GA-A15840

MASTER

**US/FRG UMBRELLA AGREEMENT
FOR COOPERATION IN GCR DEVELOPMENT
FUEL, FISSION PRODUCTS AND GRAPHITE
SUBPROGRAM**

**QUARTERLY STATUS REPORT
FOR THE PERIOD
JANUARY 1, 1980 TO APRIL 1, 1980**

**by
T. D. GULDEN**

**Prepared under
Contract DE-AT03-76ET35300
for the San Francisco Operations Office
Department of Energy**

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PREFACE

This report describes the status of the cooperative work being performed in the Fuel, Fission Product and Graphite Subprogram under the "HTR IMPLEMENTING AGREEMENT" of the United States/Federal Republic of Germany Umbrella Agreement for Cooperation in GCR Development. The status is described relative to the commitments in the "Subprogram Plan for Fuel, Fission Products and Graphite," Revision 1, March 1980. The work described is performed in the HTGR Base Technology Program at Oak Ridge National Laboratory and the HTGR Generic Technology Program at General Atomic Company.

The requirement for and format of this Quarterly Status Report is specified in the "HTR IMPLEMENTING AGREEMENT" Procedures for Cooperation.

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1. STATUS SUMMARY

The status of progress on the major milestones, as defined in the Subprogram Plan, for the second quarter of FY-80 is summarized in Table 1. The status of the work in each of the Work Breakdown Structure (WBS) elements of the Subprogram is described in the following sections (see Appendix A for the Subprogram WBS). Most of the work is on schedule and there are no major problems. However, the dates for two of the milestones (1-4-4 and 3-1-1) shown in the Subprogram Plan were in error, in one case because the Project Work Statements had not been updated. All of the Project Work Statements will be reviewed and updated as required in the next two quarters.

2. SIGNIFICANT PROBLEMS

There are currently no major problems with the cooperation in this Subprogram. However, the work on several of the Project Work Statements has been delayed substantially from the original plan. This has generally been due to changes in program directions, priorities, or budgets. However, in some cases problems in communication have been at fault, and in one case (FD13) the difficulty of international shipment of irradiated fuel was at fault. A general update of the milestones in the Project Work Statements will provide a basis for monitoring and controlling further schedule slippages.

Table 1. Milestone* Status for the 2nd Quarter of FY-80.

<u>Milestone</u>	<u>PWS</u>	<u>Due Date</u>	<u>Resp. Party</u>	
FUEL DEVELOPMENT				
1-4-4 Ship KFA Zuchtperle to GA	FD14	3/80	KFA	Due date should have been shown as 5/80
GRAPHITE DEVELOPMENT				
3-1-1 Report results from capsules HTK-4 and HTU-1	GD1	3/80	ORNL	A change in the capsule schedule resulted in the following revised milestones: <ul style="list-style-type: none"> o Data analysis for HTU-1 to be completed in May o HTK-4 data analysis to be completed in November
3-1-2 Prepare proposed revision of PWS-GD1	GD1	3/80	KFA	Revision prepared by ORNL - to be sent to KFA
3-1-3 Begin irradiation of 300°C capsule in HFR Petten	GD2	3/80	KFA	Formal notification not yet received, but work was on schedule in February
3-1-5 Start creep capsule in HFR Petten	GD4	3/80	KFA	Formal notification not yet received, but work was on schedule in February

* Milestones taken from Table 4-1 of the "Fuel, Fission Product and Graphite Subprogram Plan."

3. STATUS OF COOPERATION

1. FUEL DEVELOPMENT

1-1 Fuel Irradiation Tests

There are three active Project Work Statements in this Work Breakdown Structure (WBS) element: PWS-FD4, PWS-FD5, and PWS-FD15 (see Appendix B for titles).

PWS-FD4 and FD5 are FRG responsibility. They involve completion of the postirradiation examination of previously completed cooperative irradiation tests on HEU fuel in the Studsvik Reactor (R2-B1) and in the DRAGON Reactor (DRGB2), respectively. Both are to be completed by April 1980. This represents a substantial delay from the original schedule as a result of the low priority in the FRG program.

A joint irradiation test (R2K13) in the Studsvik Reactor is planned under PWS-FD15. The capsule schedule was delayed approximately one year due to the FRG decision to adopt the LEU fuel cycle. Work is now on schedule for insertion of the capsule in April 1980. KFA has agreed to GA's proposed startup and operation procedure. A GA representative (W.J. Kovacs) will visit KFA and Studsvik in May to attempt to expedite receipt of additional required information. The R2K13 capsule is particularly important to the US program in that it is the only large scale test of a candidate LEU/Th fuel to be performed in the near future.

Additional possibilities for cooperation in the area of fuel irradiation testing will be explored during the visit of W.J. Kovacs to KFA in May.

1-2 Fuel Process Development

There are currently no Project Work Statements in this WBS area. However, it was agreed to emphasize the development of co-operation in this area during the next Subprogram Manager meeting in San Diego in September. Toward this end Dr. H. Huschka from Hobeg will attend the Subprogram Manager meeting.

1-3 Fuel Design Data and Specification

The table of contents of the GA Fuel Design Data Manual was sent to KFA as a possible precursor to the exchange of the entire manual for the KFA document "Daten und Technologien des HTR Brennstoffkrieslaufs" (HTR Fuel Cycle Technology and Data). It may be possible to develop a common format for the presentation of design data, and to some extent to agree on common data.

An attempt will be made to develop cooperation in the area of fuel specifications during the visit of W.J. Kovacs to KFA and Hobeg in May.

1-4 Pre and Postirradiation Characterization

There are six active or proposed Project Work Statements in this WBS area (FD9, FD10, FD12, FD13, FD14, FD20).

It was agreed in the last Subprogram Manager meeting to delay the KFA work on FD9 (FRG lead) by about one year to allow the limited manpower and equipment to be devoted to higher priority work on FD10. Since FD9 is devoted to an advanced coating type (silicon carbide alloyed pyrocarbon) and FD10 is devoted to characterization of the SiC coating, this is appropriate. Several revisions of PWS-FD10 have been proposed; and we are close to agreement on a final draft.

Both FD12 and FD13 are under ORNL cognizance. They involve evaluation of the permeability of BISO particles and comparison of PIE techniques (IMGA and PIAA) for failed fuel detection, respectively. The work on these PWS's has been delayed significantly due

to shipping problems, communication problems, and equipment limitations. These problems have underscored the difficulties involved in cooperation that requires the shipment of irradiated fuel and that involves mutually interdependent experiments. However, the work performed under these PWS's remains valuable and is being continued. The Project Work Statements will be updated to reflect current schedules and work scopes by the next Subprogram Manager meeting.

The work on FD14 is essentially on schedule. This work is particularly important in the calibration of the gamma spectroscopic examination of the surveillance and test fuel elements from Fort St. Vrain.

FD20, coated particle analysis by IMGA, is in the draft stage. It will be considered in the next Subprogram Manager meeting.

1-5 Fuel Design, Performance Assessment and Modeling

There are three active Project Work Statements in this WBS area (FD8, FD11, FD18). Work on the TRISO particle stress model under FD8 and on fuel performance in accident conditions under FD11 is proceeding on schedule for FY-80. However, the Project Work Statements need to be finalized.

It is expected that PWS-FD18 will be terminated, due to its limited scope, and the cooperation continued on an information exchange basis.

2. FISSION PRODUCT BEHAVIOR

2-1 Fission Product Release and Transport

There are two active Project Work Statements in this subprogram area (FP1 and FP2). ORNL has completed the reports on tritium and carbon-14 distributions committed in FP1. The PWS will be updated to reflect a delayed schedule.

The work to prepare a format for a fission product data book under FP2 is on schedule.

2-2 Methods Verification

Work in this area cannot proceed until KFA provides the revised draft of FP3. This is committed in July 1980.

3. GRAPHITE DEVELOPMENT

3-1 Irradiation Testing

There are four Project Work Statements in this WBS area, one under ORNL lead (GD1), two under KFA lead (GD2 and GD4), and one under GA lead (GD9). The first milestone shown for GD1 in the Subprogram Plan (3-1-1) is in error as discussed in Section 4. The data analysis for HTU-1 is on schedule for completion in May 1980. The Project Work Statement has been updated by ORNL to reflect these changes. The changes will be communicated to KFA.

We expect to be informed via the FRG Quarterly Report for this Subprogram area as to the status of GD2 and GD4. As of the Subprogram Manager meeting in early February, they were on schedule.

Execution of GD9 is contingent on the FY-81 budget at GA being sufficient to proceed with capsule OG-6. As a necessary precursor, capsule OG-5 is being irradiated during FY-80.

3-2 Characterization of Properties

There are four Project Work Statements in this WBS area. Three of these, GD6, GD10, and GD11, involve oxidation and the effect of oxidation on strength. Work on all of these is proceeding on schedule. The fourth PWS in this area (GD12), involving the development of strength acceptance tests, is also on schedule.

3-3 Graphite Design Data and Specification

Exchange of the GA Fuel Design Data Manual, which contains graphite as well as fuel and fission product data, with KFA could lead to cooperation in the development of design data.

3-4 Performance Assessment, Modeling and Verification

Two Project Work Statements (GD3 and GD5) have been completed in this WBS area. One additional PWS (GD13), involving cooperation in the analysis of a KFA experiment to help verify stress analysis methods, has been proposed, but agreement has not yet been reached. KFA has committed to providing a revised proposal in September 1980.

3-5 Control Materials

No cooperation is anticipated in the near term in this WBS area. The US program is not funded in FY-80 and is not expected to be funded in FY-81.

4. PROGRAMMATIC CHANGES

Two milestones listed on Table 4-1 of the Subprogram Plan are in error. There was apparently a typographical error in milestone 1-4-4. The due date should read 5/80 rather than 3/80. Milestone 3-1-1 should read "Complete Data Analysis from Capsule HTU-1" due 8/80. This error arose because the PWS had not been updated to reflect the current capsule schedule.

5. REPORTS EXCHANGED

A system is being established at General Atomic to ensure that Quarterly and Semiannual Report and program planning documents are sent to KFA on a regular basis.

Reports Sent to KFA in the Current Quarter

1. HTGR Base Program, Monthly Progress Report for January 1980,
F.J. Homan, Program Manager, ORNL/GCR/B-80/1.
2. HTGR Base Program, Monthly Progress Report for February 1980,
F.J. Homan, Program Manager, ORNL/GCR/B-80/2.
3. HTGR Base Program, Monthly Progress Report for March 1980,
F.J. Homan, Program Manager, ORNL/GCR/B-80/3.

Reports Received from KFA in the Current Quarter

1. "Arbeitsprogramm 1980 - Themenlist HBK Project," (1980).
2. "Gammasspektrometrische Ergebnisse," Tech. Note IRW-TN-6/80
by W. Kühnlein, et al.
3. "Bestrahlungsexperiment - Information," HBK Project (1980).
4. "Notes on Visit of Dr. E.H. Voice at KFA Jülich from 1/30 to
2/1/80," Nablieck, (1980).
5. "Berichte der Österreichischen Studiengesellschaft für
Atomenergie Ges. m.b.H.," Seibersdorf Report SGAE Ber. No.
A0108, CH-262/80, (Feb. 1980).
6. AVR Third Quarter Report for 1978.
7. Potential der Thorium-Nutzung im Hoch Temperature Uranverbrauch
und Koster Langfristiger HTR-Strologien im Vergleich Zu LWU
und SBR.

6. CONCLUSIONS AND RECOMMENDATIONS

The cooperation in the Fuel, Fission Product, and Graphite Subprogram is proceeding well. There are no major problems at the present time. However, a general review of the Project Work Statements, to update work scopes and milestones, is needed in order to provide a better basis for monitoring the progress on the cooperative program. This will be done during the next two quarters, and incorporated into the next update of the Subprogram Plan.

Systems for the regular exchange of documents are being established, but are not yet fully operational.

APPENDIX A

WORK BREAKDOWN STRUCTURE

APPENDIX B LISTING OF ACTIVE PROJECT WORK STATEMENTS

		Lead Org.	Status
1.	FUEL DEVELOPMENT		
1-1	<u>Fuel Irradiation Tests</u>		
FD4	Postirradiation Examination of Accelerated Capsule Test R2-B1 & Evaluation	KFA	In progress
FD5	Postirradiation Examination of Real-Time LHTGR Qualification Test DR-GB2 with Large Size Specimens	KFA	In progress
FD15	Cooperative Fuel Element Irradiation Test of GA & HBK Fuel	KFA	In progress
1-4	<u>Pre and Postirradiation Characterization</u>		
FD9	Testing of GA & KFA Particles with Improved Coatings	KFA	Delayed 1 year
FD10	Characterization & QC Techniques for SiC Coatings	KFA	PWS being finalized
FD12	Quantification of Irradiation Induced Permeability in PyC Coatings	ORNL	In progress
FD13	Comparison of US & FRG Postirradiation Examination Procedures for Measurement of Statistically Significant Failure Fractions for Irradiated Coated Particle Fuel	ORNL	In progress
FD14	Gamma Spectroscopic Examination of HTGR Fuel Elements	GA	In progress
FD20	Coated Particle Analysis by IMGA	ORNL	PWS being finalized
1-5	<u>Fuel Design, Performance and Modeling</u>		
FD8	Develop Common Basis for the Mechanical Design of Particle Coating	GA	In progress
FD11	Testing of GA & HBK Fuel Under Hypothetical Accident Conditions	GA	In progress
FD18	Fuel Chemical Performance Modeling	ORNL	Cancellation considered
FD19	Critical Evaluation of Fuel Performance Data	KFA	PWS being developed
2.	FISSION PRODUCT BEHAVIOR		
2-1	<u>Fission Product Release & Transport</u>		
FP1	Analysis of H-3 & C-15 Transport & Distribution in HTR Primary Circuits	ORNL	In progress
FP2	Fission Product Data Handbook	GA	In progress
2-2	<u>Methods Verification</u>		
FP3	Verification of Fission Product Design Methods & Codes	GA	PWS being finalized
3.	GRAPHITE DEVELOPMENT		
3-1	<u>Irradiation Testing</u>		
GD1	KFA Graphite Irradiation Experiment in HFIR at Oak Ridge	ORNL	In progress
GD2	Irradiation of GA Side Reflector Graphite in HFR Petten	KFA	In progress
GD4	Continuation of Graphite Creep Test in HFR Petten	KFA	In progress
GD9	Irradiation of KFA Side Reflector & Core Support Graphites in ORR	GA	Pending resolution of US program
3-2	<u>Characterization of Properties</u>		
GD6	Characterization of Core Support Graphites for Oxidation Rate & Effects	GA	In progress
GD10	Study of the Oxidative Strength Loss of KFA Core Support Graphite ASR-1R	ORNL	In progress
GD11	Characterization & Evaluation of KFA Core Support Graphite ASR-1R for Oxidation Characteristics	GA	In progress
GD12	Characterization of Core Support Structure Graphites for Acceptance/Rejection Strength Test in Purchase Specifications	GA	In progress
3-4	<u>Performance Assessment, Modeling and Verification</u>		
GD13	Verification of Stress Calculational Methods	GA	PWS being prepared

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