launch Safety Verification Test Plan was also transmitted to MMAS.

Direction for simulant encapsulation was received from DOE/NE-53, and a number of uranium pellets were encapsulated.

The test platform, furnace, and test equipment were transported to SNL and set up over the track. During a thermal drop test on March 21, one of the rods supporting the test stack broke, and the stack dropped a short distance into the converter. The converter housing latches actuated and thermal data continued to be collected. No significant damage to the module stack was discovered during a subsequent inspection.

The engineering test was successfully conducted on March 23. The first end-on RTG impact test was scheduled for mid-April.

2. Side-on RTG/Fragment Tests

A side-on conceptual test was conducted in the first week of January. During the test, the aluminum fragment dislodged from the rocket sled at a sled velocity of approximately 182 m/s. Posttest analyses suggested that aerodynamic forces acting on the aluminum fragment pulled it out of the hold-downs attached to the rocket sled. Additional work on side-on fragment impacts was postponed, pending programmatic guidance regarding tradeoffs between more robust fragment hold-downs and fragment release mechanisms.

D. Research and Development

1. Cold Process Verification (CPV) Tests

Mound personnel identified graphite hardware with simulated ablation for the CPV-12 module impact test. Uranium pellets for the module were encapsulated, and the module was assembled.

2. High-Silicon Fuel Study

GIS A and B: GIS A (FC0007 and FC0010) was loaded into a half module that had been machined to simulate reentry ablation, and will be impact tested at a future date. By 31 March, GIS B (FC0006 and FC0008) had been in the aging furnace for 93 days. The furnace pressure was 1.2×10^{-8} torr and the GIS surface temperature was 1412°K. The scheduled date for GIS removal from the furnace is September 23.

GIS C and GIS D: The module containing GIS C (FC0019 and FC0026) and GIS D (FC0033 and FC0035) was removed from the MRMF chamber after 54 days and placed in an aging furnace. By the end of the month the GIS had been in the furnace for 17 days. The furnace pressure was 5×10^{-9} torr and the module surface temperature was 1347°K. The scheduled date for module removal from the furnace is December 9, 1995 (270 d) unless otherwise directed by DOE.

3. Evaluation of Q-1 Heat Sources/Graphitics

The evaluation of heat sources and graphitic components removed from the Q-1 radioisotope thermoelectric generator (RTG) continued throughout the month.

Prints of metallographs taken of vent and weld sections from capsules FC060 and FC220 were forwarded to Lamb Associates for review. The results of their initial examination agreed with preliminary LANL findings. The vent sections were normal in appearance. No foreign material or deposits were observed in the frit or central vent hole in either vent. The average grain sizes for weld sections on both vent sets compared favorably with the CPV test series data, as did the average thickness of the welded area.

Spectroscopic analyses were obtained from half of the floating membrane in each Q-1 GIS (Table III). The remaining half of each membrane was mounted for SEM/EDS examination. Preliminary SEM/EDS results on GIS 1 (contained FC220) indicate the presence of silicon on the membrane surface and in the interior at a depth up to 0.5 mm.

Table III. Spectroscopic Analyses of Floating Membranes from Q-1 GISs

Element (ppm)	GIS 1 (FC220)	GIS 2 (FC060)
Silicon	550	425
Aluminum	25	30
Calcium	30	30

E. Project Management

Primavera updates were received from Orbital Sciences Corporation (OSC). The status reports for Cassini and the 60-watt program were submitted on schedule.

HS-NMT9-PP-3-R07, "Feed Introduction Procedure" was distributed for review on March 10, in accordance with the IWA, requesting response by COB March 24. No response had been received by the end of the month.

RHU-NMT9-PP-4-R02, "LWRHU Fueled Clad Welding" signed document review requests, and the completed change request were sent to Mound in accordance with the Interface Working Agreement, on February 28 with request for disposition by March 17. No response had been received by the end of the month.

V. LIGHTWEIGHT RADIOISOTOPE HEATER UNIT (LWRHU) PROGRAM

A. LWRHU Weld Development

Installation of the EG&G moisture analyzer on the LWRHU weld glove box was completed. After discovering wiring problems with the optical encoder for the weld fixture, a second optical encoder was delivered and installed midmonth.

B. LWRHU Production

Preparation of the Cassini LWRHU fabrication report was started the first week of March. The report is essentially complete for the fuel processing and pellet fabrication activities, but cannot be completed until the fueled clads are welded, NDT has been completed, and the aeroshells have been assembled.

VI. PROGRAMMATIC MEETINGS AND VISITORS

Quality assurance personnel from Westinghouse Nuclear and Advanced Technologies Division (WNATD) and DOE/NE were on-site at various times throughout the month.

In the last week of March LANL staff attended the Cassini monthly status review at DOE.

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