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Fuel Behavior Research

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H P Pearson by [signature]
H. P. Pearson, Supervisor
Information Mgmt.
EG&G Idaho, Inc.

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

INTERIM REPORT

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for U.S. Nuclear Regulatory Commission

CLOSEOUT REPORT OF THE PBF RELOAD CORE PROJECT

R.W. MARSHALL JR.

August 1978

EG&G Idaho, Inc.

IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1570

TFBP-TR-288

CLOSEOUT REPORT
OF THE
PBF RELOAD CORE PROJECT

Approved:

R. W. Marshall/RLB

R. W. Marshall, Jr., Manager
PBF Design and Fabrication Division

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Thermal Fuels Behavior Program

TFBP-TR-288

for U. S. Nuclear Regulatory Commission

CLOSEOUT REPORT

OF THE

PBF RELOAD CORE PROJECT

by

R. W. Marshall, Jr.

August 1978

Thermal Fuels Behavior Program
EG&G Idaho, Inc.
Idaho National Engineering Laboratory

ABSTRACT

The PBF Reload Core was to produce, under continuous steady state conditions 50 MW of power in the driver core. This would provide sufficient neutron flux to permit testing of moderate sized clusters (~25 rods) of low enriched rods in the PBF reactor. Critical heat flux tests on electrically heated simulated core rods showed that this performance could not be achieved. Primarily, because of this, the project was terminated. This report presents a short history of the Reload Core project and identifies where the records and documentation from this effort are located and how they can be retrieved.

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TABLE

CLOSEOUT REPORT OF THE PBF RELOAD CORE PROJECT

1. HISTORY

Agreement was reached in the December 1975 - January 1976 time period between NRC, ERDA[a] and Aerojet Nuclear Co.[b] to proceed with the design and construction of what was to be known as the Reload Core for the Power Burst Facility (PBF). This core was to use fuel rods of the same outside diameter, rod spacing, and canister configuration as used in PBF's present burst core. Fuel was to be uranium dioxide and no thermal insulators were to be used on the inside of the cladding. The steady state power output of the Reload Core was to be 50 MW. This increased core power would permit testing larger fuel rod bundles with lower enrichments in the PBF reactor, while the use of an identical mechanical configuration in the core would reduce turnaround time from the burst core to the steady state core. Use of the same mechanical configuration also minimized project costs and shortened schedules.

Aerojet Nuclear Co. proceeded with the Title I and Title II designs of the Reload Core and in June 1976 issued the PBF Reload Core Preliminary Proposal, TR-854, which set forth a preliminary definition of the reload core. This report defined the scope of the project with preliminary estimates of cost and schedule. The report also summarized the engineering work that had been done up to this point.

Two potential problems had been identified in the spring of 1976: Galvanic corrosion between the zircaloy-4 fuel rod cladding and

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[a] Energy Research and Development Administration was the Predecessor to the Department of Energy.

[b] Predecessor to EG&G Idaho, Inc. as the principal Idaho National Engineering Laboratory operating contractor.

the aluminum canister with possible deleterious hydriding of the zircaloy; and the possibility that because of the close fuel rod spacing and low water pressure, the critical heat flux (CHF) might be significantly lower than predicted by existing correlations developed for pressurized and boiling water reactors. Two studies were undertaken to resolve these potential problems. The results of the zircaloy corrosion study, which showed that hydriding of the zircaloy was negligible, are set forth in An Aluminum-Zircaloy Galvanic Couple In Reactor Water, NUREG/CR-0284, TREE-1169 (August 1978). The results from the CHF tests are set forth in Critical Heat Flux Tests of a Simulated Power Burst Facility Rod Bundle, NUREG/CR-0260, TREE-1170 (August 1978). The tests showed that CHF would occur in the Reload Core at significantly lower power levels than predicted by existing CHF correlations. The impact of this finding is discussed later in this report.

The specification for the fuel rods was released in July 1976 and the request for proposal was sent to five prospective bidders on August 20. Four of the five potential bidders dropped out of the bidding, leaving Exxon Nuclear Co. as the sole bidder. Their proposal was transmitted to EG&G Idaho, Inc. on December 4, 1976 and was between 1.5 and 2 million dollars higher than had been budgeted by the project. This impact will also be discussed later.

As part of the overall Reload Core project, two one-quarter-inch thick wall in-pile tubes were to be fabricated. A contract was let on April 20, 1976 to the Wyman Gordon Co. for three Inconel 718 forgings (the third forging was a spare) from which these tubes were to be machined. The first of the forgings was delivered to EG&G Idaho on January 26, 1978.

In September of 1976, the project management started a detailed cost and scheduling effort in parallel with the ongoing detailed design work. It was felt that the Preliminary Proposal figures for both cost and schedule were overly optimistic and that realistic

numbers based on the experience gained during detailed design work should be developed as rapidly as practical. This effort was completed in January 1977. However, during the fall of 1976, as a result of the engineering effort that was underway, several problems surfaced; they were (a) the inadequacy of the control rod cooling system, (b) inadequate control rod reactivity worth, and (c) inadequacy of the poison injection system.

The inadequacy of the control rod cooling system could be resolved by rebuilding the control rod cooling air system to provide increased air flow, or by the use of water cooled control rods. No technical problems were identified in resolving this deficiency; however, its resolution would increase costs significantly. The cost increase was estimated at between $300,000 and $500,000.

Resolution of the control rod worth problem presented both technical and cost problems. Two materials were considered to be suitable for the control rod poison sections, titanium hydride and boron carbide. If titanium hydride were used, its potential disassociation had to be addressed in addition to the fact that there was no literature or uses similar to the proposed use of the material. If enriched borbon carbide were used, there would be a significant cost and schedule impact. Work to resolve this problem and to investigate the use of such materials as hafnium was underway in December 1976 and January 1977.

A review of the poison injection system showed that it was undersized and would have to be enlarged to meet the needs of the Reload Core. Cost and schedule impact of this change, which had not been included in the Preliminary Proposal, was never determined.

On December 8 and 9, 1976, a major status review of the Reload Core was held with NRC and ERDA. EG&G presented information on the project status. The minutes and findings of the review, as seen by D. A. Hoatson of NRC Washington, are set forth in Appendix A.

At the NRC midyear review (January 25, 1977) in Washington, a summary of the status of the Reload Core was presented. Key points were:

1. Power from the core would be significantly less than the specified 50 MW, probably about 37 MW. This was because of the low CHF determined in the Columbia University tests.

2. A need to increase the control rod worth. While presenting technical problems, the main problems would be an increase in cost and a probable extension of the schedule.

3. High fuel costs and a long delivery schedule. A review of the Exxon Nuclear Co. proposal indicated that some cost reductions could be made, but the total costs would still be approximately one million dollars higher than budgeted. Additionally, the delivery schedule would push availability of the Reload Core out well beyond the desired date.

4. Identification of significant additional engineering tasks that were identified in the Preliminary Proposal Report. Typical of these new tasks were the need for additional cooling air for the control rods and the need for a larger poison injection system.

5. A large increase in estimated engineering costs to perform the work based upon the September to January 1977 planning effort. An audit of these cost estimates was proposed but was not undertaken because of the termination of the project. The estimated costs and schedules developed are filed in the project manager's file (See Appendix C).

On February 11, 1977, NRC requested ERDA to terminate the Reload Core project. The overriding reason was the inability of the proposed core to achieve the 50 MW output needed for testing large bundles of

low enriched rods. Solution of the identified problems and possibly the expenditure of additional funds (Table I) could not be justified by the small increase in driver core performance.

2. TERMINATION

As finally negotiated, the termination included publication of topical reports on the Aluminum-Zircaloy corrosion problem and the results of the CHF tests, documentation of the status of ongoing work and fabrication of one thick walled in-pile tube, a flow tube and a catch basket for same, and an EG&G internal report closing out the project which identifies where the documentation is filed.

3. DOCUMENTATION

The engineering work performed for the project was documented by drawings and Engineering Design Files (EDFs). All drawings have been released for record and can be retrieved from the Control Data Service Section of EG&G Idaho, Inc. Copies of the applicable drawing lists are filed in the project manager's file (See Appendix C). That status of the engineering analyses at termination was documented in EDFs. The EDFs for the Reload Core are being maintained as part of the PBF Design and Fabrication Division's active Engineering Design File. A copy of the Reload Core EDF log and of each Reload Core EDF cover sheet constitutes Appendix B. Appendix C lists the items in the project manager's file which has been transferred to record storage. The applicable Records Storage Receipt is included in this Appendix. Appendix D lists the Record Storage Receipts and the listing of items to be found in the D. J. Langford file which has also been transferred to record storage. The topical reports on the aluminum-zircaloy corrosion problem and the CHF tests have been published as set forth previously. The thick walled in-pile tube is being fabricated as part of the current Thermal Fuels Behavior Program under cost account 42213100. Publication and transmittal of this report closes out all Reload Core activities.

TABLE I

FY'77 MIDYEAR REVIEW - JANUARY 25, 1977

ITEM	TR-717 NOV. 1975	WED-76-76 FEB. 11,1976	TR-854 JUN. 1976	REBUDGET JAN. 7,1977
MATERIAL EST.	2980	3750	2982	4787
LABOR EST.	739	739	2938	5004
OTHER COSTS	370	370	770	2185
ESCALATION	1086	1086		
CONTINGENCY	1295	1295	810	2004
PERF. ASS. STUDY		260		
TOTAL EST. COST	6470	7500	7500	13980

EG&G-S-975

APPENDIX A

LETTER, D. A. HOATSON TO L. S. TONG,
SUBMITTAL OF TRIP REPORT TO IDAHO FALLS
ON PBF RELOAD CORE,
DECEMBER 23, 1976

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

RECEIVED
1976 DEC 30 AM 10: 33
EG & G
IDAHO, INC.

DEC 23 1976

Mr. C. Williams, Manager
Idaho Operations Office
U.S. Energy Research and Development
Administration
550 2nd Street
Idaho Falls, Idaho 83401

RECEIVED BY
R. W. MARSHALL
DEC 30 1976

Dear Mr. Williams:

Subject: PBF Reload Core Project

A meeting on the status of the PBF Reload Core Project was held on December 8-9, 1976, at the EG&G offices in Idaho Falls. A trip report of this meeting is enclosed and the agreements and commitments (attachment 2) are transmitted for implementation.

The trip report indicates that there are significant problems associated with the PBF Reload Core Project. NRC is very concerned that performance, cost, and schedules on this project could be compromised if EG&G management attention is not immediately applied to this effort. I would appreciate your personal attention to the problems of this project over the next few months to be sure that information necessary for their resolution will be prepared in a comprehensive and timely way. We will be happy to assist in any way to help make the reload core project a viable one.

Sincerely,

L S Tong

L. S. Tong, Assistant Director
for Water Reactor Safety Research
Division of Reactor Safety Research

Enclosure: Memo, 12/21/76, D. Hoatson
to L. S. Tong w/3 attachments

cc w/encl: See attached page

EG&G IDAHO, INC. DEC 30 AM 11 20

76-
RD-PBF-312

cc w/encl:
W. G. Lussie, EG&G
R. E. Wood, ERDA-ID
R. Marshall, EG&G
J. Wallace, ERDA-ID
R. W. Barber, ERDA-RSRC
J. Haines, ERDA-RSRC
S. Matovich, ERDA-RSRC
W. V. Johnston, FBRB-NRC
D. A. Hoatson, FBRB-NRC
T. E. Murley, RSR-NRC

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 23 1976

MEMORANDUM FOR: L. S. Tong, Assistant Director
for Water Reactor Safety Research, RSR

THRU: W. V. Johnston, Chief
Fuel Behavior Research Branch, RSR

FROM: D. A. Hoatson
Fuel Behavior Research Branch, RSR

SUBJECT: SUBMITTAL OF TRIP REPORT TO IDAHO FALLS, ON PBF RELOAD CORE

The writer attended a meeting at the EG&G offices in Idaho Falls, Idaho, on the PBF Reload Core on December 8-9, 1976. A brief discussion of results is provided as Enclosure 1 (to this memo). The meeting raised a number of important issues and produced a list of agreements and commitments, a copy of which is provided as Enclosure 2. In Enclosure 3 provided are some specific areas of concern generated by the meeting discussions to which EG&G should respond prior to the next reload core meeting in March. Some of the issues raised at the meeting could be crucial to the success of the reload core project. The following appear to be the most important.

1. DNB - The results of DNB testing at Columbia are not favorable and could lead to limitations on core power or adoption of a less conservative DNB margin, or both. The tests are continuing and EG&G is committed to provide an evaluation of DNB results with recommendations prior to a reload core meeting tentatively scheduled for March 9-10, 1977.

2. Engineering Costs - Since the project was transferred from Engineering to Technical Support, EG&G has been reviewing cost and schedule estimates. The original estimate of engineering man-hours was about $750K (Ref TR-717). The Preliminary Proposal (TR-854) estimate of engineering man-hours increased this to $2,048K. The latest 189a on the project indicates man-hour

costs of $3,224K. NRC has not accepted either of the later two estimates and EG&G is committed to respond to our request for a detailed comparison of these cost estimates with justification of any substantive changes. EG&G has agreed to provide this by February 1, 1977 and to reflect additional costs which may be associated with fuel pin procurement and control rod cooling.

3. Control Rod Cooling - EG&G recently made a calculation of control rod heating in the reload core. An exit temperature of 1600°F with existing airflow rate was predicted. While the calculations appear to be overly conservative, there may be changes needed to the control rod cooling air system or the rods themselves which could interfere with scheduled completion and increase costs. EG&G will provide a recommended resolution prior to the March meeting.

4. Contingency - The contingency and escalation funds provided in original estimates will probably be much too small after the increased cost of man-hours and hardware are reflected. Inadequate contingency and escalation funds make project cost overruns probable. Immediate strong actions by EG&G management are essential if project costs are to be brought into control. EG&G management must be made to understand that this project must be completed without sacrifice of performance and within the $7.5 million budget provided.

5. Fuel Pin Costs - EG&G is receiving fuel pin proposals at this time. Rumored prices are substantially more than double the original $1.21M estimate. EG&G plans some negotiating measures which may bring down fuel pin procurement costs but it is doubtful that a price near the estimated cost can be achieved.

6. Control Rod Worth - Shutdown requirements can be met but appear to require the use of titanium hydride control rod inserts. There may be some technology surprises in the use of this uncommon material, particularly in view of control rod cooling problems. EG&G has also agreed to investigate Hafnium. Control problems appear at this time to be soluble and EG&G will provide recommendations prior to the March meeting.

DEC 2 3 1976

7. Schedule - A very detailed PERT type schedule in preparation for putting the project on the PMS-4 project control system is available in draft form. This draft schedule provides for a slip of 7 months or more beyond the originally scheduled July 1978 hardware availability completion date. Problems discussed above could cause further slips.

The reload core project faces some difficult decisions in the next few months. If EG&G management does not take immediate action to assure that technical, financial, and schedule problems are promptly resolved, the project will be in jeopardy.

D. A. Hoatson
Fuel Behavior Research Branch
Division of Reactor Safety Research

Enclosures:
(1) Discussion of Results of 12/8-9/76 Meeting
(2) Agreements and Commitments
(3) Specific Areas of Concern Generated by Meeting

ENCLOSURE 1

Traveler: Don Hoatson, Fuel Behavior Research Branch, RSR

Date and Place: December 8-9, 1976, Idaho Falls

Subject: Reload Core

Brief of Results:

Ralph Marshall provided background information on the project. When Dave Langford, the former manager of the reload core project left ANC, the project was transferred from Engineering to PBF Technical Support (Lussie). New schedules and cost estimates were the initial efforts of the new project management and these are to be discussed at this meeting.

1. Requirements

Marshall provided the Reload Core requirements as EDF #304 of December 7, 1976, which resulted from his review of existing documentation originally from Core II and reflecting correspondence and meeting agreements on the reload core. These requirements were transmitted in WGL-143-76 (response to comments on preliminary proposal). In addition, EDF #304 provides a statement of Core II requirements from Cro-287-74 and their applicability to the reload core.

EG&G should seek formal approval of EDF #304 from ERDA and NRC to provide a firm basis for the reload core project. Some questionable areas:

- The design reqctor power is listed as "greater than the present core up to 50 MW". Our understanding is that the design power is 50 MW, period. If the core falls short of 50 MW, it has not met one of the major project objectives.
- Core II criteria call for a DNBR of 2.0. Recent Columbia DNB test results have not been favorable and EG&G now wants "DNB criteria will be based on industry safety standards" as the reload core design requirement. Resolution of this issue awaits completion of the Columbia tests and an EG&G recommendation to be furnished prior to the meeting tentatively scheduled for March 9-10, 1977. The EG&G resolution may involve a statistical statement of DNB probability.

2. Physics

Floyd Wheeler discussed the status of physics calculations on the reload core. He presented EDF #278 which covers the assessment of test performance as of 11/15/76. Table 1 of this EDF indicates presently expected test performance of the reload core is down about 10% from that reported in TR-717 (performance assessment report). The reduction is due to tying down enrichment zones and shim pin design to reduce core peaking. Enrichments presently are 3 1/2% inner zone (72 rods) and 7 1/2% outer zone (1712 rods). Predicted test performance is a factor of 2 to 2.1 over that of Core I.

Total control requirement is \$16.7 of which \$8.6 is in movable rods. Plain B_4C rods provide a margin of \$0.1 or a margin of \$3.9 if 96% B^{10} is used. The B_4C sleeve with a TiH_x core type rod provides a shutdown margin of \$3.9 if x = 2.0, 1.5 if x = 1.75, and 1.1 if x = 1.50. Choice of poison rod type is dependent on control rod cooling assessment. Lower values of x are less temperature sensitive and x = 1.25 is also being considered now.

Wheeler also provided data available from critical experiments which validate their calculational methods. They expect the calculated K eff to be about 0.985 times the experimental K eff for the reload core. Calculations of Core I rod worth are 4% high using the present model. They are allowing 10% rather than 4% in their calculations for this calculational uncertainty. The experimental data being used for validation however also has an uncertainty of about 10%.

3. Thermal Performance

Bob Wadkins discussed the thermal design aspects of the reload core. The cannisters will have orifices (presently at bottom end) for a fixed power distribution. There is a 12% change in pin power from the largest experiment to a water filled IPT. The hottest pins will be in the inside row. Orifices will be selected based on the worst case peaking factors from physics calculations. The solid wall cannisters have been confirmed as a good design and water gaps between cannisters are adequate to assure no voiding by boiling will occur.

Colubmia tests indicate that core will be limited by DNB, not centerline temperature. The critical heat flux using the Bernath correlation was called into question by the more recent work of Lund. The Columbia tests were conducted to define the critical heat flux for the reload core geometry and operating conditions. The critical heat flux presently appears to be much lower than had been anticipated.

a set of data for run 18 give the flavor of the results - Bernath predicton: 3.96 MW/m^2, Lund: 1.63 MW/m^2, Columbia test result: 1.10 MW/m^2. There have been problems in Columbia loop operation, particularly failed electrically heated rods and cavitation of the loop pump at higher flows, and the tests are continuing. If a statistical basis for the DNB criterion is used, additional Columbia runs may be required.

Wadkins had reviewed fuel rod tolerances and their effect on centerline temperature uncertainty. The conclusion was that DNB, not uncertainties in centerline temperature, would control core power.

In response to a question, Wadkins estimated that core power might be held to 40 MW or so if a DNBR of 2.0 is a firm requirement.

4. Control System

Joe Selensky discussed the Control, PPS, and Instrument requirements for the reload core. The control system is being designed for interchangeability with Core I. Major changes from Core I are: 8CR + 4TR become 10CR + 2TR; power increase to 50 MW; a power scheduler will be added for slow PCM ramps; some additional scrams will be added; and interchange requirements are added. Power change requirements of experimental programs have been reviewed to establish design requirements for the control system. Per agreement, the design requirement section of the SDD will be provided to programs for concurrence in the near future. There was some discussion of whether the power peaking which could occur with 2 control rods in servo had been reflected in physics and DNB calculations (see agreement #4).

5. Al-Zr Corrosion

Walt Reuter provided some preliminary results from the Alcoa test program. They show that an anodized Al film is very effective in reducing corrosion currents. Autoclaving of Zr has little effect, spacing has little effect, and external resistance has little effect until it exceeds 100 K ohms. The corrosion currents stabilized in 2-3 hours and no film breakdown is apparent after 24 days.

6. Graves Letter of August 18, 1976

The portions of this letter which had not already been covered were discussed and satisfactory responses provided.

7. Control Rod Cooling

Ralph Marshall discussed the control rod cooling problem. This problem arose mid-November when calculations were made to check whether cooling of control rods was adequate. The calculations indicated that the present 1200 scfm airflow would result in an air outlet temperature of 1600°F. They are requesting measurements of air temperature be made in Core I to confirm calculations, but they believe that they are fairly good. The higher power density of the reload core and considerable energy due to boron n, alpha reaction lead to roughly 3 to 4 times the rod heating of Core I. EG&G is going to do some parametric analyses of delta T across the poison sections. At the temperatures they are calculating, the stability of TiH is in question. They would like to hold temperatures to less than 600°F for this material to be sure it dows not release hydrogen. Preliminary calculations indicate 4400 scfm is required to reduce outlet temperature to 400°F. This will require additional compressors and new air supply and discharge piping which could cost 350-500K additional. They are also looking at water cooling of the outer rods, cruxiform rods, and agreed to look at Hafnium rods as a possibility. Discussion indicated that substantial hardware changes would be needed if water cooled rods are adopted.

Their current calculations are based on the assumption that rods are fully inserted during full power operation - an overly conservative assumption that has to be evaluated. It is possible that resolution of this problem could entail a schedule slip of completion date. EG&G is to provide a program for resolution of this problem within two weeks.

8. Fuel Pin Bid

The fuel pin bid from Exxon has been delayed. EG&G has received the QA portion, the technical portion has been mailed and the cost portion is expected next week. Marshall has arranged for LOFT fuel people to assist in bid review. Unofficially, the price will be $3M vs. the $1.25M estimate for the fuel pins. This price is very high on a $/kg basis and undoubtedly has a large allowance in it. EG&G feels that modification of some specified requirements to be more consistent with Exxon production methods without sacrifice of quality is possible and should result in a lower price. Substitution of LOFT QA for present reload core QA requirements may also help. EG&G will also explore CPFF procurement as a possiblity although there was negative ERDA and NRC sentiment to CPFF procurement. Negotiations with Exxon over the next few weeks will establish the seriousness of this cost problem.

9. IPT

Forgings are on order but delivery will slip from January 1, 1977, to April 4, 1977. A problem of cracking of billets during "potting" has occurred and a new "potting" contractor has to be used. Late delivery of these rough forgings went beyond the schedueld maintenance shutdown of the Wyman-Gordon forge. EG&G is also planning change orders to Wyman-Gordon for additional material for weld qualification and additional ultrasonic testing. EG&G hopes to trade this argument to the schedule slip for a no cost change order. IPT delivery is not a critical path item.

10. Cannisters

EG&G has changed from an Al base plate in the cannister to stainless to reduce the possibility of Al-Zr corrosion. They are re-evaluating the method of locating fuel pins in the lower grid to reduce the tolerance in response to the DNB results they have been getting. They are also considering going to Zr cannister walls rather than Al and would expect the higher cost to be more than compensated by elimination of additional inspections of hot rods due to Al-Zr corrosion. It is possible that DNB studies may require top orificing of cannisters and that would require additional cannister changes.

11. Cables

EG&G had proposed procurement of additional reactor buildings to control building cables under the reload core. They are currently thinking in terms of a GPP item to cover this in FY 1977. An 18-month lead time is apparently required and this will mean they will not be available till mid to late FY 1979. Cost and delivery are dictated by the 5/8 mile length of cables required for this service. Possibly not all cables have to be one piece. Problem is still being discussed between ID and EG&G.

12. Scheduling

EG&G has prepared a very detailed schedule of Reload Core activities. It is presently in the preliminary stage and is being prepared as input to the site wide PMS-4 scheduling system EG&G is adopting. Completion date presently shown is January 30, 1977 (a 7-month slip from the present schedule).

13. Costs

Marshall is preparing the table of costs presently anticipated with those in the performance assessment report. They do show a substantial increase in EG&G man-hours from about $750K to over $2000K and ID pointed out that the recent 189 indicates over $3000K in EG&G man-hours. EG&G agreed to provide their revised cost estimates including fuel pin bid prices and cost of control rod cooling changes by February 1, 1977.

14. SDD's

PSDD's are all in work and Marshall's schedule for their completion is January 31, 1977. This represents a slip of 8 months from the original design schedule.

ENCLOSURE 2

RELOAD CORE MEETING DECEMBER 8 AND 9, 1976
AGREEMENTS & COMMITTMENTS

1. EG&G will formally submit the proposed reload core schedule prior to January 1, 1977.

2. EG&G will check to confirm that LOCA programs do not require delays between blowdown and scram or other program requirements that cannot be accommodated by the ¼ inch wall IPT.

3. It is EG&G's understanding that LOCA heatup tests will not be performed in the ¼ inch wall IPT.

4. The asymmetry in power resulting from 2 control rods in automatic control will be considered in establishing peak-to-average power ratio used in DNB calculations.

5. The functional and design requirements portion of the reload core control system SDD will be concurred in by the program personnel as soon as necessary to avoid last minute delays in SDD submission.

6. A prompt solution of the control rod cooling problem is essential to prevent delays in reload core availability. EG&G will provide within 2 weeks a program leading to resolution of this problem before the meeting on March 9-10, 1977.

7. Unfavorable DNB results from Columbia tests could impose limitations on core power and test performance. EG&G will provide evaluated DNB results with recommendations prior to the March 9-10 meeting. EG&G will also provide a statement of core power limit if the DNBR of 2.0 is retained as a design requirement.

8. Available rod worth may be marginal on the reload core. EG&G will evaluate required vs. available rod worth reflecting uncertainties and provide recommendations prior to the meeting on March 9-10, 1977, and identify any operational restrictions that may be imposed.

9. Unofficial fuel rod cost estimates are on the order of twice estimated cost. An additional $350-500 K may be required to resolve control rod cooling problems. EG&G estimates considerable increases in design engineering will be required over earlier estimates. In view of these serious cost problems, EG&G will provide their assessment of cost impacts as soon as possible but no later than February 1, 1977.

10. No contract committment for fuel rod procurement will be made without authorization to proceed from NRC. EG&G will provide target date schedule by December 22nd.

11. A preliminary evaluation of Hafnium as a PBF control rod material should be carried out as early as possible. The following items should be evaluated:

a. Availability of material, and cost of fabrication into either cylindrical sleeves (in current moderator rod) or solid cylinder

b. Worth relative to current design.

c. Heat production and temperatures relative to current design.

12. The current design basis for the reload core is 36 PWR rods. EG&G will review the pertinent analysis to determine if they are adequate to accommodate 37 rods.

13. Presently it is the intent that axial flux shaping be done inside the IPT.

14. The preliminary proposal (TR-854) will not have to be rewritten.

EG&G

EG&G

ERDA-HQ

NRC

ERDA-ID

Specific Areas of Concern on Reload Core Resulting from Presentations at the December 8, 9, 1976 meeting.

1. Control Rod Worth

Uncertainties in control rod worth calculations are such that there is a risk that the stuck rod criterion might not be met. EG&G should make a qualitative evaluation of options that might reduce the reactivity requirement in the event that happens. The following options should be among those evaluated:

(a) Operation with transient rods partially or fully inserted
(b) Reduced operating power level (shim rod addition)
(c) Withdrawal limits on high worth control rods
(d) Preferential location of reactivity shim rods around the high worth control rod locations

Restrictions that these options might impose on planned experiments should be identified and the recommended option chosen for use if required.

2. Control Rod Heating

EG&G should investigate heating which would occur with the more probable case of a withdrawn rod bank rather than the assumed fully inserted rods at full power. A curve of power level limit (due to rod heating) vs. rod position should be developed assuming the existing CRCA system and minor improvements to it.

EG&G, before concluding that a major investment in CRCA modifications is needed, should consider an experimental run at reduced power in Core I with a rod fully inserted to measure the heating experienced.

3. DNBR Limits

FBRB would prefer to retain the present minmum DNBR criterion of 2.0 for an experimental facility like PBF. If EG&G concludes that the ratio must be lowered to values used by commercial reactors, then an investigation of the sensitivity of DNB to many design and operating parameters must be made, and extreme values for these parameters assumed. Examples are the following:

(a) Reactor overpower requirements
(b) Power range channel drift and instrument uncertainties
(c) Fabrication tolerances and their effect on peak heat flux and coolant channel enthalpy rise.

3. <u>DNBR Limits</u> (continued)

   (d) Circumferential variation of heat flux around rod
   (e) Variation of coolant pressure
   (f) Effect of control rod position on peak to average power density and PPS power calibration
   (g) Effect of coolant inlet temperature variation on PPS power calibration
   (h) Fuel cannister orificing uncertainties.

Although all of these should be reviewed, even with a DNBR of 2.0, they need not be quantitatively considered if their effect on DNBR is small (1-3%). In view of the cost problems the project appears to be facing, incurring additional engineering analysis upon reducing the DNB margin is an undesirable tradeoff.

4. Local DNB Conditions

The Columbia DNB test observation of a stable local DNB condition at a point of minimum spacing between rods suggests that the following be investigated:

   (a) If local DNB exists on a nuclear fuel rod, how will surface temperature and heat flux redistribute around the rod?
   (b) How does the redistribution around a nuclear rod compare with that of a sheath heated rod used at Columbia?
   (c) Is the sheath heater a conservative representation of the nuclear rod?
   (d) Are there surface corrosion/erosion problems in the vicinity of a local, stable DNB region?

5. Transient Rod Movement

Some experiments require rather rapid power ramps obtained by transient rod movement which causes misalignment of transient rods and control rods. EG&G should confirm that this misalignment will not adversely affect power calibration of the PPS detector or the peak/average power density.

One requirement calls for a 17 kw/ft to 1 kw/ft power reduction on voiding of the IPT. EG&G should evaluate the coupled effects on reactivity due to IPT voiding, change in IPT power shape due to voiding (if axial power shapers in the IPT are used), and available total transient rod worth.

6. Axial Power Shaping

In the event of confirmation of unfavorable DNB results, EG&G should reevaluate the option of axial power shaping by using non-uniform B_4C loading in shim rods near the IPT. This could provide lower peak heat flux and centerline temperature in the driver core and could reduce the change in flux shape in IPT voiding in the IPT.

APPENDIX B

LOG AND COVER SHEETS
OF THE PBF RELOAD CORE
ENGINEERING DESIGN FILES

PBF ENGINEERING DESIGN FILE LOG

EDF SERIAL NO.	PROJECT FILE NO.	AUTHOR	DATE	SUBJECT
175		R. W. Marshall, Jr.	1-7-77	Preliminary Core II Fuel Trade-Off Study
176		R. W. Marshall, Jr.	8-18-76	PBF Reload Core Program Cro-204-75
177		G. S. Gill	6-22-76	Rod, Cladding and Enrichment Reactivity Studies for the PBF Reload Core
178		R. W. Marshall, Jr.	11-22-76	Functional Requirements for Core II - CRO-287-74
179		J. W. Bacon	7-19-76	Design of Poison Sections in Reload Core Control and Transient Roc
180		R. L. Chapman	11-30-76	Effect of Fission Gas Release on Fuel Rod Internal Pressure
181		W. G. Reuter		Experimental Evaluation of Exposing Heat Treated Inconel 718 to 1089K (1500°F) for 20 Minutes
182		R. M. Horton	7-2-76	Hydrogen Analysis of Zircaloy
183		W. G. Reuter	7-6-76	Potential Problems Associated with Zircaloy Galvanically Coupled to Inconel
184		R. M. Horton	7-7-76	Potential Laboratories to Conduct Short Term Tests on Aluminum-Zircaloy Calvanic Couples
185		J. L. Plum	7-12-76	Cost of Close Tolerance Zr-4 Cladding
186		E. F. Taylor	7-19-76	Preliminary Design of the Catch Basket for the Reload Core
187		H. Fielding	7-19-76	Modification of Pneumatic Tubing to Control Rods for Scramming

PBF ENGINEERING DESIGN FILE LOG

EDF SERIAL NO.	PROJECT FILE NO.	AUTHOR	DATE	SUBJECT
188		J. W. Bacon	7-19-76	Design of Storage Racks to Safely Hold PBF Reload Core Canisters
189		E. F. Taylor	7-19-76	10-2 Configuration Rod Drive, Control Bridge Equipment and Super Structure Drawings and DCN's
190		J. W. Bacon	7-19-76	Modifications of PBF Core I Design for PBF Reload Core
191		G. A. Reimann	7-20-76	pH Control in PWR's
192		G. A. Reimann	7-20-76	Availability of 5454 Aluminum Alloy for PBF Canisters
193		~~EDF NOT COMPLETED AND/OR RELEASED~~		
194		H. A. Traue	7-20-76	Conceptual Design Report and the Environmental Assessment for the Crane Upgrade Study at the PBF and SPERT IV Buildings
195		R. M. Horton	7-21-76	Proposed Short Term Test Program to Evaluate Aluminum - Zircaloy-4 Galvanic Corrosion in PBF Reload Core
196		G. A. Reimann	7-22-76	Galvanic Attack on Aluminum Due to Coupling With Stainless Steel at Three-Mile Island Facility
197		R. M. Horton	7-22-76	Discussions with Rockwell Int. and Alcoa of Scope, Schedule, and Cost of Proposed Corrosion Tests of Aluminum-Zircaloy Galvanic Couple
198		R. M. Horton	7-23-76	Visual Examination of 6061 Aluminum Orifice Plates Which had Been in Contact with Stainless Steel in PBF
199		J. F. Mendoza	7-27-76	Design Criteria for IPT Hardware
			END OF BOOK	I

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
200		R. W. Marshall, Jr.	07/29/76	Basis for Number of Fuel Rods to be Ordered
201		H. W. Spaletta	07/30/76	Final Comments from the PRODUCIBILITY Section on Specification ANC 50105 - PBF Reload Core In-Pile Tube Pressure Tube
202		H. W. Spaletta	07/30/76	Comments on Tensile Tests and Impact Blank Fabrication for the PBF Inconel 718 Alloy IPT Forging
203		J. Klein	07/28/76	Fuel Rod, PBF Reload Core
204		J. Klein	07/27/76	Canister Design Criteria
205		H. Fielding	07/19/76	Modification of Orifice Plates for Reload Core
206		R. L. Greenleaf	07/29/76	Document Tree, PBF Reload Reactor Core
207		J. F. Mendoza	07/19/76	Some Flow Tube Design Analysis
208		J. F. Mendoza	07/26/76	Guide Strut, 304 Stainless Steel
209		J. F. Mendoza	08/02/76	Bolt Sizing
210		W. O. Olson	07/28/76	Selection of Shim Pin B_4C Content

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
211		J. Klein	08/03/76	Filler and Reflector Rod
212		F. J. Wheeler	08/05/76	Fuel Rod Design Specification - Enrichment and Cladding OD Tolerance
213		R. G. Ambrosek	08/10/76	Check on PBF Secondary Heat Rejection Capacity
214		R. W. Marshall	08/11/76	Pellet Dishing and Radial Gap Recommendations for PBF Reload Core
215		R. K. Malik	08/09/76	Thermal Conductivity of Titanium Hydride
216		R. T. McCracken	08/19/76	Differential and Integral Boron-Carbide, Titanium-Hydride Rod Worths
217		R. P. Wadkins	07/20/76	PBF Catch Basket Requirements (Located in Record Storage - Box 25929, Space 29c)
218		R. P. Wadkins	08/25/76	PBF Reload Core Accidents for Catch Basket Criteria
219		R. T. McCracken	08/16/77	Plutonium Production
220		R. W. Marshall	08/16/76	Procedure for Handling Future Drawing Changes While Maintaining Existing Drawings in the As-Built Condition Applicable to Proposed Changes or Those Not for Immediate Execution
221		J. W. Bacon	08/17/76	Design of Poison Sections of Transient and Control Rods

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
222		J. W. Bacon	08/17/76	Stress Analysis of Canister Design
223		J. W. Bacon	08/17/76	Updated Stress Analysis of Canister Design
224		EDF NOT COMPLETED AND/OR RELEASED		
Rev. 1 225		R. G. Ambrosek	09/23/76 08/27/76	Reactivity Insertion Accidents for PBF Reload Core
226		R. W. Marshall	08/25/76	Comments on PBF Reload Core Fuel Rod Assembly Specification ANC-50106
227		J. Klein	09/01/76	In-Pile Tube Fabrication Specification Meeting
228		R. P. Wadkins	09/03/76	PBF PPS Requirements for LOCE
229		R. W. Marshall	09/03/76	Elimination of Strain Gaging of Thin Walled IPT During Hydrotest
230		R. P. Wadkins	09/03/76	PBF Fast Speed Transient Rod Withdrawal
231		J. Klein	09/17/76	IPT Wall Thickness Measurement
232		EDF NOT COMPLETED AND/OR RELEASED		

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
233		L. G. Johnston	09/15/76	Comparison Costs for Aluminum and Stainless Steel Versus Zirconium for PBF Reactor Reload Core Canister Assemblies (ANC Dwg. 406806-1)
234		R. P. Wadkins	09/17/76	PBF Reload Core Control Rod Positions for Control Rod Temperature Calculations
235		E. F. Taylor	09/30/76	PBF Reload Core Control Bridge Deflection Analysis, Preliminary
236		A. G. Work	09/20/76	Comparative Costs for Fabrication Canisters From Aluminum or Zircalloy
237		R. A. Freeman	09/27/76	Response to Question 10, R. E. Simonds (ERDA) Letter of 09/09/76
238		V. Strickholm	09/24/76	Recommended Changes to PBF Inconel 718 IPT Forging Drawing and Requirements for In-Service Inspection
239		S. C. Madden	09/24/76	Power and Group 3 Flux Distributions in PBF Reload Core
240		T. S. Bohn	10/12/76	Test-Energy Optimization and Calculation of Kinetics Parameters
241		H. R. Hilker R. A. Freeman	09/27/76	Response to Exxon Nuclear Co. Prebid Questions on Specification 50106 and Drawing 406263,406800, 406801
242		EDF NOT COMPLETED AND/OR RELEASED		
243		H. W. Spaletta	09/27/76	Logic Network for the PBF Inconel 718 IPT

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
244		EDF NOT COMPLETED AND/OR RELEASED		
245		L. G. Johnston	09/27/76	Industry Specification for Boron Carbide for Nuclear Application
246		R. A. Freeman	09/28/76	Telecon to Beloit Power Systems Co. Mr. John Henthorn
247		T. C. Yen	10/01/76	Fuel Rod Bowing in the PBF Reload Core
248		H. R. Hilker	09/30/76	Response to Nuclear Fuel Services, Inc. Prebid Questions
249		J. W. Bacon	09/30/76	Handling of In-Pile Pressure Tube During Manufacture and Assembly
250		L. G. Johnston	10/01/76	Review of Potential Zirconium Tube Suppliers for PBF Reactor Reload Core Fuel Rods (ANC Drwg 406263)
				END OF BOOK II

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
251		L. G. Johnston	10/05/76	Review of Canister Assembly Drawings 406803, 406804, 406805, 406806, 406807, and 406808 and Purchase Specification ANC 50110 LGJ-7-76
252		EDF NOT COMPLETED AND/OR RELEASED		
253		EDF NOT COMPLETED AND/OR RELEASED		
254		G. A. Reimann	10/07/76	Plan for Uninstrumented Al-Zr Galvanic Corrosion Tests
255		EDF NOT COMPLETED AND/OR RELEASED		
256		R. T. McCracken	10/11/76	Average Fast Flux in the In-Pile Tube Wall
257		R. T. McCracken	10/11/76	Gamma Heating in the Fuel Canisters and In-Pile Tube Wall
258		R. T. McCracken	10/12/76	Tolerances on Boron-Carbide Particle Size, Density, and Homogeneity in the Reload Core Shim Pins
259		J. Klein	10/12/76	IPT Nozzle Loads
260		R. W. Marshall,Jr	10/02/76	Proposed Changes to IPT Forging Contract at Wyman Gordon Subcontract S-2660
261		J. W. Bacon	10/29/76	Radiation Safety Evaluation, PBF Expanded Core Storage Basin Shielding Analysis - Storage of PBF Reload Core in Proposed PBF Canal Extension

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
262		G. S. Gill	11/05/76	Physics Parameter Calculations for Use in RELAP-4 Model of PBF Reload Core
263		R. G. Ambrosek	11/12/76	Meeting to Discuss PBF Reload Core Control Rod Design
264		G. S. Gill	10/27/76	Reactivity Change Due to Boron Impurities in PBF Fuel
265		J. W. Bacon	10/27/76	Poison Rod Cooling Air Flow
266		J. Klein	10/28/76	In-Pile Pressure Tube Cost Comparison of Trepanned Method Versus Boring Main ID
267		J. Klein	10/23/76	49 Rod Canister Assembly Cost Estimate - Aluminum Versus Zirconium
268		H. G. Kraus	10/08/76	Preliminary Analyses of Reload Core Catch Basket and IPT for 36 and 49 Rod Meltdowns
269		L. G. Johnston	11/02/76	Time to Complete Estimate PBF In-Pile Tube P/N 400230 (LGJ-10-76)
270		L. G. Johnston	11/02/76	Time to Complete Estimate PBF Canister Assembly P/N 406806-1 (LGJ-9-76)
271		E. F. Taylor	11/02/76	PBF Reload Core Control and Transient Rod Drives Velocities During Normal and Accident Case Operations
272		R. G. Ambrosek	11/12/76	Meeting II to Discuss PBF Reload Core Control Rod Design

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
273		EDF NOT COMPLETED AND/OR RELEASED		
274		EDF NOT COMPLETED AND/OR RELEASED		
275		G. A. Reimann	11/8/76	Sources and Capabilities for Producing B_4C and TiH_x Sections for Transient Rods
276		H. W. Spaletta	11/12/76	Status Report for PBF Inconel 718 IPT Forgings Wyman Gordon Contract S-2660
277		J. W. Bacon	11/10/76	Proposed Configurations for Maximum Sized Fuel Arrays to be Tested in Reload Core
278		R. T. McCracken	11/15/76	PBF Reload Core Test Performance Assessment
279		EDF NOT COMPLETED AND/OR RELEASED		
280		R. A. Freeman	11/11/76	Preliminary Proposal for Installing Additional Air Compressors for CRCA System
~~280A~~		~~R. A. Freeman~~	~~12/20/76~~	~~Further Comments on Proposed 5000 SCFM Compressor Building~~
281		E. F. Taylor	11/11/76	Examination of the Design Temperatures of the Core I Items of Control and Transient Rod Air Shrouds and Part of the Low Pressure Air System
282		J. Klein	11/12/76	Estimate of UO_2 Required for Reload Core
283		D. E. Wessol	11/13/76	The Effect of the Wigner-Seitz Approximation on S_n Transport Theory Calculations of an 8% Enriched PBF Reload Core Fuel Pin Cell

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
284		R. W. Marshall,Jr	11/16/76	Location of Flux Shapers for Experiments to be Run in the Reload Core
285		G. S. Gill	11/17/76	Reactivity Change due to Re-Distribution of the Test
286		R. A. Freeman	11/18/76	Control Rod Cooling Air Modification
287		EDF NOT COMPLETED AND/OR RELEASED		
288		R. L. Chapman	11/22/76	Fuel Rod Internal Gas Pressure
289		R. A. Goodell	11/19/76	Seismic Analysis of PBF Core 1
290		R. W. Marshall	11/19/76	Probable Use of Enriched B_4C for the Poison Sections
291		F. J. Wheeler	11/19/76	Reference Documentation for Physics Methods and Partial Validation of Reload Core Model
292		R. W. Marshall,Jr	11/22/76	Action on Exxons Request for Relaxation of the Fuel Stability Test Acceptance Criterion
293		R. W. Marshall,Jr	11/23/76	Processing Information From Exxon
294		R. G. Ambrosek	11/23/76	PBF Control Rod Cooling Air Temperature Comparisons Between Present Core and Reload Core

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
295		R. S. Marsden	12/01/76	Meeting to Consider Effects of Titanium Hydride Properties on PBF Reload Core Control Rod Design
296		W. G. Reuter	11/23/76	Evaluation of NDT Requirements for Alloy 718 Forgings for Use in the 1/4-Inch In-Pile Tube
297		E. L. Wills	11/30/76	PBF Reload Core Project Files (Langford Files) Through Mid-1976
298		R. W. Marshall,Jr	11/30/76	Actual Data on Densification in Commercial Fuel Pellets Based on a Pellet Stabilization Test
299		T. Watanabe	12/06/76	Comparison of Uniform & Non-Uniform Void Distribution Models for Reactivity - Feedback Calculations
300		R. W. Marshall,Jr	12/03/76	Titanium-Hydride Density to be Used for Analysis (Preliminary)
				END OF BOOK III

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
301		J. G. Collett	12/03/76	HEAT TREATING OF THIN WALL INCONEL 718 IPT
302		R. W. Marshall,Jr	12/06/76	SYSTEM/COMPONENT APPLICABLE CODES AND STANDARDS
303		R. S. Marsden	12/06/76	MEETING TO DISCUSS OPERATION OF PBF RELOAD CORE WITH RESTRICTIONS ON CONTROL-ROD WITHDRAWALS
304		R. W. Marshall,Jr	12/07/76	RELOAD CORE REQUIREMENTS - A Presentation For The December 8 and 9, 1976 Review Meeting
305		H. W. Spaletta	12/08/76	PROPOSED CHANGES TO IPT FORGING CONTRACT AT WYMAN GORDON - Subcontract S-2660
306		B. R. Adams	12/08/76	STATUS REPORT FOR PBF 718 IPT FORGINGS WYMAN GORDON CONTRACT S-2660
307		H. W. Spaletta	12/08/76	ROM MILESTONE SCHEDULE FOR FABRICATION OF THE INCONEL 718 PBF IPT DESIGN
308		J. W. Bacon	12/09/76	CRITICALITY SAFETY EVALUATION FOR STORAGE OF THE PBF RELOAD CORE
309		R. A. Freeman	12/13/76	INVESTIGATION OF 5000 SCFM CRCA COMPRESSOR
310		R. L. Gump	12/10/76	ENRICHED BORON CARBIDE - PROCUREMENT AND FABRICATION COST
311		R. T. McCracken	12/15/76	AVERAGE FAST-NEUTRON ENERGY IN THE IN-PILE-TUBE WALL, SUPPLEMENT TO EDF-256

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
312		R. A. Dimenna	12/16/76	PRELIMINARY REACTIVITY INSERTION ACCIDENT LIST - Attachment To RAD-10-76
313		R. W. Marshall,Jr	12/20/76	POTENTIAL PROBLEM WITH FUEL CONTRACT A Telecon With Owen Kruger, Exxon Nuclear
314		R. W. Marshall,Jr	12/20/76	INQUIRY FROM EXXON NUCLEAR ON PBF's PULSE CAPABILITY A Telecon From Owen Kruger, Exxon Nuclear
315		J. Klein	12/20/76	FEASIBILITY CALCULATION OF POISON ROD INSERTION IN WATER
316		J. Klein	12/20/76	CANISTER INSTALLATION CLEARANCE
317		J. G. Collett	12/17/76	HAFNIUM CORED CYLINDERS
318		B. R. Adams	12/17/76	STATUS REPORT FOR PBF IPT FORGINGS WYMAN GORDON CONTRACT S-2660
319		J. W. Bacon	12/21/76	Proposed Design for Mounting Fuel Rods in Fuel Canisters
320		R. G. Ambrosek	12/17/76	PRELIMINARY CALCULATIONS TO DETERMINE FEASIBILITY FOR COOLING THE CONTROL RODS WITH REACTOR COOLANT
321		R. S. Marsden	12/20/76	SAFEGUARD OF PLUTONIUM PRODUCED DURING OPERATION OF PBF RELOAD CORE
322		R. L. Gump	12/22/76	HAFNIUM PROPERTIES

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
323		EDF NOT COMPLETED AND/OR RELEASED		
324		J. Klein	12/27/76	MINIMUM WALL THICKNESS OF IN-PILE PRESSURE TUBE
325		R. L. Gump	12/16/76	FUEL ROD - CANNISTER BOLTING - RLG-18-76
326		R. W. Marshall,Jr	12/22/76	IDENTIFICATION AND DISCUSSION OF RISKS ASSOCIATED WITH FUEL FABRICATION AND OPERATION - Report of Dec. 20, 1976 Meeting
327		J. G. Collett	12/29/76	TRANSIENT AND CONTROL ROD POISON SUB-ASSEMBLY Fabrication Cost Estimate - JGC-15-76
328		M. W. Young	12/30/76	PRESSURE DROP ANALYSIS OF AIR COOLED B_4C-TiH_2 CONTROL RODS PROPOSED FOR PBF RELOAD CORE
329		R. W. Marshall,Jr	12/30/76	REVIEW TO DETERMINE IF CAPABILITY OF PERFORMING LOCA HEAT-UP TESTS IS A REQUIREMENTS OF THE RELOAD CORE
330		W. O. Olson	1/3/77	EFFECT OF WATER COOLING ON CONTROL ROD WORTH A Preliminary Analysis
331		R.W.Marshall,Jr.	01/04/77	REQUIREMENTS FOR NEW "THIN WALL IPT HEAD" CRO-244-76
332		EDF NOT COMPLETED AND/OR RELEASED		
333		R. P. Wadkins	1/7/77	RELOAD CORE BOWING CALCULATIONS

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
334		R. P. Wadkins	1/7/77	PBF FUEL ROD THERMAL ANALYSIS OF END CAPS
335		F. J. Wheeler	1/10/77	WATER FOLLOWERS FOR THE OUTER CONTROL ROD GUIDE TUBES
336		R. G. Ambrosek	1/12/77	PRELIMINARY INVESTIGATION OF COOLANT MIXING
337		J. Klein	1/12/77	PROPOSAL TO INCREASE C.R.D. SCRAM AIR PRESSURE
338		H. K. Peterson	1/14/77	RELOAD CORE PLUTONIUM HAZARD ASSESSMENT
339		R. P. Wadkins	1/19/77	PBF RELOAD FRAP ANALYSIS
340		F. J. Wheeler	1/20/77	PARTIAL FOLLOWERS FOR THE OUTER-ROD GUIDE TUBES
341		M. L. Russell	1/20/77	DISCUSSIONS WITH EXXON ON METHODS FOR REDUCING COSTS OF FUEL Report of January 13, 1977 Meeting
342		S. C. Chang	1/10/77	Review of NRC Model and Rolstad Model for Reactor Fuel Densification
343		R. E. Locke	1/24/77	HYDRO TEST AT NATIONAL FORGE AND AUTOCLAVE ENGR., OF THICK WALLED IPT - July 1972
344		W. O. Olson	1/24/77	WORTH OF HAFNIUM AS THE CONTROL ROD POISON

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
345		EDF NOT COMPLETED AND/OR RELEASED		
346		R. T. McCracken	1/25/77	BORON-10 DENSITY FOR BORATED STAINLESS STEEL SHIM RODS
347		EDF NOT COMPLETED AND/OR RELEASED		
348		E. F. Taylor	1/31/77	INSPECTION OF THE SPARE PROTOTYPE CONTPOL ROD DRIVE AND LISTING THE ACCEPTABLE PARTS
349		J. Klein	1/31/77	POISON SECTION SPIDER DESIGN CONCEPT
350		R. A. Goodell	2/4/77	PBF SEISMIC ANALYSIS INFORMATION
				END OF BOOK IV

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
351		R. A. Freeman	2/3/77	5000 SCFM CRCA COMPRESSOR COST ESTIMATE AND SCHEDULE
352		L. G. Johnston	2/8/77	ROM COSTS TO FABRICATE ONE EACH 406587-1 In-Pile PRESSURE TUBE ASSEMBLY
353		R. A. Freeman	2/10/77	CONTROL AND TRANSIENT ROD SHROUD REMOVAL PROCEDURE
354		D. K. Morton	2/11/77	Fatigue Life Evaluation of PBF Reload Core Fuel Rod End Piece
355		C. Kido	2/15/77	IN-PILE TUBE STRESS ANALYSIS
356		W. O. Olson	2/15/77	WORTH OF PWR-TYPE POISON RODS IN THE OUTER POSITIONS
357		F. J. Wheeler	2/16/77	UTILIZATION OF CORE -1 POISON SECTIONS IN THE RELOAD CORE
358		R. G. Ambrosek	2/15/77	PBF RELOAD CORE ACCIDENT LIST
359		EDF NOT COMPLETED AND/OR RELEASED		
360		EDF NOT COMPLETED AND/OR RELEASED		
361		EDF NOT COMPLETED AND/OR RELEASED		

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
362		G. A. Reimann	2/16/77	Fabrication of PBF Poison Rods from Enriched Boron Carbide
363		G. S. Gill	2/17/77	Review of the Worth of Gadolinium Nitrate Hexahydrate Poison in the Poison Injection System
364		L. G. Johnston	2/17/77	COST ESTIMATE PBF IPT ASSEMBLY WITH HEAD AND INTERNALS
365		W. O. Olsen	2/22/77	Energy Deposition in B_4C - TiH_2 Poison Sections
366		EDF NOT COMPLETED AND/OR RELEASED		
367		L. L. Chi	2/23/77	Temperature Distribution for Rod Bowing Analysis
368		R. G. Ambrosek	2/24/77	FLOW-3 Evaluation of Fuel Canister Design Alternatives
369		EDF NOT COMPLETED AND/OR RELEASED		
370		T. Watanabe	3/1/77	Initial Enrichment of Test Pins for PWR Irradiated 36-Pin High Enrichment Test
371		D. W. Nigg	3/7/77	PBF Reload Core Three-Dimensional Neutronics Model Development
372		EDF NOT COMPLETED AND/OR RELEASED		

ENGINEERING DESIGN FILE LOG

EDF SERIAL NUMBER	PROJECT FILE NUMBER	AUTHOR	DATE	SUBJECT
373		R. W. Marshall	3/8/77	Analyses & Recommendations For Added Torquing of the IPT Locking Tube - A Recovery Plan For Removing the IPT (Pulled - Not Reload Core Related)
374		R. L. Gump	3/9/77	IPT Forging - Status Report
375		R. T. McCracken	3/15/77	Reactivity Insertion due to Voiding the In-Pile Tube
376		EDF NOT COMPLETED AND/OR RELEASED		
377		EDF NOT COMPLETED AND/OR RELEASED		
378		T. B. McLaughlin		Irradiated Data for Experiments to be Handled in the TFBP Experiment Assembly & Checkout Facility (Pulled - Not Reload Core Related)
379		EDF NOT COMPLETED AND/OR RELEASED		
380		EDF NOT COMPLETED AND/OR RELEASED		
381		R. A. Dimenna W. R. Carpenter	3/24/77	Relap 4 Kinetics Model for the PBF Reload Core
382		W. R. Carpenter	3/24/77	Comparison of the PBF Reload Core RELAP and HYDRAX Kinetics Models
383		EDF NOT COMPLETED AND/OR RELEASED		

END OF BOOK V

ENGINEERING DESIGN FILE

PROJECT FILE NO.

EDF SERIAL NO. PBF-175

FUNCTIONAL FILE NO.

DATE January 7, 1977

PROJECT/TASK

SUBTASK

SUBJECT

PRELIMINARY CORE II FUEL TRADE-OFF STUDY

ABSTRACT

This EDF places in the file an undated study with the subject title (Title shown on black pasteboard binder in J. Klein's file). Table of contents gives a title of Core II FUEL TRADE-OFF STUDY.

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. W. Marshall, Jr.				R.W. Marshall Jr.	2/7/77

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EG&G Idaho, Inc.

PROJECT FILE NO.

EDF SERIAL NO. PBF-276[redacted]

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO.

PROJECT/TASK PBF RELOAD CORE/SYSTEMS ENGINEERING

DATE August 18, 1976

SUBTASK Requirements

SUBJECT

PBF RELOAD CORE PROGRAM

Cro-204-75

ABSTRACT

This EDF places the subject letter in the engineering file.

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R. W. Marshall, Jr.	5520			R W Marshall Jr	1/4/77

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. PBF-177

FORM EG&G-2631 (Rev. 6-76)

GWA NO.

TASK PBF Reload Core Physics

DATE June 22, 1976

SUBJECT

ROD, CLADDING AND ENRICHMENT REACTIVITY STUDIES FOR THE PBF RELOAD CORE
GSG-2-76 Dated June 22, 1976

ABSTRACT

This EDF places the subject letter report in the engineering file.

The main purpose of this sutdy is to determine reactivity worths for two types of control rods. B_4C poison is used as the neutron absorbing material for the first type of rod (core 1 design), and the second type of rod has TiH_2 poison in the center with a surrounding B_4C poison outer layer. Most of the calculations were for a driver-core fuel of Zircaloy-cladding UO_2 fuel pins at a U-235 enrichment of 8% operating at 50 MW. Using the first type of rod combined with a voided IPT, reactivity worths were calculated for the four inner rods, the six outer control rods, the stuck rod and the 10-2 rod configurations. Since it is advantageous to compare the results of the two types of rods, a stuck rod study was made using the second type of poison rod and a voided IPT. The 10-2 rod case, all-rods-in case and 2 outer transient rods-in case were also studied with 611 K (640°F) water in the IPT using the second type of poison rods.

The results indicate that, for the stuck rod study, the TiH_2 and B_4C poison increases the control capability by about 20%. Indications are that the B_4C poison rods alone may not provide adequate control.

Results indicate that compared to Zircaloy cladding at 8% enrichment, using stainless steel cladding at an enrichment of 10% resulted in an 8.9% loss in the TiH_2 + B_4C rod worth.

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W. G. Lussie, R. W. Marshall, R. T. McCracken, W. O. Olsen, D. E. Wessol, F. J. Wheeler

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
original ltr signed by G. S. Gill				R W Marshall Jr	12/6/78

EG&G Idaho

FILE NO.

EDF SERIAL NO. PBF-178

ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev 8-76)

GWA NO.

TASK PBF Reload Core System Engineering

DATE November 22, 1976

SUBJECT

FUNCTIONAL REQUIREMENTS FOR CORE II

CRO-287-74

ABSTRACT

This EDF places the subject letter in the engineering file.

Also included in this file are three other documents relating to the criteria for the second core. They are:

1. PBF SECOND CORE PERFORMANCE CRITERIA, WED-551-73, Letter W. E. Durkee to W. D. Ennis, dated September 21, 1973.

2. Draft of draft letter, PBF SECOND CORE CRITERIA - COMMENTS ON WED-551-73, Layman to Manager, ID, dated 10/12/73.

3. A two page undated document entitled PBF CORE II which categorizes the information presented as: (1) The functional requirements for the PBF second core, and (2) The design constraints for PBF second core.

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W. G. Lussie

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(Rev 2-76)

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-179

GWA NO. 45073-330-021

TASK PBF Reload Core - Poison Rods

DATE July 19, 1976

SUBJECT DESIGN OF POISON SECTIONS IN RELOAD CORE CONTROL AN, TRANSIENT RODS

ABSTRACT

A preliminary study was made on the preload spring required to hold the poison sections together within the poison rods during the maximum acceleration of the rods by their associated drives. Also a proposal has been put forward to make the poison sections out of a cylindrical shell of B_4C with another cylindrical shell of TiH_2 inside. This would apply to both the new transient and new control rods. Proposals have been submitted to thermal analysis.

Calculations attached are preliminary spring values awaiting august tests for transient rod drives at 1/2 hydraulic pressure which may reduce spring sizes. (Ref. JWSielinsky).

This configuration superceded by configuration set forth in EDF 279.

Two sketches included.

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J. W. Bacon	PBF DESIGN ENGINEERING	[signature]	7-2-76	RWMarshall	11/18/76

EG&G Idaho

FILE NO.

EDF SERIAL NO. PBF-180

GWA NO. 11-30-76

DATE

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

TASK PBF Reload Core
Core Design/Fuel Design

SUBJECT

EFFECT OF FISSION GAS RELEASE ON FUEL ROD INTERNAL PRESSURE

ABSTRACT

This EDF places the subject memo in the project file. This work has been superceded by a FRAP analysis, the details and results which are set forth in EDF 288.

This simplified analysis was based upon extrapolation from a Westinghouse PWR analysis. It estimates a rod gas pressure of 36 psia at full power at end of life for the Reload Core fuel rods.

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J. Klein, W. G. Lussie, M. K. Shane

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R. L. Chapman				RWMarshall	11/30/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-181

GWA NO. 45071-330-106

DATE

TASK PBF IPT

SUBJECT

EXPERIMENTAL EVALUATION OF EXPOSING HEAT TREATED INCONEL 718 TO 1089K (1500°F) FOR 20 MINUTES.

ABSTRACT

The present IPT for PBF fabricated from Inconel 718 may be exposed to temperatures ranging from 977K (1300°F) to 1089K (1500°F) for times from 2 to 20 minutes. The purpose of these tests, was to evaluate the effect of exposing heat treated Inconel 718 to 1089K (1500°F) for 20 minutes.

The thermal excursion to 1089K resulted in a reduction of 10 to 20% of the yield strength and tensile strength and a substantial (30 - 45%) increase in ductility and fracture toughness.

Exposing heat treated Inconel 718 for 20 minutes to 1089K (1500°F) and then water quenching resulted in changes in mechanical properties as shown below:

Test Temperature K	(F)	Ultimate Tensile Strength MPa	(ksi)	Yield Strength MPa	(ksi)	% El	% RA
616 (a)(c)	(650)	1269	(183.9)	901	(130.6)	24.1	30.3
616 (b)(c)	(650)	1116	(161.7)	703	(101.9)	31.3	41.8
294 (a)(d)	(70)	1366	(198)	952	(138)	27.9	30.0
294 (b)(d)	(70)	1318	(174)	821	(108)	36.2	41.4

(a) Heat treated Inconel 718
(b) Heat treated Inconel 718 plus exposure to 1089K for 20 minutes.
(c) Actual test results
(d) Extrapolated test results

The instrumented precracked Charpy specimens when tested at room temperature showed an increase in dynamic fracture toughness from MNm$^{3/2}$ (189 ksi-in.$^{1/2}$) for heat treated Inconel 718 to 289 MNm$^{3/2}$ (263 kis-in.$^{1/2}$) for those thermally cycled to 1089K for 20 minutes.

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. PBF-182
GWA NO.
DATE July 2, 1976

TASK PBF Reload Core - Galvanic Corrosion

SUBJECT

HYDROGEN ANALYSIS OF ZIRCALOY

ABSTRACT

Call to Tom Naylor, Sandvik, Kennewick, WA.

Asked for names of companies who could do good hydrogen analyses on zircaloy. He said any firm that manufactures or processes zircaloy probably could. He named:

Sandvik, Wah Chang, Exxon (Richland), Zirtech (Albany, Ore.), and Pittsburgh Testing Lab (referee tests).

Tom recommended Wah Chang of Albany, OR. as the lab probably most capable of giving the best routine results. Jim Schlewitz (phonetic) is person to contact. He said all labs seem to use LECO vacuum fusion equipment. He also reported the normal H content of as-received zircaloy tubing to be about 10 - 15 ppm H.

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JKlein RLMiller JLWallace, ERDA-ID
FJKriz GAReimann
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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-183

GWA NO.

TASK PBF Reload Core - Galvanic Corrosion

DATE July 6, 1976

SUBJECT

POTENTIAL PROBLEMS ASSOCIATED WITH ZIRCALOY GALVANICALLY COUPLED TO INCONEL

ABSTRACT

Dr. R. A. Proebstle of General Electric, San Jose, was one of those in attendance at a meeting held on June 24, 1976, concerning the potential of hydride embrittlement on the PBF reload core. The specific topic of discussion was the potential problem of hydride embrittlement, due to the galvanic cell created by 5454 aluminum in contact with zircaloy. During the course of the meeting Dr. Proebstle identified a hydride problem he had encountered when inconel was smeared on zircaloy.

I have since contacted Dr. Proebstle in order to obtain specific information concerning his observations. The specifics of the conservation are as follows:

1. Tests were conducted by smearing inconel on zircaloy. Originally the inconel was smeared on the zircaloy by co-drilling an inconel piece on top of zircaloy. Burnishing is a more severe method of smearing inconel on zircaloy.

2. The extent of hydriding was determined metallographically.

3. Tests were conducted at temperatures ranging from 350 to 550°F. Considerable problems were encountered at test temperatures ranging from 350 to 450°F but no problems were observed at 550°F.

4. No test data are available for temperatures ranging from RT to 350°F. At this time it is not possible to predict the behavior for temperatures less than 350°F.

5. Reports indicating test procedures, result, etc. were not available.

6. Hanford may be an additional source of information since they had some experience with zircaloy - inconel thermo couples.

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-184

GWA NO.

DATE July 7, 1976

TASK PBF Reload Core - Galvanic Corrosion

SUBJECT

POTENTIAL LABORATORIES TO CONDUCT SHORT TERM TESTS ON ALUMINUM-ZIRCALOY GALVANIC COUPLES

ABSTRACT

Seven laboratories with the potential capability of conducting short term tests on Al-zircaloy galvanic couples were contacted. They were:

1. Rockwell Int., Science Center, Thousand Oaks, CA.
2. Battelle N. W., Richland, WA.
3. Kaiser Aluminum and Chemical Corp., Pleasanton, CA.
4. Texas Instruments, Attleboro, MA.
5. Reynolds Aluminum, Richmond, VA.
6. Alcoa, New Kensington, PA.
7. HARCO, Los Angeles, CA.

Only two of these, Rockwell and Alcoa, indicated the interest and ability to meet our critical schedule needs. Detailed work scope discussions will be pursued with these two organizations.

The discussions with the eight laboratories constitute the body of this EDF.

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R. M. Horton RMH	Materials Technology	R. E. Schmunk	7/15/76	RWMarshall	7/9/76

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FILE NO. ______

EDF SERIAL NO. PBF-185

GWA NO. 45073-540-006

TASK PBF Reload Core - Fuel Procurement

DATE 7/12/76

SUBJECT

COST OF CLOSE TOLERANCE Zr-4 CLADDING

ABSTRACT

Question: What are the cost and schedule penalties, if any, associated with the purchase of Zr-4 tubing with a ± .0015" tolerance on the ID and a ± .0015" or .0025" tolerance on wall.

Mr. Tom Naylor, Sandvik, indicated it would be quite costly. Feels tolerance of .0015 to .0025 would be out of the question on cost. The lower tolerance would increase cost by about a factor of four. The ± .0025" tolerance would increase cost by a factor of two to three.

Bud Cook, Thermal Electron, indicated that labor cost would be about $4.50 per foot for tubing with an ID of ± .0015" and wall of ± .001". As a materials cost had not been received from Wah Chang, the author estimated $33 per rod. Therefore, the total estimated cost per rod is $51. Total estimated delivery lead time of about 34 weeks after the award of a tubing contract.

7/14/76

The estimate for the material cost is $100,000 per Mr. Cook this date. This is about $33.50/rod and, for all practical purposes, does not change the above estimate. However, because Thermal Electron may have some difficulty buying the starting billet to the tolerances required we should add a 15% contingency to the material cost. This will increase the material cost to about $38 per rod for material plus $18 per rod for labor, or $56/rod total for tubing. This is still within 10% of the $51 estimated originally.

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J. L. Plum

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R. Marshall
R. Ringer

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
J. Plum	Fuels Dept.			RW Marshall	7/12/76

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FILE NO. ____

EDF SERIAL NO. PBF-186

GWA NO. ____

DATE July 19, 1976

TASK PBF Reload Core - Catch Basket Design

SUBJECT PRELIMINARY DESIGN OF THE CATCH BASKET FOR THE RELOAD CORE

ABSTRACT

Three designs for a catch basket were designed and examined based on the following initial design requirements:

1. A constant decay power of 108 kW for the fuel rod bundle.
2. Basket must contain 240 cubic inches of fuel and its cladding.
3. Initially, coolant temperature is 500°F at 2250 psig on both sides of the catch basket.
4. The IPT temperature shall be kept below 1300°F.
5. Molten uranium in the basket is at 5300°F initially.

The first design was a single .25 in. thick Ta-10W wall catch basket with a 600°F steam gap between it and the IPT wall. Computer calculations showed that the IPT wall temperature rose above 1300°F in less than 2 minutes and the uranium boiled.

The second design consisted of two .25 in. thick Ta-10W walls with a TaC insulator between the walls and a 600°F steam gap between the outer Ta-10W wall and the IPT. Computer calculations showed IPT wall temperature exceeded 1300°F in less than 5 minutes and the uranium boils.

The third proposed design consisted of a single outer .25 in. thick Ta-10W wall with an inner wall .50 in. thick of pyrolytic graphite. A 600°F steam gap exists between the IPT and the outer Ta-10W wall. No computer calculations have been run yet.

Design work on the catch basket was stopped on 7/8/76, and will continue when R.P. Wadkins states the new design requirements.

Enclosed calculations are based on the initial design requirements listed above.

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E.F. Taylor	PBF Design Engr.	[signature]	7-21-76	RWMarshall Jr.	7/22/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-187

GWA NO.

TASK PBF Reload Core - Pneumatic Tubing

DATE July 19, 1976

SUBJECT

MODIFICATION OF PNEUMATIC TUBING TO CONTROL RODS FOR SCRAMMING

ABSTRACT

Each control rod has an assembly containing a pressure gage, a regulating and back pressure relief valve, and other piping. Two new assemblies were installed on the south side of the bridge. A 1/2 in. schedule 40 pipe was run between the north and south sides of the control bridge through the I-beams. The pipe center line is 2.5 in. above the bottom of the I-beams, over a foot from the structure housing the rods going into the core and at least 6 in. from the bridge support structure on the ends. The tubing from the control rod air accumulators to the assemblies above were rerouted to include the new control rods.

See Dwgs. 407120 PBF Reactor Reload Core Tubing Installation Pneumatic Supply Control Rod Drives

407167 PBF Reload Core Control Rod Drive Hydraulic and Pneumatic Control Assembly

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RWMarshall RPWadkins

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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FILE NO.

EDF SERIAL NO. PBF-188

GWA NO.

DATE July 19, 1976

TASK PBF Reload Core - Canister Storage Racks

SUBJECT DESIGN OF STORAGE RACKS TO SAFELY HOLD PBF RELOAD CORE CANISTERS

ABSTRACT

Extension of PBF canal proposed to hold storage of Reload Core and still allow for storage of Core I in existing storage racks. Analysis being performed on the use of existing design for storage racks only with stainless steel being substituted for aluminum. Analysis to include:

1. Criticality of stored canisters and/or amount of shielding required.

2. If and how many canisters alone constitute a criticality.

3. Amount of shielding required to reduce radiation dose in first basement to safe level for continuous occupancy.

Ref: Storage rack dwg. 402158

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. PBF-189
GWA NO.
DATE July 19, 1976

TASK PBF Reload Core - 10-2 Configuration Drawings

SUBJECT

10-2 CONFIGURATION ROD DRIVE, CONTROL BRIDGE EQUIPMENT AND SUPER STRUCTURE DRAWINGS AND DCN's

ABSTRACT

Use of the 1/2 scale 10-2 configuration rod drive model revealed modifications to the rod drives and other bridge equipment and therefore, new drawings to show the needed modifications. Drawings drawn were as follows:

407076 PBF Reactor Reload Core 10-2 Rod Drives Installation

407044 PBF Reload Core Control Rod Drives 4 & 8 Control System Wiring Boxes Installation

407047 PBF Reload Core Control Rod Drives 9 & 10 Control System Wiring Boxes Installation

406765 PBF Reactor Reload Core Transient Rod Drive Assembly

DCN's were prepared on drawings of the control bridge super structure, and piping and equipment on the control bridge.

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E. F. Taylor	PBF Design Engr.	[signature]	7-22-76	RWMarshall Jr.	7/22/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. PBF-190

GWA NO.

DATE July 19, 1976

TASK PBF Reload Core - Modifications From Core I

SUBJECT MODIFICATIONS OF PBF CORE I DESIGN FOR PBF RELOAD CORE

ABSTRACT

Due to the change in core control configuration in going from Core I to Reload Core, various modifications to existing hardware were required.

1. Superstructure supports changed so as not to interfere with repositioned transient rod drives. Ref. Dwg. 402437. Structural analysis required.

2. Control rod hydraulic latch supply modified to supply new control rod drive configuration, and expanded to supply two new control rod drives. Ref: Dwg. 403428

3. Transient rod hydraulic drain, supply and return piping moved out of the way of repositioned transient rod drives. Now supplies two instead of four drives. Ref: Dwg. SPT-E-8577

4. LVDT limit switch (lower) repositioned due to shortening of transient rod stroke. Also LVDT assembly respositioned 45° CW (looking down). Ref: Dwg. SPT-E-8840

5. Scram air switch on relocated control rod drives was repositioned due to interference. Ref: Dwg. 407046

6. New flow and filler shrouds for new core configuration. Ref: Dwgs. 406809, and 406810

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FILE NO. ______
EDF SERIAL NO. PBF-191
GWA NO. ______
DATE July 20, 1976

TASK PBF RELOAD CORE - GALVANIC CORROSION

PAGE NO 1 OF 1

SUBJECT

pH CONTROL IN PWR's

ABSTRACT

PWR pH is adjusted to 9-10.5 (Rm. Temp) for general corrosion control (to reduce overall corrosion rate). No real problems with Zr-4 when PWR out of optimum pH range unless pH is very far from desired value for a long period. LiOH or NH_4OH is used for pH control. LiOH tends to leave deposits in crevices and "dead spots" while NH_4OH tends to dissociate and produce gas pockets. A resin bed is used which does not remove LiOH or NH_4OH, so these chem. additions are not continually removed from system.

If pH not controlled, Zr-4 cladding will endure for a considerable period of time. (This is in untreated water, pH 6-6.5.) pH control in PWR minimizes the amount of irradiated corrosion products being circulated.

Info from: Ed Kalakay, ext 1984

From the foregoing it appears that the major benefit of pH control in the PWR's is the avoidance of an accumulation of "hot" corrosion products, and that corrosion of Zr-4 cladding due to prolonged immersion in untreated deionized water under PBF operating conditions would be negligible.

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RLMiller WGReuter HWSchutz JLWallace

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[signature]	Materials Tech	W Francis	7/20/76	RWMarshall	7/22/76

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. PBF-192
GWA NO.
DATE July 20, 1976

TASK PBF RELOAD CORE - FUEL CANISTERS

SUBJECT

AVAILABILITY OF 5454 ALUMINUM ALLOY FOR PBF CANISTERS

ABSTRACT

The 5454 alloy was selected by Jack Klein because:

(1) It has proven to be very satisfactory as the present core canister material.

(2) It is compatible with characteristics of coolant.

(3) It is easily welded and machined.

There was no known problem obtaining this alloy for the canisters presently in use. However, this material was procured by the contractor and if he had any difficulty, it was not disclosed.

We will require 1600 lb of 3/16 in. stock for side plates and 275 lb of 1¼ in. mounting plates.

The 5454 alloy is not normally stocked by distributors--users of large quantities purchase directly from the factory. Minimum order is 6000 lb for 3/16 in. sheet and 8000 lb for 1¼ in. plate. Delivery on these quantities is from 8 weeks (Reynolds) to 10-12 weeks (Alcoa). Quantities we desire may be obtained with longer lead times. This will require a high degree of coordination between buyer and vendor to assure timely availability of the 5454 alloy.

Alloys 5083, 5086, and 5456 may be substituted for 5454, but higher Mg contents may result in susceptibility to intergranular corrosion (Ref TR855, p. 8).

NOTE: 5454 aluminum alloy will be used for the canisters. (RWMJr.)

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WGReuter, RMHorton, JLWallace, RLMiller

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. PBF-194
GWA NO. 45070-820-008
DATE July 20, 1976

TASK Architect Engineering & Construction

SUBJECT

CONCEPTUAL DESIGN REPORT AND THE ENVIRONMENTAL ASSESSMENT FOR THE CRANE UPGRADE STUDY AT THE PBF AND SPERT IV BUILDINGS

ABSTRACT

1. Additional experiments were proposed in PBF Reactor Building and the SPERT IV Building requiring larger capacity cranes than are presently in these buildings.

2. A comparison study was made to determine which type of four alternates should be used.

3. Based on economics it was recommended that 50/5 ton modified commercial cranes should be used which includes some of the intent of RDT Standards without the high cost. Crane rails and runway girders should be replaced. Columns and bracing should be revised to support the heavier loads.

4. Project and funds were canceled after the Preliminary Conceptual Design Report was issued; therefore, the report was never completed.

5. Attached are Preliminary Conceptual Design Report and Environmental Assessment.

6. Original located at Central Facility Engineering,

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
H. A. Traue	8200	[signature]	7-21-76	R.W. Marshall Jr.	7/23/76

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ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. PBF-195

GWA NO. 45070-330-007

DATE July 21, 1976

TASK PBF RELOAD CORE - GALVANIC CORROSION

SUBJECT

PROPOSED SHORT TERM TEST PROGRAM TO EVALUATE ALUMINUM - ZIRCALOY-4 GALVANIC CORROSION IN PBF RELOAD CORE

ABSTRACT

The body of this EDF describes a test program which is proposed to evaluate potential problems resulting from galvanic corrosion between 5454 aluminum and zircaloy-4 in pure water. The test schedule and the predictions which will result from the proposed tests are also described.

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R M Horton	Materials Technology				

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FILE NO. ______
EDF SERIAL NO. PBF-196
GWA NO. 45070-330-007
DATE July 22, 1976

ENGINEERING DESIGN FILE

TASK PBF RELOAD CORE - GALVANIC CORROSION

PAGE NO 1 OF 1

SUBJECT

GALVANIC ATTACK ON ALUMINUM DUE TO COUPLING WITH STAINLESS STEEL AT THREE-MILE ISLAND FACILITY

ABSTRACT

The Three-Mile Island (Met. Ed.) Facility has experienced considerable difficulty with corrosion of aluminum racks fastened to the 304 SS tank linings in the fuel pools. Met. Ed. is presently experimenting with insulators to separate the Al racks from the SS. DI water plus 1.2% boric acid (pH 4-5) is used in the storage pools and the problems with aluminum corrosion is attributed to the use of borated water.

Since we are unaware of any plans for use of borated water, or other deliberate water additions to the PBF coolant, the Met. Ed. experience with the Al-SS couple is not applicable to PBF.

Some orifice plates were removed from the PBF water circuit and examined. These plates had seen actual service in the PBF system in direct contact with stainless steel for about four years. Very little corrosion was evident. A small amount of pitting was observed on the Al, but no attack occurred at the contact between Al and SS.

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RLMiller	WGReuter	HWSchutz	JLWallace	

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FILE NO. ______

EDF SERIAL NO. PBF-197

GWA NO. 45070-330-007

DATE July 22, 1976

TASK PBF RELOAD CORE - GALVANIC CORROSION

SUBJECT

DISCUSSIONS WITH ROCKWELL INT. AND ALCOA OF SCOPE, SCHEDULE, AND COST OF PROPOSED CORROSION TESTS OF ALUMINUM-ZIRCALOY GALVANIC COUPLE

ABSTRACT

A visit was made to F. Mansfeld of Rockwell International at Thousand Oaks, CA to discuss the proposed tests. They can do all the proposed tests in four months at an estimated cost of 15 K. If only one anodized layer thickness on Al is tested, the test duration can be reduced to three months and the cost to about $12.5 K.

Telephone discussions were held with Bob Bonewitz at the Alcoa Center, PA. They can conduct the proposed tests except that intermittent rather than continous current measurements would be made. The interval they would use between the current measurements is sufficiently short that intermittent measurements should be acceptable. They can do these tests in about six weeks for an estimated cost of $5K.

Since Alcoa can do the work faster and at a lower cost, and since they are capable of performing the work they would appear to be our major contender for this work.

Details of the discussion with Rockwell Int. and with Alcoa form the body of this EDF.

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FILE NO. ______

EDF SERIAL NO. PBF-198

GWA NO. 45070-330-007

DATE July 23, 1976

TASK PBF RELOAD CORE - GALVANIC CORROSION

SUBJECT

VISUAL EXAMINATION OF 6061 ALUMINUM ORIFICE PLATES
WHICH HAD BEEN IN CONTACT WITH STAINLESS STEEL IN PBF

ABSTRACT

The results of the examination of three 6061 Al orifice plates which had been in contact with stainless steel in PBF is described.

Conclusion: No serious corrosion problems were detected which would preclude the use of these coupled together in PBF.

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FILE NO. ____
EDF SERIAL NO. PBF-199
GWA NO. ____
DATE July 27, 1976

TASK PBF Reload Core In-Pile Tube (RCIPT)

SUBJECT

DESIGN CRITERIA FOR IPT HARDWARE

ABSTRACT
The RCIPT assembly is located in the Reload Core test space and is positioned coaxially with the vertical axis of the core. Its external dimensions, support configuration and interface requirements are the same as the Core I IPT, thus allows for the removal and replacement of the entire assembly as a unit.

This new design for IPT has a complete interface compatibility with Core I IPT. The pressure tube material is also Inconel 718. There are no external changes to gas jacket. To accomplish above criteria the following changes were made,

1) Steady-state testing. The increase in the inside diameter of the pressure tube made possible by reducing its wall thickness to 0.25 inches.

2) Changed head bolt circle diameter and bolt size due to lower loads and space requirements.

3) Changed pressure tube collar (See dwg. 407199) to save cost and to eliminate welding to nozzles.

4) Eliminated option on - 2 assembly, item 7, for Dwg. 406587, for optional method of fabrication (2 halves).

5) Increase outside diameter of pressure tube in nozzle area to 8.125 from 8.00 inches.

6) Decrease tab dimensions therefore, .062 to match changes in #5.

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FILE NO. ______

EDF SERIAL NO. PBF-200

GWA NO. ______

TASK PBF Reload Core - Fuel Procurement

DATE July 29, 1976

SUBJECT

BASIS FOR NUMBER OF FUEL RODS TO BE ORDERED

ABSTRACT

The requisition for ordering the reload core fuel has specified 1800 high enriched rods and 205 low enriched rods with an option to buy an additional 500 rods (enrichment to be specified at time of excerising option). The basis for the quantities selected is as follows:

Per present physics calculations -

Maximum no. of fuel rods required	1876
No. of rods with low enrichment	100 - 200
Therefore, no. of rods with high enrichment	1676 - 1776

My decision to buy 1800 high enrichment rods allows for some spares (1.3%) for assembly problems. On this basis, we need 203 low enrichment rods - buy 205.

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FILE NO. ______

EDF SERIAL NO. 201

GWA NO. ______

DATE July 30, 1976

TASK PBF Reload Core - In-Pile Tube

SUBJECT

FINAL COMMENTS FROM THE PRODUCIBILITY SECTION ON SPECIFICATION ANC 50105

PBF Reload Core In-Pile Tube Pressure Tube

ABSTRACT

The body of this EDF consists of the final comments by the Producibility Section on Specification ANC 50105. The changes set forth should be incorporated prior to release of this specification.

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W. G. LUSSIE
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WGR

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FILE NO.

EDF SERIAL NO. 202-3

GWA NO.

DATE July 30, 1976

TASK PBF Reload Core - IPT Forging

SUBJECT

COMMENTS ON TENSILE TESTS AND IMPACT BLANK FABRICATION
FOR THE PBF INCONEL 718 ALLOY IPT FORGING

ABSTRACT

The body of this EDF, written by the Producibility Section, recommends tensile test and impact blank locations for the Inconel 718 IPT forgings.

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FILE NO.
EDF SERIAL NO. 203
GWA NO.
DATE July 28, 1976

TASK PBF Reload Core - Fuel Rod Design

SUBJECT

FUEL ROD, PBF RELOAD CORE

ABSTRACT

The following criteria applied for the fuel rod design.

1) Interchangeability with Core I canisters
2) UO_2 fuel pellets
3) Ceramic insulators on either side of fuel stack
4) Low and high enriched pellets
5) Zircaloy cladding and end plugs
6) Tight cladding control is required internally for gap dimensions and externally for small moderator variations.

Dwg. 406263 shows all above requirements in detail. Fuel rod specification ANC 50106 describes in detail all fabrication processes and their control.

At the present time enrichment values are not as yet rigidly determined. The specification will be updated when final calculations are completed.

The fuel rod dwg also shows the shim rod assembly. The only difference between shim and fuel rod assemblies is the pellet material. The .15 gr/cm^3 B_4C content for the shim rod pellets is tentative and will be updated in time and also a tolerance will be placed on the B_4C content.

TR-788 specifies the pellet dishing and radial gap dimensions and the pellets are dimensionally in agreement with TR788.

TR-788 is filed under Reload Core EDF 214.

DISTRIBUTION RAGoodell RWMarshall JDStearns FJWheeler JKlein JLPlum RPWadkins

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J Klein	PBF Eng.	[signature]	7-30-76	RWMarshall Jr	10/8/76

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FILE NO.
EDF SERIAL NO. 204
GWA NO.
DATE July 27, 1976

TASK Reload Core Canister Design

SUBJECT

CANISTER DESIGN CRITERIA

ABSTRACT Design criteria for the Reload Core Canister Assemblies are:

1) Complete interchangeability with present canisters. This means maintaining the inside and outside envelope.
2) Eliminate all crossflow capability. This means eliminating all slots as per the present design.

The 2 criteria generate quite a departure from the present design.

a) Fuel rods must be located by holding bolt to mounting plate hole tolerances instead of by removable spacer blades.
b) Mounting plate is matched drilled with the canister side plates and light press pins provide the holding mechanism.
c) Fuel pin spacer grids are pinned in position and the pins welded into the canister walls.
d) Outer periphery spacer pins are provided to eliminate contact of the fuel pin with the canister walls in the grid areas.
e) Since no RIA testing is planned for the Reload Core the mounting plate is substantially thinner, still having a rod jump capability of ± 75 lbs. per rod, for the 62 rod canister assembly, increasing to 95 lbs. per rod for the 28 rod canister assembly.
f) The Zircaloy fuel rod-Aluminum canister galvanic coupling has been minimized by anodizing all interior surfaces of the canister and changing the mounting plate and grid plates to SS 304L.
g) As a precaution against canister installation problems the present canister to canister clearance gap of .027 has been increased to .047. This will give some power peaking in the gap (on the order of 3%) which is no problem according to F. J. Wheeler. The gap between the 28 canister assemblies and the central filler piece has been maintained at .027 since no additional power peaking can be tolerated there. The .147 canister wall has been identified with a slot to facilitate installation.

Reference Dwg. 406803 through 406808, 406816, 407007.

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[signature]	[illegible]			RPMarshall Jr	8/10/76

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FILE NO. ______

EDF SERIAL NO. E 205

GWA NO. ______

TASK PBF Reload Core - Orifice Plates

DATE July 19, 1976

SUBJECT

MODIFICATION OF ORIFICE PLATES FOR RELOAD CORE

ABSTRACT

Orifice plates are 0.125 in. thick aluminum plates in three shapes. Four of each shape are placed between a support grid and the canisters. New hole sizes, determined by thermal analysis, were put in the plates and spaced to miss the edges of the holes in the support grid underneath. The two holes for the 34 rod canisters will not fit into the hole into its hole in the support grid. This probelm has not been solved as of this date.

See Drawing 407275 PBF Reactor Reload Core Lower Orifice Plates and Assembly

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AUG 1 1 1976
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H. FIELDING	[signature]	[signature]	7-20-76	[signature]	7/27/76

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FILE NO. ____

EDF SERIAL NO. 206

GWA NO. ____

DATE July 29, 1976

TASK PBF Reload Core - Document Tree

SUBJECT

DOCUMENT TREE, PBF RELOAD REACTOR CORE

ABSTRACT

The Power Burst Facility (PBF) Reload Reactor Core will utilize much of the existing Core I equipment. Major changes will be made in the Reload Reactor Core System and the Reload Reactor Core Control and Protective System and their system design descriptions (SDD's) will be completely rewritten. These SDD's will carry the original number with the addition of an "A", i.e., SDD 4.2 for Core I will become SDD 4.2A for the Reload Core. SDD's for other systems requiring lesser revisions will be updated by addenda.

The major new components of the Reload Reactor Core System and the In-Pile Tube System will be shown separately on the document tree charts for greater clarity.

DISTRIBUTION RLGreenleaf RWMarshall
JKlein BKPope

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FILE NO. ______
EDF SERIAL NO. 207
GWA NO. ______
DATE July 19, 1976

TASK PBF Reload Core - In-Pile Tube (RCIPT)

SUBJECT

SOME FLOW TUBE DESIGN ANALYSIS

ABSTRACT Designing of flow tube for the proposed experiment of fuel rods (uranium oxide, UO_2 .422 inches Dia. X 36 inches long, 36 pieces) for the PBF Reload Core In-Pile Tube (RCIPT).

The flow tube is coaxial with the pressure tube. It serves as a separator for the bidirectional flow within the pressure tube. The test fuel (UO_2) will be placed inside this flow tube. The maximum experiment diameter of the test fuel is determined by the inside diameter of the flow tube.

1. The flow tube is designed in three sections; the upper, center and lower flow tube and are 6.300 in. ID and 6.550 in. OD with a total length of 159.25 inches.

2. The upper flow tube is made of three parts, all welded together. The top and lower parts are made of type 321 stainless steel. The center part is made of an Inconel 718 forging and lies at an elevation between the inlet-outlet nozzle on the pressure tube.

3. The center flow tube is made from Zircaloy 2 with an overall length of 43.50 in. It has a coupling hub on each end which are joined to the coupling hubs of the top flow tube and lower flow tube.

4. The lower flow tube is made from type 321 stainless steel. It has twenty longitudinal slots, .5 in. wide X 4 in. long equally spaced around the circumference. At its lower end it has twelve .25 in. diameter hole equally spaced used to support the catch basket by means of screws.

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FILE NO. ___
EDF SERIAL NO. 208
GWA NO. ___

TASK PBF Reload Core In-Pile Tube (RCIPT)
DATE July 26, 1976

SUBJECT

GUIDE STRUT, 304 STAINLESS STEEL

ABSTRACT

The guide strut connects to the pressure tube by means of an integral internal spline that mates with an externally splined collar on the pressure tube. The strut is held captive to this collar by means of tabs that are welded to both sides of the collar and extend over the splines on the strut.

The strut, collar, tabs and tubular extensions are all made of 304 stainless steel rather than Inconel material.

1. The 304 stainless steel is cheaper than Inconel 718 material. It is much better and easier to machine thereby saving material cost, time and labor in fabrication.

2. The 304 stainless steel has more expansion than Inconel 718 material but by giving more clearance or opening to the strut internal spline the clearance remaining is bigger than the expected expansion rate, thus the design will be safe.

3. Strut will be at reactor coolant temperature.

For calculation it was assumed that the pressure tube is at 800°F (extremely conservative).

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FILE NO.
EDF SERIAL NO. 209
GWA NO.
DATE August 2, 1976

TASK PBF Reload Core In-Pile Tube (RCIPT)

SUBJECT

BOLT SIZING

ABSTRACT A Different size of bolt was designed for bolting the closure head into the flange at the top end of the pressure tube due to the following:

1. Closure head major dia. is 10 inches, the same size as in Core 1 IPT.
2. Bolt circle dia. was increased from 8.500 to 9.000 inches.
3. Enlargement of pressure tube inside dia. from 6.1 to 7.375 inches.
4. Lower pressure in the IPT for Reload Core.

A smaller bolt size was selected at 9/16 inches dia . 20 pieces as used in Core 1 IPT.

Attached calculations show the adjustment of bolt size and material,

This size selected as the basis for the Section III stress analysis,

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FILE NO. ____

EDF SERIAL NO. 210

GWA NO. 45073-320-020

DATE July 28, 1976

TASK PBF Reload Core - Physics

SUBJECT

SELECTION OF SHIM PIN B_4C CONTENT

ABSTRACT

An estimate of B_4C content has been requested(1) for use in the procurement package for shim pins for the PBF reload core. These pins use B_4C-alumina pellets in standard fuel rod cladding.

Physics studies have been made with 0.15 g/cm^3 natural B_4C content shim pins in an 8% enriched, zirc clad core(2,3). These establish a "salt and pepper" pattern as useful in controlling power peaking (radial power shaping) and also determine a relative worth for these shim pins in a representative configuration.

Because of the limited extent of these calculations, a rather broad range of possible B_4C content is suggested (0.10 to 0.20 g/cm^3). In particular, studies at different enrichments and studies which incorporate shim pins in a core having two enrichment zones are needed for refinement of this estimate.

1. Verbal request, Ralph Marshall, July 26, 1976

2. PBF Reload Core Preliminary Proposal, TR-854, Aerojet Nuclear Company, June 7, 1976

3. Rod, Cladding and Enrichment Reactivity Studies for the PBF Reload Core, G. S. Gill, letter to D. J. Langford, GSG-2-76, June 22, 1976

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
Willard Olson	Reactor Physics			R W Marshall	8/12/76

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EDF SERIAL NO. 211

GWA NO. ________

DATE August 3, 1976

TASK Filler and Reflector Rod Design

RECEIVED BY R. W. MARSHALL AUG 04 1976

SUBJECT

FILLER AND REFLECTOR ROD

ABSTRACT

The filler and reflector rod design are identical with the present PBF-1 designs. Drawings were updated only. Reference: 406800, 406801.

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JKlein MKShane WGLussie (Cover sheet only)
RWMarshall RPWadkins

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IDAHO NATIONAL ENGINEERING LABORATORY

PBF RC PROJECT

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 213

GWA NO.

DATE August 10, 1976

TASK PBF Reload Core-Systems Engineering

SUBJECT

CHECK ON PBF SECONDARY HEAT REJECTION CAPACITY

ABSTRACT

Data taken on June 11, 1976 at 17:45 with the reactor at 25 MW was used to check the PBF secondary heat rejection capacity.

A heat balance was made using the inlet-outlet temperatures and the primary and secondary coolant flow rates. This heat balance indicated the temperature differentials should have been 11.4^oF for the primary coolant and 11.8^oF for the secondary coolant. These compare to measured values of 14^oF and 13^oF, respectively.

Weather conditions at the time were obtained from NOAA, and a wet bulb temperature was obtained from a psychrometric chart.

Transferring the primary inlet temperature and calculated wet bulb temperature to the curves calculated by R. A. Wells for an overall heat transfer coefficient of 365 Btu/hr-ft^2-^oF results in a reactor power capability of ~25 MW.

It is concluded that the indicated secondary coolant system performance is still as projected and reported in Wells-8-75.

DISTRIBUTION JLLiebenthal, RWMarshall, RPWadkins, RGAmbrosek
WGLussie, RLPierce, CRToole

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
[illegible signature]	[illegible]	[illegible signature]		[signature]	9-11-76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 214 (Deleted 8-11-76)

GWA NO.

TASK PBF Reload Core
Core Design/Fuel Design

DATE February 27, 1976

SUBJECT

PELLET DISHING AND RADIAL GAP RECOMMENDATIONS FOR PBF RELOAD CORE

Technical Report No. 788

ABSTRACT

This EDF places TR 788, title as above, in the project file. This report was originally issued February 27, 1976.

Oxide fuel pellets stacked in a column inside a tubular metal can (cladding) have proved very satisfactory for many reactor applications. Bowing forces can be reduced by dishing out the ends of the fuel pellets slightly so that the thermal expansion found at the higher temperature pellet centerline will not cause a dome shape at the ends of the pellet. It is also necessary to provide a gap between the pellets and the cladding to accomodate pellet growth and radial thermal expansion of the pellets. Thermal analyses were performed to determine requirements for the pellet dishing and radial gaps. The results were then compared with values used in other reactors to provide a greater level of confidence.

Recommendations

It is recommended that the fuel rods be fabricated with a relatively small radial gap sufficient to permit ease of assembly and avoid unnecessary stress in the cladding wall. A nominal plenum should be provided to accommodate the gaseous fission products. The pellets should be dished concavely at the ends to allow for the differential thermal expansion caused by the higher temperature at the fuel pellet centerline. Recommended values for pellet design are:

1. Radial dish depth = .015 in. on each end of pellet
2. Undished shoulder width .048" (same as PWR)
3. Radial gas gap .008" at room temp
4. Dish radius = 2.83 in.

DISTRIBUTION R. S. Marsden, R. W. Marshall (3)

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R. G. Ambrosek, J. Klein, W. G. Lussie, R. P. Wadkins

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R.L. Chapman by RWM				RWMarshall	11/24/76

(Rev. 2-76)

IDAHO NATIONAL ENGINEERING
AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 215

GWA NO. 45070-330-007

DATE Aug 9, 1976

TASK PBF-Reload Core

SUBJECT

THERMAL CONDUCTIVITY OF TITANIUM HYDRIDE

ABSTRACT

Thermal Conductivity (k) values for the different titanium hydrides are believed to be contained in GE report[1] and are reportedly[2] very close to those of zirconium hydrides and Type 316 SS. The k values for titanium hydrides are expected to be in the range of 0.2 $\pm$ 0.03 Watts cm^{-1} K^{-1}. The dissociation temperature of titanium hydride is 950K (1250^{o}F). Titanium hydride powders with a surface oxide layer are stable in air to 750K (900^{o}F) for thousands of hours[3]. Massive or bulk titanium hydride can be stored in air to 750K (900^{o}F).

REFERENCES:

(1) "High Temperature Materials and Reactor Component Development Program-Materials" G.E.-NMPO (Nuclear Materials and Propulsion Operation) Various GEMP reports from 1961 to 1966. Like GEMP-334B, 334A, 334C, 400B, 475B, 177B, 277B, etc.

(2) Y.S. Touloukian and C.Y. Ho "Thermal Conductivity - Non metallic solids" Thermophysical Properties Research Center, Purdue University. Indiana. 1970.

(3) Telephone conversations with Bob Van Houtin of NRC, Washington, D.C. Tel. 21 - 427-4266.

DISTRIBUTION

RGAmbrosek   RWMarshall, Jr.   WGLussie   WGReuter   RKMalik
RPWadkins

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R.K. Malik	Materials Tech	WG Reuter	8-12-76	RWMarshall Jr	8/12/76

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(Rev 2 76)

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ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 216

GWA NO. 45073-320-020

DATE August 19, 1976

TASK PBF Reload Core Physics

SUBJECT

Differential and Integral Boron-Carbide, Titanium-Hydride Rod Worths

ABSTRACT

The differential and integral worths of the titanium-hydride, boron-carbide transient and control rods in the 10-2 configuration have been determined. The "window shade" method was employed using the PDQ code in conjunction with a one-dimensional axial model of the reload core. The differential and integral worth data were normalized such that the 10 control rod cluster worth and the 2 transient rod cluster worth agreed with the respective cluster worths computed in earlier X-Y PDQ calculations. The results of the calculations were used to construct differential and integral rod worth curves.

The attached report, RE-N-76-010, includes a description of the techniques used and presents the final results of this study.

DISTRIBUTION RGAmbrosek, TSBohn, WRCarpenter, RLChapman, GSGill, JWHenscheid, JKlein, SCMadden, DWNigg, JWSielinsky, WOOlson, GKWachs, DEWessol, FJWheeler, MKShane, RWMarshall, RTMcCracken

COVER SHEET ONLY W. G. Lussie

EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. T. McCracken	Reactor Technology			RWMarshall	9/13/76

FORM INEL-2631
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FEFPL PROJECT

ENGINEERING DESIGN FILE

FILE NO. ____

EDF SERIAL NO. 218

GWA NO. ____

DATE 25 August 1976

TASK PBF Reload IPT

SUBJECT

PBF RELOAD CORE ACCIDENTS FOR CATCH BASKET CRITERIA

ABSTRACT

The PBF Reload Core Preliminary Safety Assessment (1) report stated that a LOCE with no reactor trip is an anticipated accident, i.e., no damage to the IPT can be tolerated. Under normal conditions the reactor will trip, however, it is not a PPS (RDT C 16-1T) system so failure is thus anticipated. The anticipated event should consider water around the catch basket at 12 psia. The other conditions were specified in EDF 217.

If the quench valves fail to open along with a LOCE and no trip we would have an unlikely accident where IPT integrity must be retained. This condition, for the catch basket, should be analyzed under the criteria set forth in EDF 217 with the exception that 12 psia should be used for saturated steam pressure.

The pressure stated in EDF 217 should be reduced to 12 psia. After analysis of the catch basket unlikely accident, i.e., no reactor trip with LOCE and failure of quench valves, if the analysis shows that failure of the IPT is possible we will consider opening the loop isolation valves.

However, opening the loop isolation valves could cause a pressure pulse in the IPT. Analysis of the IPT for a pressure pulse of the resultant magnitude, if such a pulse did occur, is extremely difficult. Careful evaluation of the possible consequences need to be considered.

DISTRIBUTION RGAmbrosek, JKlein, RMarshall, NEPace, ETaylor, RPWadkins

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R.P. Wadkins		No		[signature]	

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FORM EG&G-2631
(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 219

GWA NO. 45300-322-100

DATE August 16, 1976

TASK PBF Reload Core Physics

SUBJECT

PLUTONIUM PRODUCTION

ABSTRACT

The plutonium inventory in the Reload Core as a function of time of operation at 50 MW was estimated. A PDQ radial depletion calculation with cross-section data from the LEOPARD code was used to determine the isotopic concentrations of Pu-239, 240, and 241 from 0 to 4000 hr. of operation at 50 MW (i.e., 0 to 200,000 MWh). It was found that the core would contain about 2.6 kg of plutonium after 5,000 MWD of steady, full power operation. The rate of plutonium production was found to be roughly constant at 0.022 kg/1000 MWh over the range of fuel burn-up investigated.

A report numbered RE-N-76-013 contains details of the calculation.

DISTRIBUTION R. S. Marsden, R. W. Marshall, G. K. Wachs, F. J. Wheeler FJW

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. T. McCracken RTM	Reactor Tech.	G K Wachs	2/10/77	R W Marshall	2/14/77

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 220

GWA NO. ______

TASK RRCS - Management

DATE August 16, 1976

SUBJECT: Procedure for Handling Future Drawing Changes While Maintaining Existing Drawings in the As-Built Condition Applicable to Proposed Changes or Those Not for Immediate Execution

ABSTRACT

On 12 August, Kirk Lemon and Jim McBride presented to PBF personnel a procedure for handling the subject changes. The procedure is designed to solve the problem of the need to have detailed construction drawings while at the same time maintaining drawings for day-to-day use in the as-built configuration.

The body of this EDF consists of the material presented by Messrs. Lemon and McBride.

It is the opinion of this writer that the Reload Core is an ideal application for this procedure and its use will be instigated shortly.

DISTRIBUTION: REHeffner, JKlein, KDLemon, WGLussie, RWMarshall, JNMcBride, BKPope, RWRohweder, MKShane, EDF File, ERDA-ID JLWallace

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. W. Marshall (signed)	5520			(signed)	8/16/76

FORM INEL 2631
(Rev. 2-76)

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ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. R221 - 3

GWA NO. ______

DATE August 17, 1976

TASK PBF Reload Core - Poison Rods

SUBJECT

DESIGN OF POISON SECTIONS OF TRANSIENT AND CONTROL RODS

ABSTRACT

Proposals (sketches 1 and 2) for poison sections sent to R, G. Ambrosek for thermal analysis.

DISTRIBUTION JWBacon, MKShane, JKlein, RPWadkins, RWMarshall, FJWheeler

COVER SHEET ONLY RGAmbrosek, WGLussie

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[signature]	PBF-DESIGN ENGINEERING	[signature]	8-17-76	[signature]	8/24/76

(Rev 2 76)

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 222
GWA NO.

TASK PBF Reload Core - Canister Design

DATE August 17, 1976

SUBJECT

STRESS ANALYSIS OF CANISTER DESIGN

ABSTRACT

Initial analysis of canister design.

DISTRIBUTION JWBacon, RAGoodell, JKlein, RWMarshall, MKShane, RPWadkins, FJWheeler

COVER SHEET ONLY WGLussie
EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
J.W. Bacon	PBF - DESIGN ENGINEERING	[illegible]	8-17-76	RWMarshall	8/24/76

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ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 223

GWA NO. ______

DATE August 17, 1976

TASK PBF Reload Core - Canister Design

SUBJECT

UPDATED STRESS ANALYSIS OF CANISTER DESIGN

ABSTRACT

Updated analysis of canister design to be submitted with canister specification for detailed stress analysis.

DISTRIBUTION JWBacon RWMarshall FJWheeler
RAGoodell MKShane
JKlein RPWadkins

COVER SHEET ONLY WGLussie
EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
J.W. Bacon	PBF - DESIGN ENGINEERING	[signature]	8/17/76	RWMarshall Jr	8/24/76

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FEFPL PROJECT

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. E225 Rev. D

GWA NO.

DATE September 23, 1976

TASK

SUBJECT

REACTIVITY INSERTION ACCIDENTS FOR PBF RELOAD CORE

ABSTRACT

A meeting was held on August 13, 1976 at 8:15 AM in the Broadway Conference Room to discuss accidents which could result in reactivity insertions in the PBF. Those in attendance were: E. C. Anderson, R. P. Wadkins, F. J. Wheeler, W. R. Carpenter, R. A. Dimenna and R. G. Ambrosek. Based on the discussions and notes taken during the meeting, a list of accidents was prepared. Comments received on the initial list have been incorporated and the revised list makes up the body of this EDF. It is intended that this list will be used for reactivity accidents to be included in the PBF Reload Core safety analysis.

DISTRIBUTION RLChapman, JLLiebenthal, RPWadkins, RGAmbrosek, File-PBF Reload Core, MKShane, JWSielinsky, BKPope, WGLussie, CRToole, JGCrocker, WRCarpenter

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R.G. Ambrosek RGA	3380	RPW		RWMarsh Ralty	9/24/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 226

GWA NO.

DATE August 25, 1976

TASK PBF Reload Core - Core Design

SUBJECT

COMMENTS ON PBF RELOAD CORE FUEL ROD ASSEMBLY SPECIFICATION ANC-50106

Telecons with John Haines, Jack Wallace, and ERDA-ID's Written Comments

ABSTRACT

The body of this EDF covers comments by John Haines of ERDA-Washington, D. A. Hoatson of NRC-Washington, Harvey Graves, Consultant to NRC, and Jack Wallace of ERDA-ID who have been reviewing the subject specification. It also includes the written comments from ERDA-ID as set forth in a letter dated September 9, 1976 from R. E. Simonds to L. H. Kent.

It is planned that ANC's response to these comments will be discussed with ID informally (for concurrence) and will be presented to the bidders at the prebid bidders conference. This writer's responses to the questions are included.

ACTION: Ron Hilker shall prepare ANC's response to these questions with assistance from others in the project.

DISTRIBUTION

HRHilker	WGLussie	REWilliams
JKlein	RWMarshall	JLWallace, ERDA-ID
LHKent	MKShane	

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. W. Marshall RWM	5520			RWMarshall Jr	10/4/76

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 227
GWA NO.
DATE September 1, 1976

TASK PBF RRCS - IPT Design

SUBJECT

IN-PILE TUBE FABRICATION SPECIFICATION MEETING

ABSTRACT

The following items were discussed and agreed upon. Action is assigned to the person shown in parentheses.

1. Define the size of the forging for qualification of the 8" weld on the primary tube (R. Y. Creer). Include in the IPT Specification as the contractor supplied.

2. Sketch the locations of the specimens for material testing. The sketch is to be part of the IPT Specification (V. Strickholm and W. G. Reuter).

3. Make sketches on all specimens. These sketches are to be part of the IPT Specification (V. Strickholm and W. G. Reuter).

4. Show trepanned section sizes including the sections available for material testing and weld qualification. This sketch is to be part of the IPT Specification (A. G. Work) or a statement shall be put in the specification giving the dimensions of the three pieces (two nozzle pieces and one weld material piece).

5. Investigate the differences between the LP and ultrasonic specifications called out on forging drawing versus those called out on IPT pressure tube drawing (V. Strickholm). Publish an EDF identifying these differences.

6. The yoke material is 304 Stainless Steel series as shown on the IPT pressure tube drawing. A weld qualification is needed and must be included in the IPT Specification (R. Y. Creer).

DISTRIBUTION RYCreer JKlein RWMarshall RBRinger VStrickholm
DKFischer WGLussie WGReuter HWSpaletta AGWork

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
J. Klein RWM Jr for	3320			RWMarshall Jr	9/9/76

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FILE NO. ______

EDF SERIAL NO. 228

GWA NO. ______

DATE September 3, 1976

TASK PBF

SUBJECT

PBF PPS REQUIREMENTS FOR LOCE

ABSTRACT

Preliminary Thermal Analysis of the catch basket for LOCE analysis indicates unacceptable IPT temperature when the criteria of EDF 217 are used.

Because of the extreme conditions, upgrading two systems is required.

It is suggested that the reactor trip on closing the isolation valves be upgraded to a PPS level. It is also suggested that a backup quench system be available to supply water to the experiment and IPT.

Comments on the proposed upgrading are requested.

DISTRIBUTION

JKlein, JRLarson, JLLiebenthal, RWMarshall, MKShane, RPWadkins, PBF File

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. P. Wadkins RPW	Thermal Analysis	[signature]	9-8-76	RWMarshall Jr	9/16/76

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AEROJET NUCLEAR COMPANY
ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 229
GWA NO.
DATE September 3, 1976

TASK PBF Reload Core - IPT Design

SUBJECT
Elimination of Strain Gaging of Thin Walled IPT During Hydrotest

ABSTRACT

Based on the strain gaging of the thick walled IPT during hydrotest, it was planned to place strain gages on the thin walled IPT for the hydrotest. Bob Goodell has pointed out that this should not be necessary since the thin walled IPT is an ASME Code stressed vessel and expected stresses will be much lower. The thick walled IPT was stressed to 0.9 of yield during the hydrotest.

Ken Shane pointed out that the strain gages were a check on the analysis and possible material anomalies as terminal pressures were reached. The test would have been stopped if an unexpected increase in strain rate had occurred.

Since the thin walled IPT, Dwg. 407564, will be a code stressed vessel, the strain gaging during hydrotest is hereby deleted. Action should be taken to delete all callouts for strain gaging from ANC 50105 and Dwg. 407564.

DISTRIBUTION DKFischer JKlein RWMarshall RBSilliman AGWork
RAGoodell WGLussie MKShane VStrickholm

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R. W. Marshall	5520				9/13/7[illegible]

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 230

GWA NO.

DATE September 3, 1976

TASK PBF Reloa' Core - Safety Analysis

SUBJECT

PBF FAST SPEED TRANSIENT ROD WITHDRAWAL.

ABSTRACT

Attached is work preformed by KDBulmahm before his leaving the company on the possibility of fast speed (approximately 160 in/sec) withdrawal of the transient rods.

Larry Chi and Mike Young have reviewed the attached study. Their comments are also enclosed. From Larry's comments the fast withdrawal would be an anticipated event for one transient rod. For two transient rods withdrawing at high speed the event is unlikely.

DISTRIBUTION

LLChi, RWMarshall, JLLiebenthal, JWSielinsky, RPWadkins, MWYoung, PBF File

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R. P. Wadkins	3380	[signature]		RWMarshall	9/16/76

5

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. -231
GWA NO.
DATE September 17, 1976

TASK PBF Reload Core In-Pile Tube Design

SUBJECT

IPT WALL THICKNESS MEASUREMENT

ABSTRACT

Per the requirements of RDT Standard F2-2, Ammendment 1, December 1973, Section 5.3 the IPT wall thickness will be checked in 10 places as will be described in the purchase specification for the IPT. The check will be performed after final machining but prior to hydraulic testing. Per the IPT specification ANC 50105 Section 3.4.1 the suggested method of testing is ultrasonic inspection per NB5330 of the Code. Any procedure suggested by the Subcontractor must be submitted to the Contractor for approval.

DISTRIBUTION RAGoodell JKlein RWMarshall MKShane RLSouthon DKFischer

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
[signature]	[signature]	[signature]		RWMarshall Jr	10/4/76

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ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 233

GWA NO. 45070-330-006

DATE September 15, 1976

TASK PBF Reload Core - Core Design

SUBJECT
COMPARISON COSTS FOR ALUMINUM AND STAINLESS STEEL VERSES ZIRCONIUM FOR PBF REACTOR RELOAD CORE CANISTER ASSEMBLIES (ANC DWG. 406806-1) - LGJ-5-76

ABSTRACT
Per the Project's request, the Producibility Section has completed a cost comparison of 406806-1 PBF Reactor Reload Core 49 Rod Canister Assembly based on the following attachments:

Attachment No. 1 is a detailed cost breakdown for (30) 406806-1 PBF Reactor Reload Core 49 Rod Canister Assembly. This estimate is for the assembly being fabricated from Aluminum and 304L Stainless Steel.

Attachment No. 2 is a detailed cost breakdown for (30) 406806-1 PBF Reactor Reload Core 49 Rod Canister Assembly. This estimate is for the assembly being fabricated from Zirconium alloy.

Attachment No. 3 is a comparative summary of Attachments No. 1 and No. 2.

The end item cost estimate of Attachment No. 1 is:

$80,695.50; in quantity of thirty units is $2,700 each.

End item cost estimate of Attachment No. 2 is:

$179,442.50; in quantity of thirty units is $6,000 each.

This is a fabrication cost ratio of 2.2 to 1; Zirconium vs Aluminum/Stainless Steel.

Material cost by weight is 25 to 1; Zirconium vs Aluminum and Stainless Steel.
Machining cost ratio is 3 to 1; Zirconium vs Aluminum.

DISTRIBUTION (complete package)
R. W. Marshall
L. G. Johnston

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D. D. Keiser — H. W. Spaletta
W. G. Lussie

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
L. G. Johnston	Materials Tech.	H. W. Spaletta	9/15/76	R W Marshall Jr	9/16/76

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FEFPL PROJECT

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. C 234

GWA NO. 45073-330-008

DATE September 17, 1976

TASK PBF RELOAD CORE CONTROL ROD POSITIONS

SUBJECT PBF RELOAD CORE CONTROL ROD POSITIONS FOR CONTROL ROD TEMPERATURE CALCULATIUNS

ABSTRACT

This EDF is intended to give the worst case condition for control rod heating. It is not intended to give the planned operating procedure. If subsequent thermal analysis shows that there is adequate air flow to cool the rods, no restriction on rod movement will be required from a thermal standpoint. If, however, excessive control rod and transient rod temperatures or air temperatures are calculated, then administrative controls or even more restrictive controls will be required.

Throughout this EDF, and hopefully other EDF's, the transient rods will refer to the two outer rods that are hydraulically actuated.

the values for control rod and transient rod worths were obtained from an EDF to be published by Rich McCracken.

DISTRIBUTION RChapman, JLLiebenthal, RMarshall, JSielinsky, KShane, CToole, WGLussie RPWadkins, FWheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. P. Wadkins RPW	3380			RWMarshall	9/24/76

EG&G Idaho

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FORM EG&G-2631 (Rev 6-76)

FILE NO.

EDF SERIAL NO. 235

GWA NO. 45300-332-330

TASK PBF Reload Core Control System Modification

DATE September 30, 1976

SUBJECT

PBF RELOAD CORE CONTROL BRIDGE DEFLECTION ANALYSIS, PRELIMINARY

ABSTRACT

For the reload core, the control system configuration is being changed from an 8-4 configuration (8 outer control rods and 4 inner transient rods) to a 10-2 configuration (6 outer control rods and 2 outer transient rods and 4 inner control rods). See pages 32 and 33 for location.

This EDF covers a preliminary analysis for the bridge deflection under the scram condition (10 CR's).

The deflection was found to be 0.057 inches or well within the design value of ±0.1 inch deflection per PBF FSAR Appendix B/VII Section 2.2.

DISTRIBUTION J. Klein, E. F. Taylor

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
Earl F. Taylor	PBF Design Engr.	W.U. Chu	12/8/76	R.W. Marshall Jr.	2/6/76

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FILE NO. ______
EDF SERIAL NO. 236
GWA NO. 45071-330-103
DATE September 20, 1976

TASK PBF RELOAD CORE - Canister Design

SUBJECT COMPARATIVE COSTS FOR FABRICATION CANISTERS FROM ALUMINUM OR ZIRCALLOY

ABSTRACT

1. Attachment I:

   Cost estimate for 16 of the 60 canisters to be manufactured from aluminum material. Factor the total dollars for 16 aluminum canisters by 3.75 for total dollars to manufacture 60 aluminum canisters.

2. Attachment II:

   Cost estimate for 16 of the 60 canisters to be manufactured from Zircalloy 4 material. Factor the total dollars for 16 zircalloy canisters by 3.75 for total dollars to manufacture 60 zircalloy canisters.

3. Comparison:

   The comparison dollar estimate of zircalloy canisters will cost about 6.25 times the aluminum canisters.

DISTRIBUTION SCohen RWMarshall RBRinger AGWork JKlein JNMcBride MKShane

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A. G. Work	3320			RBRinger	

FORM [illegible]
(Rev. 2 76)

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 237 [illegible]

GWA NO. ______

DATE September 27, 1976

TASK PBF RELOAD CORE - CORE DESIGN

SUBJECT

RESPONSE TO QUESTION 10, R. E. SIMONDS (ERDA) LETTER OF 9/9/76

ABSTRACT

All fuel pins in the PBF reactor are accounted for by serial number and location in the core. The same practice will be followed in the Reload Core. Since the serial numbers of Reload Core fuel rods will be quite different from Core I rods, it will be immediately apparent to any reactor operator whether a fuel pin is from Core I or Reload Core.

Secondly, the orientation of the handling pin at the top of the rod will be at 90° to the wrenching lugs on the bottom of the rod. Core I rods are aligned with the wrench lugs, since this causes all of the handling pins in a canister to line up, it will again be apparent to the operator or to any observer that if one or more of the handling pins is crosswise to all the others, that pin is from the wrong core. The handle of the fuel pin handling tool is also aligned with the handling pin in the top of the fuel pin, so the operator should realize very quickly from the orientation of the handle if he has installed a fuel pin from the wrong core.

DISTRIBUTION HRHilker LHKent MKShane REWilliams
JKlein RWMarshall JLWallace ERDA-ID

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EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. A. Freeman	PDE			RWMarshall Jr	11/22/76

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ____

EDF SERIAL NO. 238

GWA NO. 45075-330-007

DATE September 24, 1976

TASK PBF Reload Core - IPT Design

SUBJECT

RECOMMENDED CHANGES TO PBF INCONEL 718 IPT FORGING DRAWING AND REQUIREMENTS FOR IN-SERVICE INSPECTION

ABSTRACT

1. Single First Melt Provision

   a. Recommend deletion of general note 3 of drawing 401566 which requires all forgings to be from a single first melt. The requirement is not considered realistic as the required electro slag remelt (ESR) process will introduce a chemical variance to the vacuum induction master melt (VIM). It is suggested that the stress level for the nozzles be examined to confirm that the stress level is low enough to allow for heat to heat variations.

   b. Recommend concurrent deletion of item 4 in special provisions of purchase requisition F186690.

2. In-Service Inspection

   The current PBF Inservice Inspection Plan requires visual examination only of the Inpile tube: Therefore inclusion of ultrasonic shear wave examination as a baseline for inservice inspection is not required.

DISTRIBUTION RWMarshall, HWSpaletta, DDKeiser, DWHood, JKlein, WGReuter, AGWork, WGLussie

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[signature]	3350	[signature]	Sept 24-76	RWMarshall	9/24/76

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ENGINEERING DESIGN FILE

FILE NO. 239
EDF SERIAL NO.
GWA NO. 45073-320-020
DATE September 24, 1976

TASK PBF Reload Core Physics

SUBJECT

Power And Group 3 Flux Distributions In PBF Reload Core

ABSTRACT

Two dimensional four group R-Z PDQ calculations have been performed to estimate power and epithermal neutron flux distributions for an approximate critical rod bank position in the PBF reload core. Calculations were performed assuming an 8% enriched oxide fuel reload core with 4% enriched fuel in the inner zone. Results are normalized to a total core power of 1 MW.

DISTRIBUTION WRCarpenter, GSGill, JKlein, RWMarshall, RTMcCracken, DWNigg, WOOlson, KShane, GKWachs, RPWadkins, DEWessol, FJWheeler, EDF File, RSMarsden

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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EG&G Idaho

FILE NO. ______

ENGINEERING DESIGN FILE

EDF SERIAL NO. 240

FORM EG&G-2631 (Rev. 8-76)

GWA NO. D2103

TASK PBF Converter Conceptual Design

DATE October 12, 1976

SUBJECT

TEST-ENERGY OPTIMIZATION AND CALCULATION OF KINETICS PARAMETERS

ABSTRACT

Additional calculations have been made to verify the capability of a modified PBF reactor as a fast-flux transient test reactor.

With a 7-pin (naturally enriched) fuel bundle as the test and by flattening the converter and driver-core radial fission source density profiles, the peak specific energy deposition was predicted to be 2300 J/g at the center test pin. Higher values can be expected through continued refinement of the model.

The results of reactivity calculations for a PBF converter reactor with no hodoscope and a 19-pin (fully enriched) mixed-oxide fuel bundle of FTR-type fuel rods indicate that the reactivity insertion for a maximum burst would be 0.020 $\Delta\rho$ ($2.78) where the temperature defect was determined to be 0.013 $\Delta\rho$ ($1.81). A transient analysis predicted the prompt-neutron generation time to be 15.7 μsec and a minimum reactor period of 1.19 msec.

DISTRIBUTION RWMarshall, GKWachs, FJWheeler, TSBohn, SCMadden, GSGill, RTMcCracken, WOOlson, DEWessol, MKShane, EDF File, RSMarsden

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
T. S. Bohn	Reactor Tech.				

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 241

GWA NO.

TASK PBF Reload Core Fuel Procurement

DATE 09/27/76

SUBJECT

RESPONSE TO EXXON NUCLEAR CO. PREBID QUESTIONS ON SPECIFICATION 50106 AND DRAWING 406263, 406800, 406801

ABSTRACT

See attached.

DISTRIBUTION R. A. Freeman, H. R. Hilker, J. Klein, L. H. Kent, R. W. Marshall, M. K. Shane, R. E. Williams, J. L. Wallace ERDA-ID

COVER SHEET ONLY W. G. Lussie
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R. A. Freeman/ H. R. Hilker	PBF			R W Marshall	9/27/76

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 243

GWA NO. 45075-330-007

DATE September 27, 1976

TASK Inconel 718 IPT

SUBJECT

LOGIC NETWORK FOR THE PBF INCONEL 718 IPT

ABSTRACT

Attached is the logic network for design, procurement and fabrication of the PBF Inconel 718 1/4-inch wall IPT.

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RWMarshall, JKlein, VStrickholm, WGLussie, DWHood, DDKeiser, LGJohnston

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D W Spaletta	3550	DD Keiser	9/28/76	RWMarshall	9/28/76

FORM INEL 2631
(Rev. 2-76)

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 245
GWA NO. 45075-330-007
DATE September 27, 1976

TASK Reload Core - Core Design

SUBJECT

INDUSTRY SPECIFICATION FOR BORON CARBIDE FOR NUCLEAR APPLICATION

ABSTRACT

Contacted Mr. Ed Hamel of the Norton Co., Worcester, Mass. Re: Industries Specifications for B_4C Nuclear Grade Powder.

He stated Norton Co. uses the following specifications:

1) ASTM C-750

2) Norton Product Information Bulletin #N-T-1

HE has forwarded a copy of N-T-1 to writer.

NOTE: FTS 21-8365251

Norton Co., 8531000

Enclosed is a copy of ASTM C-750 and #N-T-1.

DISTRIBUTION HRHilker RWMarshall
JKlien MKShane

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RAFreeman, HWSpaletta, DDKeiser, WCFrancis

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[signature]	3350	Spaletta	27 Sep 76	RWMarshall Jr.	9/27/76

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PAGE NO. 1 OF 1

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 246

FORM EG&G-2631 (Rev. 6-76)

GWA NO.

TASK PBF RELOAD CORE - CRCA

DATE September 28, 1976

SUBJECT

TELECON TO BELOIT POWER SYSTEMS CO. MR. JOHN HENTHORN

ABSTRACT

Beloit PSC has taken over Fairbanks/Morse Compressor Business. Same people. Same plant. F/M retains diesel business.

Mr. Henthorn stated speed of our 2 stage helical lobe compressor (10,290 rpm) is at top of capability and that system capacity cannot be increased in this manner.

DISTRIBUTION RAFreeman RWMarshall
JKlein MKShane

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 247
GWA NO. 45071-330-104
DATE October 1, 1976

TASK PBF Reload Core - Core Design

SUBJECT

FUEL ROD BOWING IN THE PBF RELOAD CORE

ABSTRACT

This EDF places the subject calculations in the Reload Core Engineering File.

Bowing of the PBF reload core fuel rods was investigated and maximum deflections determined. This bowing is due to a non-symmetric temperature distribution in the fuel-rod clad. Stresses due to rod bowing and internal pressure were also determined.

The following assumptions were made:

1. The fuel rod is fixed at the lower end
2. Fuel pellets do not contribute to fuel-rod stiffness
3. Clad temperature varies linearly through the clad thickness (temperatures obtained from Thermal Branch were for inner and outer surfaces of the clad).

The following results were obtained:

1. δ = 0.0042" (maximum deflection of rod due to bowing)
2. σ = 2070 psi (maximum clad stress due to rod bowing)
3. σ = 1330 psi (maximum clad stress due to pressure)

DISTRIBUTION R. W. Marshall, R. P. Wadkins, J. Klein, K. M. Shane, R. A. Goodell

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W. G. Lussie

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[signature]	3390	R. A. Goodell	10/1/76	R W Marshall	10/1/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 248

GWA NO.

TASK PBF RELOAD CORE - FUEL PROCUREMENT

DATE 9/30/76

SUBJECT

RESPONSE TO NUCLEAR FUEL SERVICES, INC. PREBID QUESTIONS.

ABSTRACT

SEE ATTACHED

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HRHilker	RWMarshall	JLWallace - ERDA-ID
LHKent	MKShane	REWilliams

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H. R. Hilker (signature)	TRTSD			R W Marshall (signature)	9/27/76

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ENGINEERING DESIGN FILE

FORM EGAG-2631 (Rev. 8-76)

FILE NO. ______

EDF SERIAL NO. 249

GWA NO. 45500-332-100

TASK PBF Reload Core - In-Pile Tube

DATE September 30, 1976

SUBJECT

HANDLING OF IN-PILE PRESSURE TUBE DURING MANUFACTURE AND ASSEMBLY

ABSTRACT

A stress analysis was performed on the In-Pile Pressure Tube to determine the maximum stresses and deflections produced by supporting the tube in various manners. The analysis was performed in an attempt to determine the highest stress and largest deflection for each supporting condition. The results obtained will serve as a guide for handling of the pressure tube during manufacture, shipment to PBF and final installation.

Summary of results:

A. Pressure tube clamped at head end in a horizontal position.

1. Downward deflection of breech end = .26 in.
2. Maximum stress in tube = 6300 psi.

B. Pressure tube held in a vertical position with nozzles unsupported.

1. Downward deflection of nozzle end = .0013 in.
2. Maximum stress in nozzle = 263 psi.

C. Pressure tube supported at both ends in a horizontal position.

1. Maximum downward deflection of tube = .041 in..
2. Maximum stress in tube = 1476 psi.
3. Maximum downward deflection with gas jacket attached = .057 in.

D. Pressure tube supported at two points: One point 35 in. from head end and another point 61 in. from breech end.

1. Maximum stress in tube = 1016 psi.
2. Maximum stress in tube with gas jacket = 1017 psi.
3. Load to yield pressure tube > 79g's.

DISTRIBUTION JWBacon DKFischer RAGoodell JKlein RWMarshall MKShane EFTaylor

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(Rev 2-76)

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ____

EDF SERIAL NO. 250

GWA NO. 45075-330-007

TASK PBF Reload Core Inconel 718 IPT

DATE October 1, 1976

SUBJECT

REVIEW OF POTENTIAL ZIRCONIUM TUBE SUPPLIERS FOR PBF REACTOR RELOAD CORE FUEL RODS (ANC Drwg 406263) - LGJ-6-76

ABSTRACT

Per the Project's request, a submitted list (Attachment 1) of potential zirconium tube suppliers was reviewed to verify capabilities and interest for producing close tolerance zirconium tubes for the PBF Reactor Reload Core Fuel Rods.

The five listed suppliers were contacted (Attachments 2-6) and only one, Thermo Electron Corporation, Woburn, Massachusetts, was capable and interested in producing close tolerance zirconium tubing.

Additional suppliers were contacted by the Producibility Section (Attachments 7-11) and the following suppliers were determined capable and interested:

(1) Sandvik Special Metals Corporation, Kennewick, Washington

(2) Wolverine Tube, Special Metals Division, Dearborn Heights, Michigan

(3) Zirconium Technology Division of KBI, Albany, Oregon

(4) Thermo Electron Corporation, Woburn, Massachusetts

Wah Chang Albany, Albany, Oregon (Attachment 12) is capable of supplying starting stock.

Attachment #13 is definitions of various methods of producing tubing.

It will be noted on Attachment #2 that the requirement of O.D. ⌖ .001 I.D. would produce 50% fallout using standard methods of producing tubing. Writer submits the following approach to producing the subject tube to blueprint with a low percentage of fallout at a reasonable cost.

(1) Starting Material: .765/.770 Dia ⌖ .005 I.D. x .630/.625 Dia x 45.50 long tube, produced by standard methods.

(2) Face ends to 45.437 long, gun drill I.D. to .640/.637. Mount tube on mandrel, mount tube and mandrel on grinder between centers, finish grind O.D. to .752/.749 ⌖ .001 I.D.

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R.W. Marshall, L.G. Johnston, EDF File

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D.D. Keiser, W.G. Lussie, J. Klein, H.R. Hilker, H.W. Spaletta, V.J. Furio

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
L.G. Johnston	3350	H.W. Spaletta	10-1-76	RWMarshall Jr	10/1/76

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 251
GWA NO. 45300-335-302
DATE October 5, 1976

TASK PBF RELOAD CORE - CORE DESIGN

SUBJECT

REVIEW OF CANISTER ASSEMBLY DRAWINGS 406803, 406804, 406805, 406806, 406807, AND 406808 AND PURCHASE SPECIFICATION ANC 50110 - LGJ-7-76

ABSTRACT

Per the Project's request, the Producibility Section has reviewed the PBF Reload Core Canister Assembly Purchase Specification ANC 50110 and related drawings. It is recommended that ANC Specification 50110 be discontinued, the engineering requirements be incorporated on the face of the engineering drawings and quality requirements of the specification be reflected on Q.C. Form 1097.

The specific changes recommended are set forth in the body of this EDF.

A copy of the specification and Dwg. 406808 are attached for filing.

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R. W. Marshall, J. Klein

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H. W. Spaletta, W. G. Lussie, V. Strickholm, D. D. Keiser, M. K. Shane, L. G. Johnston

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
L. G. Johnston	3350	Spaletta	8-27-76	RWMarshall	10/11/76

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 254

GWA NO. 45300-335-400

DATE October 7, 1976

TASK PBF RELOAD CORE - CORE DESIGN

SUBJECT

PLAN FOR UNINSTRUMENTED Al-Zr GALVANIC CORROSION TESTS

ABSTRACT

The uninstrumented galvanic corrosion tests will be conducted at INEL in conjunction with the instrumented tests conducted by Alcoa. The uninstrumented tests will concentrate on coupons coupled through aluminum or stainless steel mounting plates where measurement of potential and current is not possible. It is anticipated that metallography and hydrogen analyses will permit correlation between instrumented and uninstrumented tests of similar coupon pairs.

The uninstrumented tests will employ selected combinations of anodized and bare aluminum coupons with autoclaved and bare Zr-4 tubing. These tests will include several duplicate coupon assemblies to ascertain the degree of reproducibility, as well as assemblies containing Zr-4 weldments and scratched anodized and autoclaved surface films.

The tests will be conducted in PBF deionized water using a simulated PBF temperature cycle that employs 2 days at 185±5F and 1 day at RT. The tests will run for 30 days (10 cycles). Maintenance of water purity will be ascertained by periodic measurement of water conductivity at RT.

The specific specimens and combinations are detailed in Table II, which is a part of this EDF.

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R. M. Horton, R. L. Miller, J. Klein, W. G. Reuter, G. A. Reimann, H. W. Schutz, R. W. Marshall, J. L. Wallace, W. G. Lussie, M.K. Shane

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EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO. ______

EDF SERIAL NO. 256

GWA NO. 45300-322-100

DATE October 11, 1976

TASK PBF Reload Core Physics

SUBJECT

Average Fast Flux in the In-Pile-Tube Wall

ABSTRACT

The average fast (damage) flux in the IPT wall was obtained from a four-group, radial PDQ calculation. Four-group constants were coalesced from 33-group data with the SCAMP code. The three fast-energy group-average fluxes calculated by the PDQ code were averaged over energy by hand to obtain a single average fast neutron flux over the 0.532 eV to 10 Mev energy range.

The average fast flux in the IPT wall was found to be 2.1×10^{17} neut./cm^2-MWd. For 5000 MWd fuel burn-up this flux results in an average fast neutron fluence of 1.05×10^{21} nvt.

DISTRIBUTION R. W. Marshall, F. J. Wheeler, Reactor Design Group, G. K. Wachs, J. W. Henscheid, M. K. Shane, R. P. Wadkins, W. G. Reuter

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 257

GWA NO. 45300-322-100

DATE October 11, 1976

TASK PBF Reload Core Physics

SUBJECT

Gamma Heating in the Fuel Canisters and In-Pile-Tube Wall

ABSTRACT

The rate of gamma-energy deposition in the reload-core aluminum fuel canisters and Inconel in-pile-tube was estimated. The methods used were based on several simplifying assumptions and the results must be considered approximate. The average gamma energy deposition rates were found to be 0.41 $\frac{\text{watts}}{\text{gm}}$ and 0.43 $\frac{\text{watts}}{\text{gm}}$ for the canisters and IPT, respectively, with the core at 50MW. These translate into average absorbed dose rates of $7.0 \times 10^5 \frac{\text{Gy}}{\text{MWd}}$ and $7.4 \times 10^5 \frac{\text{Gy}}{\text{MWd}}$, respectively.

DISTRIBUTION R. W. Marshall, G. K. Wachs, F. J. Wheeler (?), Reactor Design Group, M. K. Shane, J. W. Henscheid, R. P. Wadkins, J. Klein, R. S. Marsden, R. G. Ambrosek

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R. T. McCracken	Reactor Tech	G K Wachs	11/15/76	R W Marshall Jr	11/22/76

FORM INEL 2631 (Rev. 2-76)

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 258

GWA NO. 45300-322-100

DATE October 12, 1976

TASK PBF Reload Core Physics

SUBJECT TOLERANCES ON BORON-CARBIDE PARTICLE SIZE, DENSITY, AND HOMOGENEITY IN THE RELOAD CORE SHIM PINS

ABSTRACT

Estimates have been made based on core-physics constraints of the allowable tolerances on B_4C particle size, density, and homogeneity of dispersion in the Al_2O_3-B_4C shim material mixture. These estimates were made using 33 group, transport calculations and some simple one-dimensional models. The recommended tolerances to be specified are:

(1) A maximum B_4C particle size of .05 mm (2 mils),

(2) A B_4C density range from 0.147 $\frac{gm}{cm^3}$ to 0.153 $\frac{gm}{cm^3}$ on a pellet basis,

(3) Sufficient homgenization to restrict B_4C density variations to no more than 5% in 95% of all samples ranging in mass from 20 mg to 30 mg.

DISTRIBUTION R. A. Freeman, J. Klein, G. K. Wachs, J. W. Henscheid, R. W. Marshall, F. J. Wheeler, R. H. Hilker, M. K. Shane, Reactor Design Group

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W. G. Lussie

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 259

FORM EG&G-2631 (Rev. 8-76)

GWA NO. 45500-332-100

TASK PBF Reload Core - IPT Design

DATE October 12, 1976

SUBJECT

IPT NOZZLE LOADS

ABSTRACT

The following loads are applicable to the IPT nozzles on the Reload Core:

Top Nozzle:

Axial: 1031 lbs.

Torque: - 20,000 lbs. in.

Vertical Moment: - 14,000 lbs. in.

Horizontal Moment: - 104,000 lbs. in.

Lower Nozzle:

Axial: 675 lbs.

Torque: - 10,000 lbs. in

Vertical Moment: + 55,000 lbs. in.

Horizontal Moment: + 47,000 lbs. in.

The assumption for the loads is that movement of the acoustic filters is zero during a loop heatup cycle (normally filters are free to move). This is based on the loop configuration after the installation of the LOCA Modification. This is a conservative assumption. An effort is underway to install an alarm which would signal restriction in the movement of the acoustic filters. The above data shows the loads on the nozzles that result from the loop heatup cycle. These loads remain on the nozzles during normal operation of the loop, and are in addition to any other loads due to operating conditions. The above data will be published by Applied Mechanics in a stress report covering the LCSM piping. Source: T. Rahl - Applied Mechanics Department, Ext. 1281.

DISTRIBUTION D. K. Fischer, R. A. Goodell, J. Klein, R. W. Marshall, T. Rahl
M. K. Shane

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[signature]	[signature]		10-14-76	R W Marshall [signature]	10/14/76

EG&G Idaho

FILE NO.

EDF SERIAL NO. 260

GWA NO. 45500-335-103

DATE October 2,, 1976

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

TASK PBF Reload Core - IPT Design

SUBJECT

PROPOSED CHANGES TO IPT FORGING CONTRACT AT WYMAN GORDON Subcontract S-2660

ABSTRACT

Changes to IPT forging contract at Wyman Gordon (Subcontract S-2660) are proposed. These changes will update the contract to reflect:

Agreements between Wyman Gordon and EG&G based upon the meetings of September 7 and 8, 1976.

The proposed configuration of the forging as set forth in Wyman Gordon Dwg 39594 A.

Correction of deficiencies in the ultrasonic inspection of the forgings.

The projects current need date for the forgings.

The body of this EDF identifies how these changes will affect the subcontract and gives background information on the proposed changes. A revised copy of the Special Provisions - 048 to Subcontract S-2660, and the revised Form 1097 are included.

DISTRIBUTION F. P. Blair, D. D. Keiser, J. Klein, E. W. Lyon, R. W. Marshall, M. K. Shane, H. W. Spaletta, J. L. Wallace

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W. G. Lussie

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R W Marshall Jr				R W Marshall Jr	11/9/76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EGAG-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 261

GWA NO. 45073-320-022

DATE October 29, 1976

TASK PBF Reload Core - Canal Extension

SUBJECT

RADIATION SAFETY EVALUATION, PBF EXPANDED CORE STORAGE BASIN SHIELDING ANALYSIS

Storage of PBF Reload Core In Proposed PBF Canal Extension

ABSTRACT

A proposal has been made to extend the present PBF canal to provide room for storage of both Core I and the Reload Core (Ref. EDF #188). An analysis has been performed to determine the shielding required to allow people to work safely at the outside wall of the canal. Wall dimensions used in the analysis were the same as the existing canal wall. If the concrete used has a density equal to or greater than 3.5 g/cm^3 (218 [illegible] lbs/ft^3), then the dose rate at the outside of the wall would be reduced below the safe level of 0.25 mR/hr. Wall dimensions and canister placement were taken from EDF #188. Safety Analysis Report #RE-N-76-016 constitutes the body of this EDF.

DISTRIBUTION JWBacon JKlein RWMarshall RSMarsden MKShane FBSimpson

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EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 262

FORM EG&G-2631 (Rev. 8/76)

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE November 5, 1976

SUBJECT

Physics Parameter Calculations for Use in RELAP-4 Model of PBF Reload Core

ABSTRACT

Physics calculations were performed to estimate β-effective, prompt neutron lifetime, core averaged void coefficients and core averaged doppler coefficients. The methods described in IDO-16983 were employed. Calculations for the PBF Reload Core were performed for a core using 8% enriched uranium oxide fuel with Zircaloy-II cladding operating at 50 MW power. For standardization purposes the inpile tube was filled with 611 K (640°F) water. Material cross sections were generated using the BOBBY-PHROG program; and eigenvalue problems were solved using a one-dimensional radial PDQ model. PDQ7 code version 2 modification 3 was used.

The attached report, RE-N-76-022, describes the methods used and the final results of the physics calculations.

DISTRIBUTION JWHenscheid, GKWachs, FJWheeler, TSBohn, DWNigg, RTMcCracken, WOOlson, WRCarpenter, JWSiclinsky, SCMadden, DEWessol, RWMarshall, RPWadkins, MKShane, GSGill RSMarsden

COVER SHEET ONLY W. G. Lussie

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EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 263

FORM EG&G-2631
(Rev 8-76)

GWA NO.

TASK PBF Reload Core - Safety Analysis

DATE November 12, 1976

SUBJECT

MEETING TO DISCUSS PBF RELOAD CORE CONTROL ROD DESIGN

ABSTRACT

Minutes of the meeting held on October 21, 1976 to discuss design of the PBF control rods are attached. They note temperatures calculated with present input, physics deficiencies, possible operating configurations, and control rod cooling capabilities.

Also recorded are assignments for getting data and information required before a design requirement can be prepared.

DISTRIBUTION R. G. Ambrosek, C. H. Cooper, R. A. Freeman, J. Klein, R. W. Marshall, W. O. Olson, R. L. Pierce, M. K. Shane, J. W. Sielinsky, R. P. Wadkins, J. L. Wallace, F. J. Wheeler

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 264

GWA NO. 45300-322-100

DATE October 27, 1976

TASK PBF Reload Core - Physics

SUBJECT

Reactivity Change Due to Boron Impurities in PBF Fuel

ABSTRACT

The reactivity change due to an 8 ppm boron impurity mixed with the 8% UO_2 fuel was determined. The Bobby-PHROG computer code was used to calculate four group cross sections, and the PDQ-7 version 2 computer code was used in a radial model to calculate the reactivity insertion. Since the Bobby-PHROG library contained boron-10 and not natural boron, the boron atom density was corrected by the relative abundance of boron-10, 19.8%. Results were obtained with the PBF Reload Core in the following configuration: 611 K (640^oF) H_2O was in the IPT; the reactor was operating at 50 MW power; all poison rods were removed; and 8% UO_2 - Zircaloy II fuel rods were used. A -.001922 change in reactivity was calculated when the boron impurities were introduced.

DISTRIBUTION F. J. Wheeler, G. K. Wachs, R. W. Marshall, R. P. Wadkins, W. R. Carpenter, J. W. Sielinsky, M. K. Shane, T. S. Bohn, D. W. Nigg, R. T. McCracken, W. O. Olson, D. E. Wessol, G. S. Gill, R. S. Marsden

W.O. for F.J. Wheeler

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 265
GWA NO. 45400-332-110
DATE October 27, 1976

TASK PBF Reload Core - Core Design and Fabrication

SUBJECT

POISON ROD COOLING AIR FLOW

ABSTRACT
The velocity of cooling air through the poison sections is limited to that of the speed of sound in air. Preliminary calculations show that the minimum area in the poison section, between the two poison pieces, should be greater than .28 in^2 in order to have a flow rate of 200 cfm/rod. Any cooling holes through the poison would also be included in this area figure.

DISTRIBUTION RGAmbrosek JWBacon LGJohnston JKlein RWMarshall WOOlson RPWadkins FJWheeler

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 266

GWA NO. 45500-332-100

DATE October 28, 1976

TASK PBF Reload Core In-Pile Tube Design and Fabrication

SUBJECT

IN-PILE PRESSURE TUBE COST COMPARISON OF TREPANNED METHOD VERSUS BORING MAIN ID

ABSTRACT

A cost comparison of two means of fabricating the In-Pile Tube (by boring, or trepanning and welding the main ID) has been made by V. J. Furio, Cost Estimator, Procurement Support Section. A significant saving results if the part is trepanned. The first piece comparison is as follows:

Boring main ID	$17,820.00
Trepanning and welding	7,800.00
First piece savings	$10,020.00

An additional saving ($2,500) would be realized on a second In-Pile Tube fabricated at the same time.

DISTRIBUTION

V. J. Furio, J. Klein, R. W. Marshall, M. K. Shane, H. W. Spaletta

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W. G. Lussie, J. L. Wallace

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Jack Klein by RWM				R.W.Marshall	11/2/76

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 267

FORM EG&G-2631 (Rev. 8-76)

GWA NO. 45300-332-300

TASK PBF Reload Core Core Design and Fabrication

DATE October 28, 1976

SUBJECT

49 ROD CANISTER ASSEMBLY COST ESTIMATE - ALUMINUM VERSUS ZIRCONIUM

ABSTRACT

The total cost of fabricating 30 each of the 49 rod canister assembly (Dwg. No. 406806 NC) from aluminum, and from zircaloy-4 has been estimated by V. J. Furio, Cost Estimator, Procurement Support Section. A comparison of these estimates is:

Cost to fabricate 30 ea. P/4 406806 from zircaloy-4	$122,161
Cost to fabricate 30 ea. P/4 406806 from aluminum	70,814

Cost ratio: $\frac{\text{zircaloy-4}}{\text{aluminum}} = 1.73$

DISTRIBUTION

V. J. Furio, J. Klein, R. W. Marshall, M. K. Shane, H. W. Spaletta

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W. G. Lussie, J. L. Wallace

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J W Klein by RWM				RWMarshall	11/2/76

IDAHO NATIONAL ENGINEERING LABORATORY

FEFPL PROJECT

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 268

GWA NO. 45071-330-105

DATE 10-8-76

TASK PBF RELOAD CORE

SUBJECT

PRELIMINARY ANALYSES OF RELOAD CORE CATCH BASKET AND IPT FOR 36 and 49 ROD MELTDOWNS

ABSTRACT

Simplified 1-D models were made of several PBF thin wall IPT catch basket design concepts using the two-dimensional heat conduction code, SIMIR/4. Four cases of fuel meltdown without water cooling to the catch basket (hypothetical accident conditions occurring during LOCE testing) were analyzed. They included three different catch basket designs. Complete fuel meltdown of either 36 or 49 rods of a test bundle inside the IPT was assumed in all cases. In addition, all this fuel was assumed to reach the inside of the fuel catch basket within one second of the initial fuel meltdown (i.e. within one second of reactor scram).

Results of all four transients are included in the body of this report. Only the last transient simulated reflects the latest catch basket design criteria.(1) As such, only analysis conditions and results for this last transient are summarized below.

Analysis Conditions:

1. Complete fuel meltdown of 49 PWR rods.
2. Catch basket - ¼-inch thick Tungsten wall with an I.D. = 6.38 inches.
3. Decay heat curve in conformance with Reference 1.
4. Initial fuel temperature of 5300°F.
5. Inlet IPT downcomer annulus gap - ¼-inch.
6. Complete steam environment at 12.5 psia surrounding catch basket.
7. Fuel vaporization temperature - 6100°F.
8. Initial temperature of non-fuel materials - 600°F.

Results of 240 second transient:

1. Wall of IPT exceeds 1800°F design limitation near 115 seconds into the transient.
2. Wall of IPT reaches 2300°F melting temperature near 160 seconds into the transient.
3. Maximum catch basket wall temperature is near 3700°F.

DISTRIBUTION Earl Taylor, N. E. Pace, H. G. Kraus, R. W. Marshall, R. P. Wadkins, J. Klein, M. K. Shane, E. V. Mobley, J. K. Rawlins, B. K. Pope, R. S. Marsden

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ___
EDF SERIAL NO. 269
GWA NO. 45300-335-302
DATE November 2, 1976

TASK PBF RELOAD CORE -IPT DESIGN

SUBJECT

TIME TO COMPLETE ESTIMATE
PBF IN-PILE TUBE P/N 400230
(LGJ-10-76)

ABSTRACT

Per the projects request, the Producibility Section has completed a time to complete estimate for subject in-pile tube assembly.

It will be noted on page 2 that the machining subcontractor will receive a trepanned forging from the forging supplier.

As noted on page 3, the time span to complete is estimated at 18.5 months. This is predicated on the following contingencies:

1. Five eight hour day work week.
2. Forging delivered to machining subcontractor no later than 3.5 months after award of machining and assembly subcontract.
3. No scrap of 207612-4 forging.

The Producibility Section will recommend qualified suppliers prior to requisition preparation; however cursory evaluations indicate the following are capable of meeting the estimated schedule:

1. Standard Tool and Die Co., Los Angeles, CA.
2. Allied Mechanical Co., Los Angeles, CA.
3. Monarch Machine Co., Los Angeles, CA.
4. Nuclear Automation Co., N. Huntington, PA.
5. VOTAW Precision Co., Los Angeles, CA.
6. Standard Pressed Steel Co., Jenkinstown, PA.
7. North American Aviation Co., Los Angeles, CA.
8. Permutit Co., Lancaster, PA.
9. Martin Marietta Co., Baltimore, MD.
10. XLO, Lima, OH.
11. Amatek Straza, El Cajon, CA.

DISTRIBUTION

V. Furio, L. G. Johnston, D. D. Keiser, J. Klein, W. G. Lussie, R. W. Marshall, M. K. Shane, H. W. Spaletta

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
L. G. Johnston	Materials Technology	Spaletta	Nov 8, 76	RWMarshall	11/9/76

(Rev 2 76)

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AEROJET NUCLEAR COMPANY

ENGINEERING DESIGN FILE

FILE NO. ______
EDF SERIAL NO. 270
GWA NO. 45300-335-302
DATE November 2, 1976

TASK PBF RELOAD CORE - CORE DESIGN

SUBJECT

TIME TO COMPLETE ESTIMATE
PBF CANISTER ASSEMBLY P/N 406806-1
(LGJ-9-76)

ABSTRACT

Per the projects request, the Producibility Section has completed a time to complete estimate for subject canister assembly.

It will be noted on page 2 the time span to complete 30 assemblies is 9.5 months. This estimate is based on an eight hour day, five days a week.

This estimate is typical for the following canister configurations in quanities noted:

406803 (4 each)
406804 (8 each)
406805 (4 each)
406807 (8 each)
406808 (8 each)

In the event the complete requirement is placed in one subcontractor facility, the time span to complete all 62 assemblies will increase to 17.0 months.

The Producibility Section will recommend qualified suppliers prior to requisition preparation; however cursory evaluations indicate the following are capable of meeting the estimated schedules:

1. Acro-Tech Co., Los Angeles, CA (EB Weld capability)
2. Allied Mechanical Co., Los Angeles, CA.
3. Fansteel, Los Angeles, CA. (EB Weld Capability)
4. Mechanical Specialities, Los Angeles, CA.
5. Rocket Research Co., Redmond, Wash. (EB Weld Capability)
6. Exxon Nuclear Co.Inc., Richland, WA.

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
L. G. Johnston	Materials Tech.	Spaletta	Nov 8, 76	R W Marshall	11/10/76

EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 271

GWA NO. 45300-332-300

FORM EGAG-2631 (Rev. 8-76)

DATE November 2, 1976

TASK Control System Modification

SUBJECT

PBF RELOAD CORE CONTROL AND TRANSIENT ROD DRIVES VELOCITIES DURING NORMAL AND ACCIDENT CASE OPERATIONS

ABSTRACT

CRD Normal Operation

During normal continuous withdrawal and insertion CRD velocity is 7.2 inches/minute or 0.12 inch/second. However, each CRD can be operated in discrete stops or steps for withdrawal and insertion and thus have an average velocity ranging from just greater than 0 inch/second to just less than 0.12 inch/second. Final scram insertion velocity over the 28 inches acceleration distance is 431.37 inches/second and 431.37 inches/second initial deceleration velocity over the 8 inches deceleration distance.

TRD Normal Operation

Normal continuous withdrawal and insertion velocity during set up and testing is 0.5 inch/second and is 0.1 inch/second during normal operation for positioning each rod. For experiment purposes maximum withdrawal velocities between 20 inches/second and 175 inches/second can be obtained by adjusting the mechanical stop on the servo valve. Maximum insertion velocity is ~ 175 inches/second.

CRD Accident Case Operation

A variation in each CRD drive rate as mentioned in EDF 225, Rev. 1, could result by a power frequency change from 60 cycles per second to the permanent-magnet drive motor on each CRD. However, the probability of this happening is extremely unlikely.

TRD Accident Case Operation

A preliminary study (EDF 230) has listed the following withdrawal accidents which could cause a withdrawal speed of 160 inches/second: actuator temporarily jams and then surges, misadjustment of TR velocity limit, and hydraulic leaks. Also, a variation in each TRD drive rate, as mentioned in EDF 225, rev. 1, could result by a power frequency change to the power supply in the servo control system of each TRD. Finally, a failure in the control system could cause the TRD to withdraw at the velocity limit set (between 20 and 175 inches/second) by the mechanical stop on the servo valve.

DISTRIBUTION RGAmbrosek JWBacon RCChampman RAGoodell JKlein RWMarshall WCOlson MKShane JWSielinsky EFTaylor RPWadkins FJWheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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ENGINEERING DESIGN FILE

FORM EG&G 2631
(Rev. 8-76)

FILE NO. ______

EDF SERIAL NO. 272

GWA NO. ______

DATE November 12, 1976

TASK PBF Reload Core - Safety Analysis

SUBJECT

MEETING II TO DISCUSS PBF RELOAD CORE CONTROL ROD DESIGN

ABSTRACT

Minutes of the meeting held on November 4, 1976 to discuss design of the PBF control rods are attached. They note reports on previous assignments and record further assignments. They also note the need for definition of desired operating limitations for material and air temperatures.

DISTRIBUTION R. G. Ambrosek, C. H. Cooper, R. A. Freeman, J. Klein, R. S. Marsden, R. W. Marshall, W. O. Olsen, R. P. Wadkins, F. J. Wheeler

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AUTHOR R. G. Ambrosek (signature: R. G. Ambrosek) DEPT. 3380
REVIEWED R. P. Wadkins DATE 11/17/76
APPROVED R W Marshall DATE 11/18/76

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 275

FORM EGAG-2631 (Rev 8-76)

GWA NO. 45300-335-400

TASK PBF - TRANSIENT ROD COMPONENTS

DATE November 8, 1976

SUBJECT

SOURCES AND CAPABILITIES FOR PRODUCING B_4C AND TiH_x SECTIONS FOR TRANSIENT RODS

ABSTRACT

Several vendors were contacted regarding their capabilities for producing B_4C and TiH_x in configurations suitable for the PBF transient rods. Suppliers of B_4C compacts were located without difficulty and it is likely that a fair number of other capable vendors exist in addition to the three listed. Suppliers for sintered compacts of TiH_x were more difficult to find since the demand for this compound has declined. More searching will certainly discover more vendors for TiH_x also.

Cost estimates for compacts of B_4C and TiH_x in configurations suitable for the transient rods are given. Since we could not be specific regarding chemistry, density, and mechanical property requirements, vendors were able to provide only rough cost estimates. It is possible that lower prices can be obtained when this information is available and when the search for suppliers is expanded.

DISTRIBUTION R. W. Marshall, Jr.

R. G. Ambrosek, W. G. Reuter, R. P. Wadkins, W. O. Olsen, F. Wheeler

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W. G. Lussie

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
George A. Rodriguez	Materials Technology	W. Reuter	4/18/77		

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FILE NO.

EDF SERIAL NO. 276

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

GWA NO.

DATE November 12, 1976

TASK PBF Reload Core Inconel 718 IPT

SUBJECT

STATUS REPORT FOR PBF INCONEL 718 IPT FORGINGS

WYMAN GORDON CONTRACT S-2660
(Spal-22-76)

ABSTRACT

Recent reports from Wyman Gordon indicate problems at Cameron Iron during conversion of the Inconel 718 ingots to the billet form. The billets supplied by Cameron will be used by Wyman Gordon as forging stock for the PBF Inconel 718 in-pile tube (IPT). A summary of the conversion problems are as follows:

1. Four billets were lost during the conversion.
2. During the upsetting operation of the ingot from 25 inch to 30 inch diameter incomplete filling of the die cavity was observed on four ingots. Surface cracks on one end were observed on one of these ingots.
3. Extrusion of a 30 inch diameter by 40 inch long billet to a 24 inch diameter resulted in surface cracks and inadequate material to meet the minimum weight required by Wyman Gordon.
4. The other two billets revealed cracks after being removed from the furnace and allowed to cool.
5. Trans-axial forging will be performed in lieu of extrusion.
6. Cameron Iron will not perform a trans-axial forge operation of the 30 inch diameter by 40 inch long billet because they consider their press capacity marginal.

Wyman Gordon's recovery plan is as follows:

A. Cameron Iron will process three additional Cabot Industries supplied 20 inch diameter ingots using an interim upsetting operation between the 25 inch diameter and the 30 inch diameter.
B. Cabot Industries has contacted Ladish, Inc., of Cudahy, Wisconsin, to trans-axial forge the 30 inch diameter billets to the Wyman Gordon's required 18 inch square configuration.

A history of Cameron Iron Works reported difficulties is included on page 2 and 3 of this EDF.

DISTRIBUTION B. R. Adams, D. D. Keiser, R. W. Marshall, M. K. Shane, H. W. Spaletta, F. P. Blair, J. O. Brigleb, E. W. Lyon

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FILE NO. ______

ENGINEERING DESIGN FILE

EDF SERIAL NO. PBF-277

FORM EG&G-2631 (Rev 8-76)

GWA NO. 45300-332-300

DATE November 10, 1976

TASK PBF Reload Core - Systems Engineering

SUBJECT

PROPOSED CONFIGURATIONS FOR MAXIMUM SIZED FUEL ARRAYS TO BE TESTED IN RELOAD CORE

ABSTRACT

Various arrays of commercial power reactor fuel rods will be placed inside the In-Pile Tube for testing in the PBF Reactor. The enclosed layouts show a cross section of the Reload Core In-Pile Tube with proposed arrays of BWR/6, PWR/15x15, and PWR/17x17 fuel pins.

For test program information, see letter: PBF Reload Core Program - Cro-204-75.

DISTRIBUTION RGAmbrosek, JWBacon, EEBurdick, JKlein, RSMarsden, RWMarshall, RKMcCardell, MKShane, RPWadkins, FJWheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 278

GWA NO. 45300-322-100

DATE November 15, 1976

TASK PBF Reload Core Physics

SUBJECT

PBF Reload Core Test Performance Assessment

ABSTRACT

A study was made to examine the test performance capabilities of the Reload Core with respect to the maximum linear power which can be generated in a given test configuration. The study included PWR/17x17 and BWR/6 test fuel bundles of various sizes, enrichments, and irradiation histories. In general, it was found that the Reload Core will provide a gain in test performance over the PBF Core I of about 2.4 for PWR/17x17 tests and 2.1 for BWR/6 tests.

The attached report, RE-N-76-034, transmits the results of this study.

DISTRIBUTION J. W. Henscheid, R. W. Marshall, Reactor Design Group, G. K. Wachs, F. J. Wheeler, R. S. Marsden

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. T. McCracken	Reactor Tech.			RWMarshall	11/18/76

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FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 280
GWA NO. 4. 00-332-300
DATE November 11, 1976

TASK PBF Reload Core - Control System Modification

SUBJECT

PRELIMINARY PROPOSAL FOR INSTALLING ADDITIONAL AIR COMPRESSORS FOR CRCA SYSTEM

ABSTRACT

Attached is a proposal for increasing the air flow for the control rod cooling air system. The proposal was prepared by the Facilities Engineering Branch.

The proposal includes the cost of installing the existing Fairbanks-Morse CRCA Compressor in the proposed building, but not the cost of removing the Fairbanks-Morse Compressor from the reactor building first basement.

The cost of providing 2400-Volt electrical power from the SPERT substation to the proposed building is not included.

DISTRIBUTION RAFreeman, JKlein, RWMarshall, MKShane, CRToole
BKPope, R. G. Ambrosek, R. S. Marsden

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EG&G Idaho, Inc.

PROJECT FILE NO.

EDF SERIAL NO. 280A

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO 45300-332-300

PROJECT/TASK PBF Reload Core

DATE December 20, 1976

SUBTASK Control System Modification

EDF PAGE NO 1 OF 3

SUBJECT

FURTHER COMMENTS ON PROPOSED 5000 SCFM COMPRESSOR BUILDING

A response to comments by B. K. Pope and D. C. Hendrickson

ABSTRACT

EDF 280 included a preliminary proposal for a new compressor building to be located east of the PBF reactor building. The proposed building would house an enlarged control rod cooling air capability as required for Reload Core.

Taking the last comment first: "Why is more CRCA capacity needed?" The Reload Core will require 400 scfm of cooling air per rod, as presently calculated, or 4800 scfm total, versus Core I's 1000 scfm total. The requirement has enlarged since EDF 280 was issued.

Should the preliminary proposal be developed into a construction project, the corrosive waste line may have to be relocated. The new air line would indeed have to cross the corrosive waste line, either above or below.

In the vicinity of the proposed building the drainage ditch would have to be narrowed and located closer to the road. The proposed building must be located as near to the PBF-620 perimeter road as possible to minimize the amount of blasting required. The nearest outcrop of lava is 30 feet from the road at the proposed site. The nearest core drills, taken before the reactor was built, shows eight feet of soil above the first rock. Since the proposed building does not require a basement, there is a reasonable chance that blasting will not be required. As is customary, if construction is planned, core drilling of each column location will be done and the presence or absence of lava in the foundation will be confirmed.

It now appears that a single 4160 volt compressor will be installed.

Please keep in mind that the proposal presented in EDF 280 is preliminary. Many considerations will affect the decision on whether to proceed.

The comments of D. C. Hendrickson and B. K. Pope, which elicited this EDF, are given on Page 2. A revised plot plan, which is attached, accounts for some of the above comments.

DISTRIBUTION (COMPLETE PACKAGE) J. Klein, R. S. Marsden, B. K. Pope, C. R. Toole, R. A. Freeman, R. W. Marshall, M. K. Shane

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W. G. Lussie

AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
R. A. Freeman	PBF	[signature]	1-7-77	R W Marshall Jr	1/10/77

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 6-76)

FILE NO.

EDF SERIAL NO. 281 281

GWA NO. 45300-332-300

DATE November 11, 1976

TASK PBF Reload Core - Control System Modification

SUBJECT

EXAMINATION OF THE DESIGN TEMPERATURES OF THE CORE 1 ITEMS OF CONTROL AND TRANSIENT ROD AIR SHROUDS AND PART OF THE LOW PRESSURE AIR SYSTEM

ABSTRACT

Heat transfer analysis on the poison sections show that elevated outlet cooling air temperatures on the order of 800°F are anticipated.

The subsequent pages of this EDF examine the low pressure air system lines from the air shrouds in the core area to the exhaust stack with reference to allowable design temperatures.

Assuming a cooling air exhaust temperature of 800°F, it can be seen readily that redesign of the entire low pressure system is in order, including the installation of variable support hangers to react against the loads generated by the thermal expansion.

An estimate of the cost to accomplish this task is $104,084.00 and is detailed on page 5.

DISTRIBUTION RGAmbrosek, JWBacon, RAFreeman, RAGoodell, JKlein, RWMarshall, RS Marsden, WCOlson, MKShane, JWSielinsky, EFTaylor, RPWadkins, FJWheeler

COVER SHEET ONLY WGLussie

EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR Earl F. Taylor | DEPT. PBF Design Engr | REVIEWED [signature] | DATE [signature] | APPROVED RWMarshall | DATE 11/30/76

EG&G Idaho

FILE NO.

EDF SERIAL NO. 282

GWA NO. 45300-332-300

DATE November 12, 1976

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 6-76)

TASK PBF Reload Core - Core Design and Fabrication

SUBJECT

ESTIMATE OF UO_2 REQUIRED FOR RELOAD CORE

ABSTRACT

To determine the UO_2 required for the Reload Core the following has been assumed:

Total Number of Fuel Rods = 2500

UO_2 Density = 10.97 gr/cm^3

Pellet Diameter .626 in. = 1.59 cm

Theoretical Density = 93%

Stack Length = 91.74 cm

Dish Factor = .98

Total weight = $2500 \times \pi/4 \times 1.59^2 \times 91.74 \times .93 \times .98 \times 10.97 = 45.53 \times 10^5$ grams

Notes:

Production losses have not been included in this estimate.

Current RFP asks subcontractor to supply: 1800 fuel rods 8% enriched
205 fuel rods 4% enriched

The additional 500 rods referenced above remains an option for EG&G to buy later.

DISTRIBUTION RHHilker, JKlein, RWMarshall, MK Shane, RP Wadkins, RE Wheeler, RE Williams

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
[signature] 11/12/76				[signature]	11/28/76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 9-75)

FILE NO.

EDF SERIAL NO. 283

GWA NO. 45073-320-020

TASK PBF Reload Core Physics

DATE November 13, 1976

SUBJECT

The effect of the Wigner-Seitz approximation on S_n transport theory calculations of an 8% enriched PBF reload core fuel pin cell.

ABSTRACT

In order to simplify the one-dimensional S_n transport calculation, it is necessary to replace the square cell outer boundary by an equivalent cylindrical outer boundary with a zero current boundary condition. This method is referred to as the Wigner-Seitz approximation and is a commonly used and acceptable technique for reactor physics calculations. Last year S_n transport calculations of the infinite cell model of thethen proposed PBF reload core were found to underpredict k_{eff} by ~1% and the thermal group moderator-to-fuel flux ratio by 14% when compared against Monte Carlo results and this discrepancy is mainly attributed to the Wigner-Seitz approximation. It is believed that these errors are symptomatic of a tightly packed lattice and will therefore be present in the current reload core design. Allowances for this effect on k_{eff} have been factored into the current reload core model. Since the 'fat oxide' fuel pins present a rather unique neutronics situation, further studies are required to fully understand these results and their impact on core design.

DISTRIBUTION JWHenscheid, RWMarshall, GKWachs, FJWheeler, RSMarsden, MKShane

COVER SHEET ONLY W. G. Lussie
EDF FILE LOG, EDF SERIAL NO. LOG, PROJECT CONTROL

AUTHOR D. E. Wessol DEPT. Reactor Tech. REVIEWED GKWachs DATE 11/23/76 APPROVED RWMarshall DATE 11/24/76

EG&G Idaho

ENGINEERING DESIGN FILE

FILE NO. ______

EDF SERIAL NO. 284

FORM EG&G-2631 (Rev. 8-76)

GWA NO. ______

DATE November 16, 1976

TASK PBF RELOAD CORE - SYSTEMS ENGINEERING

SUBJECT

LOCATION OF FLUX SHAPERS FOR EXPERIMENTS TO BE RUN IN THE RELOAD CORE

ABSTRACT

Because of the possibility of overheating the control rods if fully inserted while the reactor is operating at 50 MW, it is desireable to operate with the 4 inner control rods completely out of the core. A meeting was therefore held on October 29 with TFBP personnel to confirm the Reload Core projects understanding that there was no requirement for flux shapers to be installed in the Reload Core. Attendees were:

Representing TFBP: E. E. Burdick
R. K. McCardell

Representing the project: R. S. Marsden
R. W. Marshall
R. P. Wadkins

Mr. Burdick stated that TFBP does not have any plans for axial flux shaping using core rods. They plan to install flux shapers in the IPT when required as part of a specific experiment.

TFBF, per Mr. Burdick, has two objectives: one, to have a fixed flux profile, and, two, to have as high an FOM as possible.

CONCLUSION: Axial flux shaping will not be required of the Reload Core. Axial flux shapers will be part of specific experimental requirements and will be installed in the in-pile tube.

This is an EG&G position and has not as of this date been approved by ERDA/NRC. BL 12-1-76

DISTRIBUTION E. E. Burdick, J. G. Crocker, W. G. Lussie, R. S. Marsden, R. W. Marshall, M. K. Shane, R. P. Wadkins, F. J. Wheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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EG&G Idaho

ENGINEERING DESIGN FILE

FORM EGAG-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 285

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE November 17, 1976

SUBJECT

REACTIVITY CHANGE DUE TO RE-DISTRIBUTION OF THE TEST

ABSTRACT

The purpose of this study was to determine the reactivity change for a given re-distribution of the fuel in the test. Very conservative model approximations were made to overestimate the reactivity effect. Cross sections for the various test arrangements were calculated by the LEOPARD code using ENDF-B Version IV data on the CDC-7600 computer. Eigenvalues were calculated using PDQ 7V2/003, 10/09/75, ANC on the CDC 7600 computer. A PDQ one-dimensional radial model (as described in RTMc-1-76) was employed. All calculations were made using 8% enriched uranium oxide fuel with Zircaloy-II cladding for the core, and all shim rods were removed.

A 36-rod PWR 17 x 17 test was used with test rods having an O.D. of 9.5 mm. Eighteen separate cases were studied under PCM conditions. Uranium oxide enriched to 3%, 50%, and 93% with Zircaloy IV cladding was used as the test. Fifteen cases were accident cases of varying magnitude. Mass was always conserved. A very conservative PDQ model was employed in the studies. In the worst case the maximum positive gain in reactivity was calculated to be 0.034134 (~$4.70). This value of $\Delta\rho$ was calculated for a 93% enriched melted test uniformly smeared throughout the IPT. However, it is not likely that the total test will be enriched to 93%, but that there will probably exist an enrichment gradient in the test. The average enrichment could be approximately 50%. For a 50% enriched melted test smeared throughout the IPT, a maximum positive change in reactivity was calculated to be 0.021865 (~$3.00). See the attachments for further details of the calculation.

DISTRIBUTION R. W. Marshall, R. S. Marsden, R. P. Wadkins, M. K. Shane, W. R. Carpenter, J. W. Henscheid, G. K. Wachs, J. W. Sielinsky, Reactor Physics Group

COVER SHEET ONLY W. G. Lussie
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EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.
EDF SERIAL NO. 286
GWA NO. 45300-332-300
DATE November 18, 1976

TASK PBF Reload Core - Control System Modification

SUBJECT

CONTROL ROD COOLING AIR MODIFICATION

ABSTRACT

This EDF sums up the studies of the existing CRCA System. EDF 280 presented a preliminary proposal to install additional compressors, together with the existing compressor in a new building east of the PBF Reactor building.

The air requirement of the present CRCA System per SDD 5.2 is:

Compressor discharge pressure: 55 psig
Compressor discharge temperature: 85°F
Flow Requirement: 1000 SCFM

The capabilities of the compressor from the Fairbanks Morse literature are:

1390 cfm at 95°F, 12.0 psia inlet conditions.

58 psig discharge based on inlet condition above.

Drawing 1205-PER/PBF-620-P-8 is the CRCA P&I diagram.

Drawing 1205-PER/PBF-620-P-27 contains the CRCA piping details. The above drawings are attached.

Pressure drop for the compressed air between the compressor and the control bridge in the present three inch piping is 0.2 psi per 100 feet of pipe. Counting the effect of elbows and instrument taps there is approximately 1 psi lost from the compressor to the control bridge. The calculation is attached.

The revised compressor installation as shown in EDF 280 will fulfill CRCA needs for Reload Core if the air requirement is in the vicinity of 2000 SCFM. If this plan is approved, Acoustic advice should be sought before installing the three compressors, so that pressure oscillations may be eliminated or minimized.

ATTACHMENTS:

1. Drawing 1205-PER/PBF-620-P-8
2. Drawing 1205-PER/PBF-620-P-27
3. Calculations from 11-17-76

DISTRIBUTION RGAmbrosek, RAFreeman, JKlein, RWMarshall, RSMarsden, MKShane, BKPope CRToole

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 0)

FILE NO.

EDF SERIAL NO. 288

GWA NO. 45200-338-002

DATE November 22, 1976

TASK PBF Reload Core-Thermal Analysis

SUBJECT

FUEL ROD INTERNAL GAS PRESSURE

ABSTRACT

Fuel rod pressure for the hot pin has been estimated to be 49.0 psia at the end of core life. This value is based on a core life of 5000 MWD, and occurs after 2400 hours of operating time. The fuel rods are initially pressurized with helium to a pressure of 14.7 psia. Conservative values of core life and power peaking were used. A radial core power peak to average factor of 1.8 was assumed for this study. This gives a core life equivalance of 2720 MWD/MTU for the hot rod. The total fuel weight in the core is 3695 kg (1788 rods).Of this weight 261 kg is U-235*, 3000 kg is U-238 and the balance is oxygen. The resulting hoop stress is 89.3 psi and the axial stress is 25.4 psi. These values are considerably less severe than those usually experienced with commercial fuel rods.

*NOTE: This analysis was performed in late May and utilized only one enrichment in making these calculations, namely 8%. Based on current core configuration (1712 - 8% enriched, 72 - 4%) the U-235 would decrease by 2.3% while U-238 decreased by 0.1%. Reanalysis is not considered necessary.

DISTRIBUTION R. G. Ambrosek, R. L. Chapman(2), R. A. Goodell, R. W. Marshall, R. W. Wadkins, T. C. Yen

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev 8-76)

FILE NO.

EDF SERIAL NO. 289

GWA NO.

TASK PBF Reload Core - Core Design

DATE November 19, 1976

SUBJECT

Seismic Analysis of PBF Core 1

ABSTRACT

SDD 4.2, "Reactor Core System", pages 1-46, states the following under subparagraph (c) Seismic Loading: "the RCS is designed to withstand at least a 0.134g lateral load."

Project has asked Applied Mechanics to determine what was performed in the way of seismic stress analysis for Core 1 and, in particular, for the fuel canisters. The following is submitted in response to that request:

Stress analysis of the fuel canisters for Core 1 was performed by Paul Wilterdink. A search of his files failed to reveal any calculations or reports having to do with a seismic analysis of these components. The only seismic analysis noted was for the Core Support Structure.

DISTRIBUTION R. W. Marshall, J. Klein, M. K. Shane, R. C. Guenzler, J. G. Arendts, R. A. Goodell, C. A. Moore, R. S. Marsden

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W. G. Lussie

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev 8-76)

FILE NO.

EDF SERIAL NO. 290

DWA NO.

DATE November 19, 1976

TASK PBF Reload Core Control System Modifications

SUBJECT

PROBABLE USE OF ENRICHED B_4C FOR THE POISON SECTIONS

ABSTRACT

Red Johnston has gotten some preliminary prices for enriched boron carbide that indicates costs that will be acceptable. Based on this information and the discussions with Reactor Physics, the decision is made that, for the present, we will proceed with physic's calculations based on the poison sections being made completely of boron carbide - no titanium hydride.

Calculations should be based on the use of 96% enriched boron carbide and should be completed as soon as practicable.

The materials department shall continue their accumulation and development of the titanium hydride data that is currently under way.

DISTRIBUTION R. G. Ambrosek, W. R. Carpenter, R. A. Freeman, J. Klein, R. S. Marsden, R. W. Marshall, C. Olson, W. G. Reuter, J. Sielinsky, M. K. Shane, R. P. Wadkins, J. Wheeler, L. G. Johnston, W. G. Lussie, H. W. Spaletta

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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FILE NO. ______

ENGINEERING DESIGN FILE

EDF SERIAL NO. 291

FORM EG&G-2631 (Rev 8-76)

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE November 19, 1976

SUBJECT

Reference Documentation for Physics Methods and Partial Validation of Reload Core Model

ABSTRACT

The enclosed documentation (Whlr-20-75) describes some of the methods and the data base used for Reload Core calculations and is being entered into the EDF file as partial validation of the physics design work. The enclosure also gives comparisons with critical experiments and with calculations performed at BAPL, BNL, CRNL, GGA and SRL. The comparisons most pertinent to the Reload Core are the TRX lattices which are aluminum-clad uranium metal fuel rods in light water with a very tight lattice spacing.

This work was not funded by the Reload Core project but it is felt that it should be included in physics documentation. Anyone desiring a copy of the report can obtain one from the Reactor Physics Section or from the project - EDF Serial No. 291.

DISTRIBUTION EDF File

COVER SHEET ONLY JWHenscheid, RSMarsden, RWMarshall, GKWachs, Reactor Design Group
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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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EG&G Idaho

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 292

GWA NO.

DATE November 22, 1976

FORM EG&G 2631 (Rev. 8-76)

PBF Reload Core

TASK Core Design/Fuel Fabrication

SUBJECT

ACTION ON EXXONS REQUEST FOR RELAXATION OF THE FUEL STABILITY TEST ACCEPTANCE CRITERION

ABSTRACT

Paragraph 5.9.4E of the fuel procurement specification (ANC 50106 A) limits the fuel pellet shrinkage during the pellet stability test to .003-in. Exxon, at the meeting of November 4, requested that .006-in. shrinkage be allowed. This EDF discusses the ramifications of this request and recommends the following action:

1. Give Exxon written approval for the .006-in. shrinkage. This will permit them to bid.
2. Perform a FRAP analysis that includes all available data to either confirm (or refute) the action taken above.
3. Continue attempts to determine where the .003-in. limit came from.
4. Attempt to secure additional information on shrinkage in commercial fuels when they are subjected to the stability test.

DISTRIBUTION R. G. Ambrosek, G. A. Berna, M. P. Bohn, C. H. Cooper, D. L. Hagrman, W. G. Lussie, R. S. Marsden, R. W. Marshall, M. R. Martin, R. E. Mason, R. P. Wadkins, R. E. Williams, H. R. Hilker, J. Klein, M. K. Shane

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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EG&G Idaho

FILE NO.

EDF SERIAL NO. 293

GWA NO.

DATE November 23, 1976

ENGINEERING DESIGN FILE

TASK PBF Reload Core
Core Design - Fuel Design

SUBJECT

PROCESSING INFORMATION FROM EXXON

ABSTRACT

At the meeting on November 16 with the FRAP personnel (Mike Bohn, et. al.) they asked the following questions about the Exxon fuel:

1. What is the minimum diametral clearance that will still permit production assembly?
2. What is the fuel sintering temperature?
3. Are they using pore stabilizers?
4. What is the average size of the pores in the pellet?

Exxon's answers are as follows:

1. Present 0.010-in. clearance is the minimum that they accept without a small development program to determine if they could live with less. Per Owen Kruger.
2. Sintering temperature will vary depending upon whether the powder is dead or active. Will sinter from 1650°C to 1790°C. Dead powder sinters well and does not have much compaction on resintering (stability test) or in operation; active powder is the opposite. Per Phil Farnsworth.
3. Exxon is not using pore stabilizers though they may be using them within a year. Farnsworth.
4. Pore size is mostly in the 50 micron range or greater. A small % will be 1/2 micron or less (These are ones that give trouble.) Farnsworth.
Kruger in a later conversation indicated that Exxon does not know their pore size. They do have a bimodal distribution. Have two in-house programs to characterize pore size. Data will not be available for several months.

DISTRIBUTION R. G. Ambrosek, G. A. Berna, M. P. Bohn, C. H. Cooper, D. L. Hagrman, H. R. Hilker, J. Klein, W. G. Lussie, R. S. Marsden, R. W. Marshall, M. R. Martin, R. E. Mason, M. K. Shane, R. P. Wadkins, R. E. Williams

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 295

FORM EG&G-2631 (Rev. 6-76)

PBF Reload Core

GWA NO.

DATE November 23, 1976

TASK Core Design and Fabrications

SUBJECT

PBF CONTROL ROD COOLING AIR TEMPERATURE COMPARISONS BETWEEN PRESENT CORE AND RELOAD CORE

ABSTRACT

Heat generation rates presented in You-5-66A-N for B_4C and T_iH_2-B_4C control rods in the present core for partial rod insertion were sealed for full rod insertion. Calculated heat loads per rod for a reactor power of 20 MW were 4.13×10^4 Btu/hr-rod for the B_4C-T_iH_2 and 2.54×10^4 Btu/hr-rod for the B_4C. Calculated heat load for the B_4C=T_iH_2 rod in the outer position of the reload core at 50 MW is 1.68×10^5 Btu/hr-rod. Based on a reactor power ratio, the heat load in the reload core is 62 percent higher. For the present core with a control rod inserted and a reactor power of 40 MW the calculated bulk rise in the coolant air would be 438°F.

R. Pierce had some data on discharge air temperature for a reactor power of 23 MW and the control rods inserted ~ 9.5 inches. Air temperature at the aftercooler was ~ 55°F, with outlet temperatures of 110-115°F with a flow rate of 100 SCFM. Outlet temperatures were calculated based on the data of You-5-66A-N. Calculated discharge air temperatures were 102-107°F. However, they neglect heat added to the air by the reactor coolant prior to entering the core region.

Based on these results it is concluded that power generation reported in You-5-66A-N are near the reactor conditions and calculated heating rates for the reload core can be assumed to be reasonable.

It is recommended that inlet and outlet air temperatures be measured as close to the core region as possible to allow a better comparison of measured to calculated air temperatures.

DISTRIBUTION R. G. Ambrosek, R. W. Marshall, EDF File

COVER SHEET ONLY J. W. Bacon, J. Klein, W. G. Lussie. W. O. Olsen, R. P. Wadkins, J. L. Wallace, F. J. Sheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. G. Ambrosek (signature) R. G. Ambrosek	3380	R. P. Wadkins (signature)	11/24/76	R W Marshall (signature)	11/24/76

EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 295

FORM EG&G-2631 (Rev. 8-76)

GWA NO.

TASK PBF Reload Core System Engineering

DATE December 1, 1976

SUBJECT

MEETING TO CONSIDER EFFECTS OF TITANIUM HYDRIDE PROPERTIES ON PBF RELOAD CORE CONTROL ROD DESIGN

ABSTRACT

Minutes of the November 16, 1976 meeting to consider the effects of titanium hydride properties on the PBF Reload Core control-rod design are attached. The decrease in the decomposition temperature of titanium hydride as its hydrogen content increases may present a problem for simultaneously achieving adequate cooling and adequate worth for the control rods. Calculations are being made to determine the effect of the titanium hydride composition on rod worth, and the use of enriched boron to increase the rod worth will be investigated.

DISTRIBUTION R. G. Ambrosek, G. S. Gill, R. K. Malik, R. S. Marsden, R. W. Marshall, W. O. Olson, W. G. Reuter, R. P. Wadkins, J. L. Wallace, F. J. Wheeler

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R. S. Marsden *R S Marsden*				*RWMarshall*	12/3/76

EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 296

FORM EG&G-2631 (Rev 8-76)

GWA NO. 45500-335-106

TASK PBF RELOAD CORE IPT DESIGN

DATE November 23, 1976

SUBJECT

EVALUATION OF NDT REQUIREMENTS FOR ALLOY 718 FORGINGS

For Use In The 1/4-Inch In-Pile Tube

ABSTRACT

The existing inspection requirements identify that a 0.2 cm (5/64 in.) diameter calibration defect size be used for ultrasonic inspecting (UT) of three forgings of Alloy 718 procured for fabricating three in-pile tubes (IPT) for PBF. The adequancy of this inspection requirement was questioned for the 0.6 cm (1/4 in.) thick IPT. The question of adequancy was based on the possibility that a substantial defect might be missed which would result in the following:

1. The defect would be of sufficient size to penetrate the wall thickness and result in a leak.
2. That the defect would be of sufficient size for catastrophic failure to occur, especially for that portion of the IPT exposed to irradiation sufficient to cause significant embrittlement.

The purpose of this analysis was to calculate the critical defect size for comparison with defect sizes possibly missed by UT using the existing inspection requirements.

A fracture mechanics analysis was conducted based on Appendix A, Section XI of the ASME Boiler and Pressure Vessel Code. The following values were used in this analysis:

1. K_{1c} = 103.4 MPa - $m^{1/2}$ (94 ksi-$in^{1/2}$) for unirradiated base metal.
2. K_{1c} = 51.7 MPa - $m^{1/2}$ (47 ksi-$in^{1/2}$) for base metal irradiated to a fluence of 1×10^{21} n/cm^2 (E > .6 MeV).

The calculations indicated that no problems exist for that portion of the Alloy 718 forging exposed to irradiation less than a total fluence of 1×10^{19} n/cm^2 (E > .6 MeV). But, for that portion of the Alloy 718 forging irradiated to 1×10^{21} n/cm^2 (E > .6 MeV) the structural integrity could be in jeopardy. This was based on calculations which indicated possible catastrophic failure. In addition, the possibility exists that a significant defect could be missed, due to existing UT requirements, which would result in a leak.

Based on the above it is recommended that a 0.04 cm (1/64 in.) diameter calibration defect size be used for inspecting the 0.6 cm (1/4 in.) thick IPT after completion of rough machining.

DISTRIBUTION J. F. Cook, D. K. Fischer, R. A. Goodell, J. Klein, T. B. McLaughlin, R. S. Marsden, R. W. Marshall (2), W. G. Reuter, M. K. Shane, H. W. Spaletta

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W. G. Lussie

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
W G Reuter	Materials. Tech.	Hood	12-2-76	RW Marshall	12/3/76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EGAG-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. F297

GWA NO. 45000-552-500

DATE November 30, 1976

TASK PBF Reload Core - Project Management

SUBJECT

PBF RELOAD CORE PROJECT FILES (LANGFORD FILES) THROUGH MID-1976

ABSTRACT

PBF Design Engineering files compiled primarily by D. J. Langford are available for reference use in the CSC Technical Support Building. The files, in custody of the PBF Reload Core Branch of the PBF Technical Support Division, are a record of project activities associated with the PBF reload core, new in-pile tube, canal extension, etc., through mid-1976.

Indexes to the three main groups of files are attached herewith. One group consists of project functional categories with each file folder bearing an alpha-numeric designation (A-1 through H-11). A second group of files is arranged by hardware-function categories and employs a number (1 through 31) to identify hardware and an alphabetical letter (K through Q) to indicate the associated function. The number 1 designates fuel rods, "M" indicates the function of design, and the file folder marked "1-M" covers fuel rod design. The third group of files contains early versions of various engineering documents (specifications, procedures, SDD's, etc.) associated with the PBF reload core.

DISTRIBUTION R. G. Ambrosek, J. A. Clayton, D. W. Fischer, J. Klein, C. M. Krivanec, R. S. Marsden, R. P. Wadkins, F. L. Wheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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EG&G Idaho

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 298

FORM EG&G 2631 (Rev 3-76)

GWA NO.

TASK PBF Reload Core
Core Design and Fabrication

DATE November 30, 1976

SUBJECT

ACTUAL DATA ON DENSIFICATION IN COMMERCIAL FUEL PELLETS

Based On A Pellet Stabilization Test

ABSTRACT

The fuel specification for the reload core (ANC 50106 A, section 5.9.4 E) calls for the fuel fabricator to perform a stability test on each lot of fuel that is fabricated. The EG&G specification permits a maximum decrease in diameter of .003 inch* as a result of this test. This is a change in theoretical density of 1.3%. Exxon has taken exception to this requirement and requests a .006 inch diametral shrinkage be allowed (2.7% change in theoretical density). In support of this request Exxon has submitted data on the shrinkage of current production fuel as a result of the proposed stability test. This data is set forth on page 2.

*As of this writing the justification for .003-inch is not known.

DISTRIBUTION R. G. Ambrosek, G. A. Berna, M. P. Bohn, C. H. Cooper, D. L. Hagrman, R. R. Hobbins, Jr., J. Klein, W. G. Lussie, R. S. Marsden, R. W. Marshall, M. R. Martin, R. E. Mason, D. E. Owen, M. L. Russell, M. K. Shane, R. P. Wadkins

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
RWMarshall Jr.	5520			RWM Jr	12/1/76

EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 299

FORM EG&G-2631 (Rev 8-76)

GWA NO. 45300-322-100

TASK PBF Reload Core Physics

DATE December 6, 1976

SUBJECT

COMPARISON OF UNIFORM AND NON-UNIFORM VOID DISTRIBUTION MODELS FOR REACTIVITY - FEEDBACK CALCULATIONS

ABSTRACT

Present RELAP models for Reload-Core analysis use space-independent void coefficients provided by the Reactor Design Group. The attachment describes a study of the importance of the spatial distribution of voids in the determination of reactivity feedback.

The overall reactivity feedback from the reactor, due to moderator voiding, was computed for both the spatially-uniform and spatially-distributed cases. The range of investigation corresponds to an average void fraction of zero to twenty percent.

The conclusion reached for this study is that, for the range of investigation, no significant error is introduced into reactivity feedback models if uniform or space independent void coefficients are employed.

DISTRIBUTION R. S. Marsden, R. W. Marshall, M. K. Shane, W. R. Carpenter, EDF File, G. K. Wachs, P. J. Wheeler, R. P. Wadkins

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EG&G Idaho

FILE NO.

EDF SERIAL NO. 300

GWA NO.

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev 8-76)

TASK PBF Reload Core Control Rod Modifications/Poison Design

DATE December 3, 1976

SUBJECT

TITANIUM-HYDRIDE DENSITY TO BE USED FOR ANALYSIS (PRELIMINARY)

ABSTRACT

To provide a reference base for ongoing analyses, calculations have been made to determine the apparent density of titanium hydride. In determining the density it is assumed that the hydride composition is $TiH_{1.5}$, and that the parts are fabricated from powdered titanium hydride that is compacted to 85% of theoretical density.

Apparent density $TiH_{1.5}$ = 3.26 g/cm^3 X-ray density TiH_2 = 3.78 g/cm^3

Weight % of hydrogen = 3.06%

For additional information see EDF 295.

NOTE: It is expected that the above information will be superceded by more accurate data which is currently being developed by the Materials Technology Branch.

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 301 S

FORM EGAG-2631 (Rev. 8-76)

GWA NO.

TASK PBF RELOAD CORE IPT DESIGN

DATE December 3, 1976

SUBJECT

HEAT TREATING OF THIN WALL

INCONEL 718 IPT

ABSTRACT

A furnace was located at General Electric (Cincinnati). The furnace is a new electrically heated pit furnace with an 8 feet diameter x 22.5 feet long hot zone. Mr. Jim Hurst is the contact at G.E. He can be contacted by calling FTS No. 684-2200, then ask the FTS operator for 243-2000, then ask the switch board operator for ext. 3739 (shop) or 2287 (office). Mr. Hurst stated that there would be no problem in achieving a temperature of 2000°F and a cooling rate of 150°F/hour ± 50°F.

DISTRIBUTION F. Blair, J. O. Brigleb, J. Klein, W. G. Lussie, R. W. Marshall, M. K. Shane, H. W. Spaletta, J. G. Collett

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
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057

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ENGINEERING DESIGN FILE

FORM EG&G 2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 302

GWA NO.

TASK PBF Reload Core System Engineering

DATE December 6, 1976

SUBJECT

SYSTEM/COMPONENT APPLICABLE CODES AND STANDARDS

ABSTRACT

This EDF identifies the design and quality assurance standards to be used for the Reload Core systems and components.
Also, see EDF 206, DOCUMENT TREE, PBF RELOAD REACTOR CORE.

DISTRIBUTION J. Klein, W. G. Lussie, R. S. Marsden, R. W. Marshall, Jr., E. L. Wills

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 303

FORM EGAG-2631 (Rev. 8-76)

GWA NO.

TASK PBF Reload Core System Engineering

DATE December 6, 1976

SUBJECT

MEETING TO DISCUSS OPERATION OF PBF RELOAD CORE WITH RESTRICTIONS ON CONTROL-ROD WITHDRAWALS

ABSTRACT

Minutes of the meeting held on December 2, 1976 to discuss operation of the PBF Reload Core with restrictions on the control-rod positions are attached. These restrictions arise because of the limited amount of air-flow capacity for cooling the control rods.

Operation with restrictions on the control-rod positions to prevent overheating them appears feasible. However, removal of these restrictions would increase operating flexibility and reduce the analyses required. Therefore, increase of the air supply to remove the restrictions will be investigated.

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W. G. Lussie

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R. S. Marsden					

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ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 304

FORM EG&G-2631 (Rev. 8-76)

GWA NO.

TASK PBF Reload Core Systems Engineering

DATE December 7, 1976

SUBJECT

RELOAD CORE REQUIREMENTS
A Presentation For The December 8 and 9, 1976
Review Meeting

ABSTRACT

The Reload Core requirements as understood by the Project are set forth in this EDF. They will form the basis for discussions with NRC and ERDA as to the difference in the requirements between Core II and the Reload Core.

DISTRIBUTION J. Klein, M. K. Shane, Review Mtg. Attendees

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. W. Marshall, Jr. RWM	5520			RWM	12/7/76

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 3-76)

FILE NO.
EDF SERIAL NO. 305
GWA NO. 45500-335-103
DATE December 8, 1976

TASK PBF RELOAD CORE - IPT DESIGN

SUBJECT

PROPOSED CHANGES TO IPT FORGING CONTRACT
AT WYMAN GORDON
Subcontract S-2660

Spal-23-76

ABSTRACT

Proposed changes to the IPT forging contract (S-2660) were submitted to Wyman Gordon by EG&G Materiel Division to determine cost and schedule impact. On November 24, 1975 Bob Donahue, Wyman Gordon Sales Engineer, contacted the writer to determine what specific technical requirements were proposed. Information was needed to determine the cost and schedule changes requested by Ed Lyon's letter, "Request for Quotation F18 6690-3-PBF, Proposed Changes to Subcontract S-2660 PBF IPT Forging", Lyon-130-76. Bob Donahue was informed that the changes were made to incorporate prior verbal agreements, to reflect dimension shown in Wyman Gordon drawings and to incorporate the special provisions into the basic contract. The proposed technical changes as defined in EDF Serial No. 260 dated October 2, 1976, were reviewed with Mr. Donahue. A copy of this EDF was hand carried to F. P. Blair for transmittal to Wyman Gordon.

The verbal agreement on September 7 and 8, 1976, between Arlie Work and Wyman Gordon Gordon personnel to supply additional weld qualification material was on a "best effort" basis and not a firm committment and will be quoted as such. It should be noted that it is possible that weld qualification material may not be available for those billets presently being fabricated. A set of IPT drawings is being sent to Howard Dearborn Inc., Fryeberg, Maine to determine deep hole drilling tolerances.

DISTRIBUTION B. R. Adams, F. P. Blair, J. O. Brigleb, J. Kline, R. W. Marshall, M. K. Shane, H. W. Spaletta

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H W Spaletta	3350	Spaletta	12-14-76	R W Marshall	12/15/76

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PAGE NO. 1 OF 1

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 306

FORM EG&G-2631 (Rev 8-76)

GWA NO. 45500-335-103

TASK PBF RELOAD CORE - IPT DESIGN

DATE December 8, 1976

SUBJECT

STATUS REPORT FOR PBF 718 IPT FORGINGS
WYMAN GORDON CONTRACT S-2660

A Telecon With Cabot Ind. BRA-5-76

ABSTRACT

Per telephone conversation to Dennis Acuncius, Cabot Ind., on December 8, 1976, the following status was reported:

November 22, 1976 - Four Forgings were successfully upset at Cameron Iron Works.

December 7, 1976 - Forgings were shipped from Cameron to Stellite (Cabot).
Cabot will inspect the forgings and then ship them to Ladish on December 20, 1976.
If Ladish works thru Christmas Holidays the trans-axial forging operation should be completed by January 3, 1977.
If they do not work they should be completed by January 12, 1977.

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
B R Adams	3350	Spaletta	Dec 8-76	R W Marshall Jr	12/13/76

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 307
GWA NO. 45500-335-103
DATE December 8, 1976

TASK PBF RELOAD CORE - IPT DESIGN

SUBJECT

ROM MILESTONE SCHEDULE FOR FABRICATION OF THE INCONEL 718 PBF IPT DESIGN

Spal- 24-76

ABSTRACT

Ametek Straza, the supplier of the SLSF IPT's, has reviewed the Inconel 718 PBF IPT drawings and determined a ROM Milestone for fabrication of 45 weeks after receipt of the forging. Attached is Ametek's letter and milestone schedule.

DISTRIBUTION R. W. Marshall

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Kline, M. K. Shane, H. W. Spaletta

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
H W Spaletta	3350	Spaletta	12-14-76	RW Marshall	12/13/76

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev 8-76)

FILE NO.

EDF SERIAL NO. 308

GWA NO. 45200-322-003

TASK PBF Reload Core - Safety Analysis

DATE December 9, 1976

SUBJECT

CRITICALITY SAFETY EVALUATION FOR STORAGE OF THE PBF RELOAD CORE

ABSTRACT

A criticality analysis has been performed to determine if the PBF Reload Core canisters can be safely stored in racks similar to those used for Core I (see Drawing #402158). The storage racks will be located in an extension to PBF canal (Reference: EDF #261). The results of the analysis show that the Reload Core canisters can be safely stored in the Core I storage racks or in stainless steel racks of the same design as long as there are no missing fuel rods within the canisters. The analysis also shows that in handling the canisters, no two canisters should be allowed to come near each other outside of the racks. Safety Analysis Report #RE-N-76-040 constitutes the body of this EDF.

DISTRIBUTION

J. W. Bacon, R. A. Freeman, J. Klein, R. W. Marshall, R. S. Marsden, M. K. Shane, R. P. Wadkins, F. J. Wheeler

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
J. W. Bacon	PBF - DESIGN ENGINEERING	[signature]	1/19/77	R W Marshall	2/6/77

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 309

GWA NO. 45300-332-330

TASK PBF Reload Core - Control System Modification

DATE December 13, 1976

SUBJECT

INVESTIGATION OF 5000 SCFM CRCA COMPRESSOR

ABSTRACT

Potential vendors have been queried for information on 5000 scfm compressors for use in a proposed modification to the CRCA System. This information is summarized in Attachment 1.

Calculations, Attachment 2, indicate that six inch pipe will carry the 5000 scfm with acceptable pressure drop.

Attachments

(1) Compressor Summary
(2) Calculations, December 9, 1976

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R A Freeman	Reload Des.	[signature]	12/13/76	R W Marshall Jr	2/5/77

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. *310

GWA NO. 45500-335-100

TASK PBF RELOAD CORE

DATE December 10, 1976

SUBJECT

ENRICHED BORON CARBIDE - PROCUREMENT AND FABRICATION COST

RLG-16-76

ABSTRACT

1. Various concentrations of B^{10} are available for purchase from Isotope Sales Div. of ORNL. The maximum concentration available is 96.5% B^{10}, and the minimum is 92% B^{10}. The material is elementral boron, and the product form is powder, 200 mesh.

There is no loan program or agreement available between ORNL and government subcontractors for use of government owned and stockpiled B^{10}. For EG&G to use B^{10} from the government stockpiled material would require approval through the two ERDA offices involved.

The following prices for B^{10} are in effect at the present time. 96.5% B^{10} - \$52.00/gm, 96.19% B^{10} - \$17.75/gm, 94.89% B^{10} - \$11.00/gm, and 92.90% B^{10} - \$9.00/gm.

The amount of boron required for 5 assemblies of B_4C, 2-7/8" OD x 3/4" ID x 36" long and 9 assemblies 4" OD x 3/4" ID x 36" long is 370#. This is based on a B_4C density of .09#/in^3 which is 80% of the theoretical density. This gives a cost of \$8.76 x 10^6 for the highest enrichment, and \$1.5 x 10^6 for the lowest, and is the cost of boron only. ORNL pricing policy is such that orders over \$1,000 are based on funded costs, and these can be higher or lower than the established ones.

2. Telecon with Dynamet Technology, December 3, 1976.

A phone call was placed to Mr. Stan Abkowitz of Dynamet Technology regarding their recent quotation for B_4C in sizes required for PBF. Their quote of November 19, 1976, does not consider the B_4C as enriched, all items quoted are natural boron.

In discussing this problem with Mr. Abkowitz, if enriched boron were required, it would have to be furnished by EG&G. Their process would permit fabrication of the tubes using B^{10} as 200 mesh powder with a minimum of waste. Also, they can press to 85% of theoretical density if we require it. Dynamet has considerable experience in fabricating nuclear shields for various reactor applications, but all to date has been with natural boron. (Dynamet's letter of November 19, 1976, is included as page 2 of this EDF.)

3. Telecon with Norton Company - B_4C - PBF, December 3, 1976.

A call was placed to Mr. Ed Hamel of Norton Co. regarding their quotation for enriched B_4C cylinders for PBF. He referred me to Dr. Neal Ault, the research director who is coordinating all the efforts in putting the quote together. According to Dr. Ault, all the work done with B^{10} previously has been using customer furnished material. He indicated that the B costs alone associated with this quote is on the order of \$2 million.

Dr. Ault indicated that all enriched boron is made by Eagle Picher Corp. and is dispensed by ORNL. They are in charge of establishing priorities also in the event of supply shortages.

DISTRIBUTION R. W. Marshall, R. L. Gump

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J. G. Collett, J. Klein, W. G. Lussie, M. K. Shane, H. W. Spaletta

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R L Gump	3350	Spaletta	14 Dec 76	R W Marshall	12/14/76

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 311

GWA NO. 45300-322-100

DATE December 15, 1976

TASK PBF Reload Core Physics

SUBJECT

Average Fast-Neutron Energy in the In-Pile-Tube Wall, Supplement to EDF-256

ABSTRACT

In response to a request from W. G. Reuter and for supplementary information to EDF-256, Average Fast Flux in the In-Pile-Tube Wall, the average fast neutron energy was estimated. This was done by flux-weighting the mean group energy of groups 1 through 26 of the 33-group SCAMP reactor calculation mentioned in EDF-256. Groups 1 through 26 represent the energy range from 10 MeV to 0.532 eV. The average neutron energy over this range was found to be 0.6 MeV.

DISTRIBUTION F. J. Wheeler, G. K. Wachs, W. G. Reuter, R. W. Marshall, R. S. Marsden, R. T. McCracken, J. Klein, M. K. Shane

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R. T. McCracken	Reactor Technology			R. W. Marsden	1/6/77

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FORM EG&G-2631 (Rev 6-76)

TASK PBF Reload Core Safety Analysis

FILE NO.

EDF SERIAL NO. *312 b

GWA NO.

DATE December 16, 1976

SUBJECT

PRELIMINARY REACTIVITY INSERTION ACCIDENT LIST

Attachment To RAD-10-76

ABSTRACT

This EDF places the subject memorandum in the engineering file.

This preliminary reactivity insertion accident list for the PBF Reload Core was compiled by the Reactor Experiments Section from the references listed in the attachment. The intent in preparing this list was to collect in one document all the identified accidents for the PBF Reload Core.

The preliminary accident list is written in three parts:

(1) The majority of the accidents listed are from a "PRELIMINARY PBF CORE II ACCIDENT LIST" received from R. G. Ambrosek in June, 1976. Accidents in brackets are those added by this section.

(2) The questions typed on the right are associated with the corresponding accidents. Answers to the questions may result in deleting some accidents or identifying others.

(3) The footnotes are amplifying comments. They are subject to change if better or more recent information becomes available.

Three specifications required for all the listed accidents are:

(1) Total reactivity insertion.

(2) Rate of reactivity insertion (reactivity vs. time for the entire event or sequence of events).

(3) Fault category.

It must be emphasized that this is a preliminary list. The entire list is subject to change and is intended to be primarily a guide for the proposed accident analysis.

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W. G. Lussie

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Original signed by R. A. Dimenna				R W Marshall Jr	12/16/76

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FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 313
GWA NO.
DATE December 20, 1976

TASK PBF Reload Core
Core Design/ Fuel Procurement

SUBJECT

POTENTIAL PROBLEM WITH FUEL CONTRACT

A Telecon With Owen Kruger, Exxon Nuclear

ABSTRACT

On Friday, December 17, 1976, I received a phone call from Owen Kruger, Manager Government Contracts, at Exxon Nuclear. He was interested in how EG&G planned to operate the Exxon fuel if they were awarded a contract. Mr. Kruger indicated that R. L. Dickeman, President, Exxon Nuclear, had stated that, prior to signing a contract, Exxon would want to analyze their fuel's performance under its expected operating modes in PBF. Exxon is worried about possible fuel rod failures due to pellet cladding interaction and feel that this contract, if awarded, could pose a general risk to the company. To date Exxon has had no fuel rod failures with their commercial fuel and they wish to protect this image. This position of Exxon's flags a potential problem, albeit downstream, with the Reload Core fuel procurement.

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R. W. Marshall, Jr. [signature]	5520			RWMarshall Jr	12/20/76

EG&G Idaho

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 314

FORM EG&G-2631
(Rev. 6-76)

GWA NO.

TASK PBF Reload Core Management

DATE December 20, 1976

SUBJECT

INQUIRY FROM EXXON NUCLEAR ON PBF's PULSE CAPABILITY
A Telecon From Owen Kruger, Exxon Nuclear

ABSTRACT

On Friday, December 17, 1976, I discussed with Owen Kruger the capabilities of PBF as a pulse reactor. Mr. Kruger is Manager Government Contracts and is in charge of Exxon's bid to EG&G on the Reload Core fuel.

Exxon, Battelle Northwest, and Consumer Power (who will manage this program) are proposing to ERDA a project to study new forms of fuel under power cycling conditions. The goal of this effort is to develop fuel that would reduce, or eliminate the pellet cladding interaction problem.

They plan to fabricate different forms of fuel that would be built into segmented rods. These rods would be operated in a commercial reactor at different power ramps for several cycles. They would then be pulse tested (not defined to me) in a test reactor to study their performance. Mr. Kruger said that Battelle Northwest would be responsible for selecting the reactor; he was just gathering information.

On Monday, December 20, 1976, I called Mr. Kruger and told him that if he needed more information on test reactor capability at INEL, he should contact Dr. Richard E. Wood of ERDA.

DISTRIBUTION J. G. Crocker, W. G. Lussie, R. W. Marshall, Jr. (3), J. H. Ramsthaler, M. L. Russell, R. E. Williams

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R. W. Marshall, Jr. RWM	5520			RWMarshall Jr	12/20/76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 315
GWA NO. 45400-332-110
DATE December 20, 1976

TASK Core Design and Fabrication

SUBJECT

FEASIBILITY CALCULATION OF POISON ROD INSERTION IN WATER

ABSTRACT

To approach a solution to the poison rod cooling problem the possibility of operating the poison sections in water is under investigation. Part of this effort is to determine what pressures are required in the control rod drive accumulator to obtain an adequate scram. For this analysis the PBF I scram time of .150 second was assumed and an accumulator pressure of 125 psi. The analysis is conservative since for the mass to be accelerated a water column acceleration is assumed. This adds an average of 8 percent to the mass to be accelerated. The analysis shows that water insertion is feasible for the reload core.

It should be noted that since the reload core will be for steady state operation the .150 second scram time assumption is extremely conservative and the requirement may most likely be on the order of the LOFT scram time of 2 seconds.

This EDF will be updated if necessary as soon as a final design of the poison sections has been approved.

DISTRIBUTION J. Klein, R. W. Marshall, Jr., R. G. Ambrosek, R. S. Marsden, R. P. Wadkins

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[signature] 12/20/76		[signature]	12/21/76	RWMarshall	12/27/76

EG&G Idaho

ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. #316

GWA NO. 45300-332-300

TASK Core Design and Fabrication

DATE December 20, 1976

SUBJECT

CANISTER INSTALLATION CLEARANCE

ABSTRACT

To facilitate the installation of the reload core canisters it was proposed to increase the canister to canister gap by 0.020 inches. On the basis of existing drawings the gap appears to be a variable and is some value between 0.014 and 0.035 inches depending on location. To eliminate confusion and since the validity of increasing the gap by 0.020 inches to facilitate assembly is debatable the reload core canisters will be sized to exactly the same overall dimensions as the present canisters.

DISTRIBUTION

J. W. Bacon	W. G. Lussie	R. P. Wadkins	M. K. Shane
J. Klein	R. W. Marshall, Jr.	F. J. Wheeler	R. S. Marsden
R. G. Ambrosek			

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[signature] 12/20/76					

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 317

GWA NO.

TASK PBF RELOAD CORE FUEL ELEMENTS

DATE December 17, 1976

SUBJECT

HAFNIUM CORED CYLINDERS

JGC-13-76

ABSTRACT

Joe Loe of Wah Chang, Albany, Oregon, FTS No. 420-5811, Albany No. 926-4211, stated that cylinders to the tolerances given on the attached work sheets could be supplied for $225 per pound.

Tolerances will probably be tightened so allowances should be made for additional costs associated with more precise parts.

Loe's estimate was not a quotation, merely an engineering estimate. Total weight of the 14 cylinders is about 1230 pounds with an associated cost, of $225 per pound, for an approximate cost of $277,000. His estimate of time for delivery was 6 to 8 months after receipt of approved p.o.

EG&G Material Specification No. 80001 E was used for estimating, which allows up to 4 weight percent Zirconium.

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J. G. Collett, J. Klein, W. G. Lussie, M. K. Shane, H. W. Spaletta

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J. G. Collett	3350	[signature]	12-17-76	R W Marshall	12/21/76

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EG&G Idaho

PAGE NO. 1 OF 1

ENGINEERING DESIGN FILE

FORM EG&G 2631 (Rev. 8-76)

FILE NO.
EDF SERIAL NO. 318
GWA NO.

TASK PBF RELOAD CORE - IPT DESIGN

DATE December 17, 1976

SUBJECT

STATUS REPORT FOR PBF IPT FORGINGS
WYMAN GORDON CONTRACT S-2660

BRA-7-76

ABSTRACT

Per telephone conversation with Dennis Acuncius, Cabot Ind., on December 17, 1976, the following status was reported:

Eight forgings were shipped from Cameron to Stellite. Four of these were good according to Cameron and four were unacceptable.

As of December 17, only four forgings have been received by Cabot, two good and two unacceptable ones.

Cabot is tracing the other four.

Cabot will inspect the forgings and ship them to Ladish before December 25. Ladish is not expected to start the transaxial forge operation before January 3, as they will be closed down for the next two weeks.

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FILE NO. ______

EDF SERIAL NO. 319

GWA NO. 45300-3_2-300

DATE December 21, 1976

ENGINEERING DESIGN FILE

TASK For Pulond Core - Core Design and Fabrication

SUBJECT

PROPOSED DESIGN FOR MOUNTING FUEL RODS IN FUEL CANISTERS

ABSTRACT

The current design for mounting fuel rods in the fuel canisters involves a tolerance of ±.006 in. on the location of two adjacent fuel rods. The proposed design has reduced this value to ± .0035 in., through the use of a tapered locating hole. Use of a tapered hole will minimize the chances of a nick in either surface preventing the assembly or disassembly of the system. Undercuts on the side of the fuel rod seat against the top of the mounting plate before the tapered surfaces jam together and lock. However, tight manufacturing tolerances will have to be held in order to prevent the tapered surfaces from locking together while still allowing for accurate positioning of the fuel rods.

12/29/76

Ken –
OK for me to sign?
Ralph

Original Not in file
m 2/6/77

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 320

FORM EG&G-2631 (Rev. 6-76)

GWA NO.

TASK PBF Reload Core - Core Design and Fabrications

DATE 12-17-76

SUBJECT

Preliminary Calculations to Determine Feasibility for Cooling the Control Rods with Reactor Coolant

ABSTRACT

Based on heat loads as calculated in EDF 294, an inlet temperature of 130°F, and a discharge temperature of 200°F, calculations indicate a flow requirement of 5 gpm.

Based on flow areas equivalent to those in the last proposed design for the core region, an 8 foot channel, and a 67 psid driving force, the calculated limiting rod velocity was 4 ft/sec or an insertion time of about 583 milliseconds for 28 inches of rod travel.

These calculations are very preliminary and were done to ascertain feasibility only.

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ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. 321
GWA NO.
DATE December 20, 1976

PROJECT FILE NO. PBF Reload Core Safety Analysis

TASK

SUBJECT

SAFEGUARD OF PLUTONIUM PRODUCED DURING OPERATION OF PBF RELOAD CORE

ABSTRACT

At the suggestion of Ray Fielding, I called D. E. Six of EG&G Nuclear Materials to determine if there are any safeguard requirements, other than those presented by potential irradiation hazards, for the plutonium that would be produced during operation of the PBF Reload Core. D. E. Six did not know of any such requirements as long as the plutonium was produced as a by-product during reactor operation.

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FORM EG&G 2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. 322
GWA NO. 45500-335-103
DATE December 22, 1976

TASK PBF RELOAD CORE

SUBJECT

HAFNIUM PROPERTIES

RLG-17-76

ABSTRACT Hafnium is closely related to zirconium in chemical and physical properties, but in nuclear properties, hafnium is a neutron absorber.

Hafnium occurs naturally associated with zirconium, and hafnium is produced as a by product of zirconium purification.

Hafnium is fabricated by techniques similar to those used for zirconium. It can be cast, hot rolled, forged, cold rolled, extruded, and drawn. Certain precautions are necessary in heating and some forming operations.

Joining of hafnium to itself by welding can be done by TIG process in a manner similar to welding zirconium. Welded joints between hafnium and alloy steels are very difficult - very brittle.

Corrosion resistance of hafnium is better than that of zirconium in water and steam up to 750°F. Resistance is due to a buildup of an adherent oxide layer.

Radiation damage effects on hafnium are basically the same as those on structural materials - increase of tensile strength, and a reduction of ductility, and impact strength.

In control rod applications, hafnium has high effectiveness, resists radiation damage, and does not burn out at excessive rates. It is primarily used in the elemental form, and not as a soluble burnable poison.

Hafnium is available as reactor grade sponge, vacuum melted ingot, hot rolled rod, wire, plate, strip, and powder. Ingots are available to 8" diameter x 1000 lbs. Hot rolled rod is available up to 1.75" OD in random lengths (20'). Plate is available up to 1/2" in thickness, widths to 14", and lengths to 120". Strip is available to 0.10" thick x 18" wide x 10' lengths. Sizes stated above are "standard", other sizes and shapes are available on a product development basis. Both oxides, and carbides are available. All reactor grade hafnium metal is 95% hafnium, minimum.

Refer to EDF 317 for current end item prices and delivery schedules on hafnium.

Physical, chemical, and nuclear data pertaining to hafnium are included in pages 2 thourgh 7 of this EDF.

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FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. r 324

GWA NO. 45500-332-100

DATE December 27, 1976

TASK PBF Reload Core In-Pile Tube Design and Fabrication

SUBJECT

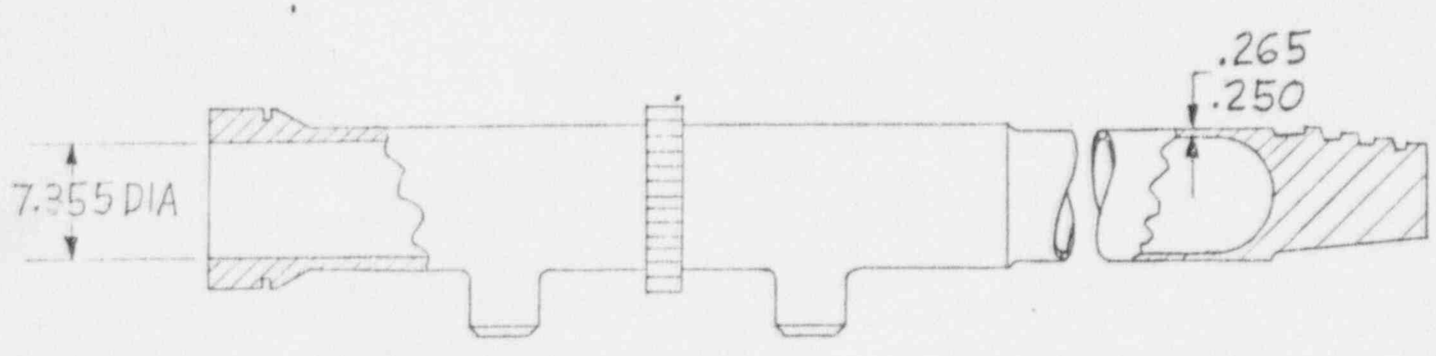
MINIMUM WALL THICKNESS OF IN-PILE PRESSURE TUBE

ABSTRACT

On the pressure tube machining drawing (#407564, not released) the tolerance buildup allows for a minimum wall thickness of 0.250 inch.

The ASME Code (Section III) requires that a value be specified for the maximum amount of corrosion expected on the wall surfaces. As stated in the in-pile tube design specification (ES 50130, not released), the maximum corrosion values are 0.010 inch on the tube O.D. and .010 inch on the tube I.D. This will reduce the minimum wall thickness to 0.230 inch.

NOTE: The sketch shows the two dimensions relating to the wall thickness as presently dimensioned on drawing "407564 - PBF Reload Core in-pile pressure tube."



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FORM EG&G-2631 (Rev. 6-76)

FILE NO.

EDF SERIAL NO. 325

GWA NO. 45300-335-302

DATE December 16, 1976

TASK PBF RELOAD CORE

SUBJECT

FUEL ROD - CANNISTER BOLTING

RLG-18-76

ABSTRACT

Materials used for the bolting of the fuel rods to the cannister assembly for PBF have been reviewed per request by R. W. Marshall's notegram to H. W. Spaletta, December 10, 1976.

Materials and configurations are defined on the following drawings: 406263, Fuel Rod Assemblies: 406806, Cannister Assembly; 407008, Rod Mounting Bolt. The main area of concern is the bolt itself. As described on the drawing, the bolt is machined from hex. bar stock, 17-4 pH material, and then heat treated to the H 1100 condition. This material in this condition meets the requirements of ASME, Section III for Class I components. No information could be located that prohibits the use of 17-4 bolts in reactor applications, although the minimum aging temperature specified is 1085°F.

An alternate bolting material for this application is A-286, which is also approved by ASME, Section III as SA-453, grade 660. This material offers 2 advantages over that required by drawing 407008: (1) Commercially manufactured bolts with rolled threads are available, and (2) The thermal coefficient of expansion of A-286 is closer to that of the stainless steel mounting plate than is 17-4pH.

A commercial bolt that could be altered to drawing requirements by machining the head as required should offer cost advantages over machining the bolt from hex stock, and then heat treating. Also, in many instances, a rolled thread has proven more reliable than a cut thread. If the coefficients of thermal expansion of the material combinations are close, less bolt stress occurs at elevated temperatures.

Properties of the two materials are summarized on page 2 of this EDF.

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W. G. Lussie, H. W. Spaletta

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R L Gump	3350	Spaletta	28 Dec 76	RW Marshall	12/30/76

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ENGINEERING DESIGN FILE

PROJECT FILE NO.

EDF SERIAL NO. 326

FUNCTIONAL FILE NO.

DATE December 22, 1976

PROJECT/TASK PBF RELOAD CORE/CORE DESIGN AND FAB.

SUBTASK FUEL ROD DESIGN AND FABRICATION

EDF PAGE NO. 1 OF 2

SUBJECT

IDENTIFICATION AND DISCUSSION OF RISKS ASSOCIATED WITH FUEL FABRICATION AND OPERATION

Report of December 20, 1976 Meeting

ABSTRACT

Purpose of Meeting: Identify and discuss risks associated with PBF reload core fabrication and operation.

Participants:

PBF Reload Core	Eng. Div.	LFPS	Nucl. Tech.	Material
R. W. Marshall, Jr.	S. Cohen	M. L. Russell	F. J. Wheeler	R. E. Williams
	R. P. Wadkins	T. E. Howell		

The group judged that reload core fabrication contract award was an unacceptable management risk because of technical (thermal-hydraulic test results, incomplete fuel rod design evaluations, control rod heating) and administrative (vendor proposal exceeds budget by 1.5 to 2 million dollars) problems. The specific risks, or problems and planned corrective actions are provided in the table on page 2.

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FILE NO.

EDF SERIAL NO. 327

GWA NO. 45300-335-302

TASK PBF RELOAD CORE

DATE December 29, 1976

SUBJECT

TRANSIENT AND CONTROL ROD POISON SUB-ASSEMBLY

Fabrication Cost Estimate

JGC-15-76

ABSTRACT

The estimated fabrication cost breakdown shown on page 2 was prepared for the configurations shown on unreleased Drawing No. 406396, dated November 8, 1976. The two configurations shown are quite similar, and will probably end up costing essentially the same per unit. The design requires some change, in order for fabrication to be practicable. An example of this is in the B_4C and TiH_2 enclosures. The drawing makes no provision for getting the material inside the cladding. The estimate assumed the necessary changes and allowed for them. The estimate only allowed for dimensional inspection. Any other inspection, deemed necessary at a later date, should be added as an additional expense.

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FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 328

GWA NO.

DATE 12-30-76

TASK PBF Reload Core Design and Fabrications

SUBJECT

Pressure Drop Analysis of Air Cooled B_4C - TiH_2 Control Rods Proposed for PBF Reload Core

ABSTRACT

An analysis has been performed to determine the pressure drop through the inner and outer control rods proposed for the PBF reload core. The initial conditions used in this analysis include a control rod inlet pressure of 60 psi and a temperature distribution which is 100°F from inlet to poison, 240°F over the poison region, and 400°F from poison to end of control rod. Volume flow rates of 200 SCFM and 400 SCFM were considered in the pressure drop analysis of each control rod.

The pertinent equations which were used in the analysis and the raw calculations are given in Appendix A. The methods and figures which were used to obtain pressure loss coefficients are provided in Reference 1. Control rod geometry and air flow channels are illustrated in drawings 406396 (inner) and 407211 (outer).

The pressure drop results are given in Figures 1 and 2. Figure 1 presents pressure drop versus SCFM for an inner control rod. In Figure 2, ΔP versus SCFM for an outer control rod is plotted. Shown in Figure 2 are two plots which reflect a different bearing-shroud gap width. It is apparent that the bearing-shroud gap is an influencing factor in the overall ΔP through a control rod.

Reference: J. L. Hobbs, Pressure Loss Computations in Incompressible Fluid Flow, APEX-754, July 25, 1961.

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M. W. Young *M W Young*	3380	*R. G. Ambrosek*	Jan 3 1977	*R. P. Wadkins*	

EG&G Idaho, Inc.

PROJECT FILE NO

EDF SERIAL NO 329

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO

PROJECT/TASK PBF RELOAD CORE/SYSTEMS ENGINEERING

DATE December 30, 1976

SUBTASK REQUIREMENTS

SUBJECT

REVIEW TO DETERMINE IF CAPABILITY OF PERFORMING LOCA HEAT-UP TESTS IS A REQUIREMENT OF THE RELOAD CORE

ABSTRACT

R. Van Houten questioned J. G. Crocker as to why Agreement 3 from the Reload Core review meeting of December 8-9, 1976 stated:

"It is EG&G's understanding that LOCA heatup tests will not be performed in the 1/4 inch wall IPT."

The question has been reviewed by the Reload Core Project with the following results:

1. The reference to the 1/4" wall IPT is in error, caused by haste in preparing the Agreements and Commitments (see pages 2 and 3 of this EDF). It should have stated:
   " . . . will not be performed in the Reload Core."
   NOTE: This does not rule out performing LOCA Heat-up tests in the 1/4" wall IPT in the present core.

2. The Preliminary Proposal, TR-854 states in paragraph 1.3, Planned Test Requirements, Table 1-I, page 1-12:
   "The PBF Reload Core will not be designed to handle the RIA tests nor the LOCA Heat-up Tests." (Page 4, this EDF)

3. A review of Preliminary PBF Reload Core Test Program, TR-815 (summarized in Tables VI and VII) does not show any plans to perform LOCA Heat-up Tests in the reload core.

In summary, the capability of performing LOCA Heat-up tests is not a requirement for the Reload Core, is not being evaluated by the Project, and is not part of the project's work scope.

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J. G. Crocker, W. G. Lussie, R. S. Marsden, R. W. Marshall, Jr., R. K. McCardell, M. K. Shane, J. W. Sielinsky

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FORM EG&G-2631
(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 330

GWA NO. 45300-322-100

DATE January 3, 1977

TASK PBF Reload Core - Physics

SUBJECT

EFFECT OF WATER COOLING ON CONTROL ROD WORTH
A Preliminary Analysis

ABSTRACT

A preliminary examination has been made of water cooling for moderated poison sections.

33-group S_6 transport calculations were made for a super cell which is composed of the poison section surrounded by an annulus of fuel and an outer reflective boundary. The comparative worths of the various rods are implied from the approximate proportionality between the worth of a given rod and the fraction of the cell absorption which takes place in the poison rod.

For both the inner and outer rods, water-cooled models are demonstrated, using $TiH_{1.5}$ (S.G. = 3.26) as a moderator, with worths comparable to the TiH_2 (S.G. = 3.76) reference models (WOO-2-75). These worths can be further increased by about 3% by replacing the $TiH_{1.5}$ moderator with water.

These results are preliminary pending thermal and structural analysis of the models. Also, the worths must be confirmed by two-dimensional reactor calculations and will also depend on the rod followers which are used.

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EDF SERIAL NO. 331

FUNCTIONAL FILE NO. ______

ENGINEERING DESIGN FILE

PROJECT/TASK PBF RELOAD CORE/SYSTEM ENGINEERING

DATE January 4, 1977

SUBTASK Requirements

EDF PAGE NO 1 OF 5

SUBJECT

REQUIREMENTS FOR NEW "THIN WALL IPT HEAD"

CRO-244-76

ABSTRACT

The Thermal Fuel Behavior Program has defined their requirements for the closure head for the thin wall IPT in the memorandum CRO-244-76. This EDF places the subject memorandum in the Engineering file.

The Reload Core Project considers this definition of requirements to be inadequate. However, pending receipt of further information from the TFB Program this data will be used as needed. It will not be used for design of the IPT head.

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FORM EG&G 2611 (Rev. 12-76)

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ENGINEERING DESIGN FILE

EDF SERIAL NO. 333

FORM EGAO-2631 (Rev. 8-76)

GWA NO.

TASK PBF Reload Core

DATE January 7, 1977

SUBJECT

RELOAD CORE BOWING CALCULATIONS

ABSTRACT

This EDF is to provide a cover sheet for the initial Thermal Calculations on PBF Fuel rod bowing. These calculations provided input to EDF 247, Tom Yen, "Fuel Rod Bowing in PBF Reload Core" Oct. 1, 1976. The analysis included only the azimuthal power variations given in Wess-2-76 "PBF Reload Core-Rod Bowing Study", Feb. 10, 1976. This analysis is to be redone using values in Wess-3-76, "PBF Reload Core Power Distribution of Inner Fuel Rod". Wess-3 includes the core linear power gradient.

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R. P. Wadkins		R. P. Wadkins	1/5/77		

4

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PAGE NO. 1 OF ____

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EDF SERIAL NO. 334

FORM EG&G-2631 (Rev. 8-76)

GWA NO. ____

TASK PBF Reload Core

DATE January 7, 1977

SUBJECT

PBF FUEL ROD THERMAL ANALYSIS OF END CAPS

ABSTRACT

This EDF is to document the work done to determine the thermal gradients in the ends of the PBF reload fuel rods. The analysis was done by R. Chapman and the calculations are contained with the original of this EDF.

The analysis was done for the hot fuel rod with a radial peak to average of 1.6, 40 mil cladding, $G = 2.24 \times 10^6$ lb/hr - FT^2. This work should be adequate for determining the stresses in the upper and lower fuel regions. The computer run is to be filed in thermal analysis file, R. P. Wadkins.

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 335

FORM EG&G-2631 (Rev. 8-76)

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE January 10, 1977

SUBJECT

WATER FOLLOWERS FOR THE OUTER CONTROL ROD GUIDE TUBES

ABSTRACT

Calculations were performed to determine the effect of water followers for the outer control positions.

Primary observations from preliminary PDQ 1/4-core calculations are:

1. Reactivity, in the rods out configuration, is increased by 2.3% $\Delta\rho$. Primarily because of this effect overall control would be increased by about one fourth for water-cooled B_4C rods with air or metal followers for the inner rods.

2. The core peak-to-average power increased from 1.75 to 2.05 for the worst case and shifted from the A canisters to those pins near the flooded outer guide tubes. Conceivably these peaks could be reduced by using low-enrichment fuel or shim rods near the outer guide tubes.

3. Test power (36 pin PWR) is reduced by about 18% with the control rods fully withdrawn. Little difference is seen when the outer rods are inserted well into the core. The results of this would be to increase the enrichment requirements for the larger tests. For small tests (1-4) rods commercial enrichments, would still be adequate since reactor power could be increased without exceeding 50-MW capability.

4. Enrichment of the primary fuel would be reduced; probably to less than 7%.

The three attached figures give the core configuration and the calculated power distributions for the two cases.

DISTRIBUTION R. W. Marshall, Reactor Design Group, G. K. Wachs, JKW R. S. Marsden, W. G. Lussie, R. P. Wadkins, M. K. Shane, J. Klein, R. G. Ambrosek

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F. J. Wheeler FJW	Reactor Tech.			RW Marshall	1/13/77

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ENGINEERING DESIGN FILE

FORM EG&G-2631 (Rev. 8-76)

FILE NO.

EDF SERIAL NO. 336

GWA NO.

TASK PBF Reload Core - Core Design & Fabrication

DATE January 12, 1977

SUBJECT

PRELIMINARY INVESTIGATION OF COOLANT MIXING

ABSTRACT

TOODEE was used to evaluate the temperature in a cooling channel with PBF conditions if the gap between rods acted as a hot stripe. Gap spacings of 0.020, 0.040, 0.060, and 0.080 inches were evaluated.

Heat flux for the PBF cases was calculated from physics parameters in run 51-G. The DNB cases used heat fluxes near the CHF as determined from the raw data taken at Columbia University.

The results are tabulated in Table 1.

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PROJECT FILE NO.

EDF SERIAL NO. 337

FUNCTIONAL FILE NO. 45300-332-300

ENGINEERING DESIGN FILE

DATE January 12, 1977

PROJECT/TASK PBF Reload Core

SUBTASK Control System Modification

EDF PAGE NO 1 OF 5

SUBJECT

PROPOSAL TO INCREASE C.R.D. SCRAM AIR PRESSURE

ABSTRACT

The PBF high pressure air system has been studied for the purpose of raising control rod drive scram air pressure from the existing 80 psi to 125.

The only component which requires replacement to accomplish this change is the regulating spring in a bypass valve, of which there is one for each drive. These springs are readily available from the valve manufacturer.

The high pressure air supply to each of the eight control rod drives has, in series, a pressure regulator, a bypass valve, and a rupture disc assembly. The regulator is manufactured by Cash-Acme Valve Company and requires only adjustment with a wrench to reach 125 psi.

The bypass valve, a Cash-Acme "Automatic" valve looks and acts like a regulator, except that on opening at set pressure, it bypasses air to atmosphere through a muffler. The action of the bypass valve is similar to that of a safe-relief valve, except that the bypass valve is designed for frequent opening service, whereas a safety valve is intended for only occasional opening.

The bypass valve may be modified for a higher rating without removing the valve from the piping. The modification is made by unbolting the top bell, removing the existing spring, installing the new spring, and refastening the top bell. The bypass valve may then be reset to the new pressure, using gages existing in the line, by adjusting the regulator to the new bypass pressure and adjusting the bypass valve to open at that pressure. A detail of the Cash-Acme bypass valve is attached.

A rupture disc assembly, set to 200 psi is installed in the air line after the bypass valve.

There is a separate assembly of regulator, bypass valve, rupture disc, and pressure gauge for each of the eight control rod drives.

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W. G. Lussie

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EG&G Idaho, Inc.

PROJECT FILE NO.

EDF SERIAL NO. 338 1

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO.

PROJECT/TASK PBF Reload Core

DATE January 14, 1977

SUBTASK Safety Analysis

EDF PAGE NO. 1 OF 2

SUBJECT

RELOAD CORE PLUTONIUM HAZARD ASSESSMENT

ABSTRACT

The project requested the Safety Division to determine whether the plutonium generated in the Reload Core, during it's operating life, would exceed the allowable release for an accident. H. K. Peterson has responded in memorandum HKP-43-76 dated December 30, 1976. This memorandum is filed with the original of this EDF. The next paragraphs set forth the body of the memorandum.

As requested, an assessment of the potential hazard presented by the plutonium bred into the PBF driver core fuel, at the end of a 5000 Mwd life has been evaluated. Section XIII, K, of the PBF FSAR limits the amount of plutonium within the IPT to a 147 gram limit because it has been conservatively hypothesized that a fuel vaporization experiment could potentially puff the entire IPT contents into a cloud which could be transported to the nearest site boundary (neglecting fallout) to give a receptor the limiting lung dose of 100 rem.

With the PBF driver core fuel contained in a water environment, 10 CFR 100 criteria for the 1% released solids would apply. One percent of the projected 2.6 kg of plutonium contained in the fuel at the end of 5000 Mwd of operation is below the 147 gram release limit by a factor of 5.65.

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R. G. Ambrosek, J. Klein, W. G. Lussie, R. S. Marsden, R. W. Marshall, Jr., M. K. Shane, R. P. Wadkins, F. W. Wheeler

AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
H. K. Peterson by King				RWMarshall Jr	1/17/77

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ENGINEERING DESIGN FILE

FORM EG&G-2631
(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 339

GWA NO.

DATE January 19, 1977

TASK PBF Reload Core

SUBJECT

PBF Reload FRAP Analysis

ABSTRACT

This EDF is proposed as a cover sheet for Nieb-1-77 to conform to official PBF Reload documentation requirements.

A more complete table is also attached to this EDF showing additional fuel rod information for the six cases investigated.

Two problem area exist in this analysis. Run ".007 inch Den." shows 0.0 contact pressure with a closed gap, likewise Run ".015 inch no Den.".

Additional FRAP analysis will be performed when the final physics numbers are obtained.

DISTRIBUTION R. G. Ambrosek, R. W. Marshall, D. A. Niebrugge, M. L. Russell

COVER SHEET ONLY J. L. Liebenthal, W. G. Lussie, M. K. Shane

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. P. Wadkins	3380	R. P. Wadkins	1/25/77		

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FORM EGAG-2631
(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 340

GWA NO. 45300-322-100

DATE January 20, 1977

TASK PBF Reload Core - Physics

SUBJECT

PARTIAL FOLLOWERS FOR THE OUTER-ROD GUIDE TUBES

ABSTRACT

PDQ 1/4-core calculations were performed to assess the effect of partial followers in the outer control locations in conjunction with water-cooled poison sections. The results were compared to calculations for a case with no solid followers (EDF 335) and it is concluded that very little benefit would be gained by incorporating the partial followers into the reload core design.

For the water-cooled system partial followers would have the effect of slightly increasing overall control, slightly decreasing peak-to-average power in the core and slightly decreasing test performance. None of these effects were found to be large enough to be significant, however.

The attached figure gives the calculated power distributions for this case.

DISTRIBUTION R. W. Marshall, Reactor Design Group, G. K. Wachs, R. S. Marsden, W. G. Lussie, R. P. Wadkins, M. K. Shane, J. Klein, R. G. Ambrosek

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
F. J. Wheeler *F J Wheeler*	Reactor Tech			*R W Marshall J*	2/2/77

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PROJECT FILE NO

EDF SERIAL NO 341

FUNCTIONAL FILE NO

ENGINEERING DESIGN FILE

PROJECT/TASK PBF Reload Core/Core Design and Fab.

DATE January 20, 1977

SUBTASK Fuel Rod Design and Fabrication

SUBJECT

DISCUSSIONS WITH EXXON ON METHODS FOR REDUCING COSTS OF FUEL

Report of January 13, 1977 Meeting

ABSTRACT

RESULTS:

1. Likely Cost Reductions:

(Exxon proposal (Items 1 thru 6)	$ 3,228,500)
a) Delete unnecessary QC requirements	288,746
b) Simplify shim rod design (use B-SS)	81,200
c) Reflector and filler rod supply by others	53,050
Adjusted cost (likely)	$ 2,805,504

2. Potential Cost Reductions:

a) Delete "fat" in project management support	200,000
b) Simplify fuel rod design	100,000
c) Adjust processing rate assumption	300,000
Adjusted cost (potential)	$ 2,205,504

3. Unanticipated (1) Cost Items

a) Facilitization	545,072
b) Quality assurance support	23,773
Adjusted cost for comparison to requisition work scope (2)	$ 1,636,659

(1) These costs not included in EG&G estimate

(2) FY1976 requisition estimate is $1,272,430

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M. L. Russell (signed)				R W Marshall Jr (signed)	1/20/77

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FILE NO.

EDF SERIAL NO. 8342 342

GWA NO. 45200-330-002

DATE January 10, 1977

TASK PBF Reload Core - Fuel Design

SUBJECT

REVIEW OF NRC MODEL AND ROLSTAD MODEL FOR REACTOR FUEL DENSIFICATION

ABSTRACT

A review of the NRC (Meyers) model and the Rolstad model for reactor fuel densification was completed. Comparisons between results of the two models and pertinent data were performed. Conclusions based on a critical appraisal of the models are presented.

Conclusions

The following conclusions are supported by this study:

1. The NRC (Meyers) fuel densification model is a conservative model developed for the purpose of licensing. The Rolstad fuel densification model is a best guess model if fuel pellet characteristics under resintering anneal are unknown.

2. The data base of the Rolstad model contains only Halden data and is much narrower than that of NRC model. This fact casts some doubt about the reliability of the Rolstad model as a tool to predict the densification behavior of new fuels.

3. As far as the calculation involving individual pellet effects (e.g. reduction of radial gap conductance and increase of linear heat generation) is concerned, the Rolstad model is not very useful due to its lack of statistical considerations. The Rolstad model is more suitable for the calculation involving cooperative pellet effects (such as power spikes resulting from axial gaps).

4. The assumption, as made in the Rolstad model, that in-reactor densification is isotropic is still in dispute. Westinghouse data is in conflict with this assumption.

5. The Rolstad model has the advantage that its prediction involves no resintering anneal.

DISTRIBUTION R. G. Ambrosek, D. Evans, J. L. Liebenthal, R. W. Marshall, M.L. Russel R. P. Wadkins, S. C. Chang

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S. C. Chang/		R.P. Wadkins	2/15/77		

EG&G Idaho, Inc.

PROJECT FILE NO. ______

EDF SERIAL NO. C343

FUNCTIONAL FILE NO. ______

ENGINEERING DESIGN FILE

PROJECT/TASK PBF Reload Core

DATE January 24, 1977

SUBTASK IPT Design/Reference Material

SUBJECT

HYDRO TEST AT NATIONAL FORGE AND AUTOCLAVE ENGR., OF THICK WALLED IPT
July 1972

ABSTRACT

R. A. Goodell, of Applied Mechanics, who is analyzing the present thick walled IPT, requested the subject information from the files of R. E. Locke. The requested information makes up the body of this EDF.

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AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
R. E. Locke E Y Wells for REL				R. W. Marshall, Jr.	1-24-77

FILE NO. ______

ENGINEERING DESIGN FILE

EDF SERIAL NO. 344

FORM EG&G-2631 (Rev. 6-76)

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE January 24, 1977

SUBJECT

WORTH OF HAFNIUM AS THE CONTROL ROD POISON

ABSTRACT

A study has been made to determine the effectiveness of hafnium in the control rod poison sections of the PBF Reload Core.

33-group S_6 transport calculations were made for a super cell which is composed of the poison section surrounded by an annulus of fuel and an outer reflective boundary. The comparative worths of the various rods are implied from the approximate proportionality between the worth of a given rod and the fraction of the cell absorption which takes place in the poison rod. The same 8% oxide fuel and fuel dimensions are used here as in EDF-330. Thus a direct comparison with B_4C poison sections is possible.

The air-cooled B_4C rods of ANCR-1008 (essentially the Core I rods) in 8% oxide fuel are used as the base cases. A solid hafnium inner rod has considerably less worth. For the inner rods, use of an optimal water-moderated annulus of hafnium yields 12% more worth than the base case. This compares to a 30% increase in worth for an optimal water cooled and moderated B_4C annulus (Case 7, EDF-330). The comparison for the outer rods shows a 13% increase for the water-moderated hafnium rod above the base case vs a 26% increase for the water-moderated B_4C rod.

It should also be noted that hafnium has a specific gravity of 13.3 and thus is subject to considerably greater gamma heating than B_4C. Thus, the heating effects in the two materials in the moderated rods are comparable.

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W. O. Olson *W. O. Olson*		*G K Wachs*	1/31/77	*R W Marshall Jr.*	2/2/77

EG&G Idaho

PAGE NO. 1 OF 1

FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 346

GWA NO. 45300-322-100

DATE January 25, 1977

SUB PBF Reload Core Physics

B10 DENSITY FOR BORATED STAINLESS STEEL SHIM RODS

ABSTRACT

Current designs call for the Reload Core shim rods to be constructed of a mixture of B_4C and Al_2O_3. Due to the high cost of these rods consideration is being given to the use of borated 304L stainless steel shim rods.

The weight-density of B^{10} required to give a borated stainless steel shim rod reactivity worth equal to that of a B_4C-Al_2O_3 rod has been calculated. This was done with the SCAMP transport code and a supercell model of a 5-by-5 array of Reload Core fuel rods. The central rod was replaced with a shim rod, and the supercell was assumed to be at 293°K for all calculations. An initial calculation was done with a B_4C-Al_2O_3 rod in place. The ratio of the absorption in the shim pin cell to the absorption in the entire supercell was noted. The B_4C-Al_2O_3 rod was then replaced with a borated stainless steel rod with a diameter equal to the outside diameter of a Reload Core fuel rod (0.953 cm). The B^{10} density in the stainless steel was varied until the absorption fraction agreed with that of the B_4C-Al_2O_3 calculation.

It was found that a B^{10} density of 0.01173 g/cm^3 in 304L pins will provide reactivity worth equivalent to the 6 vol % B_4C - 94 vol % Al_2O_3 shim material currently specified. Assuming an uncertainty in shim pin worth of 0.0004 $\Delta\rho$ the B^{10} density should be confined within the range of 0.0115 g/cm^3 to 0.012 g/cm^3.

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AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
R. T. McCracken	Reactor Techn.			R W Marshall	2/2/77

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PROJECT FILE NO.

EDF SERIAL NO. 348[illegible]

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO.

PROJECT/TASK: PBF Reload Core

DATE: January 31, 1977

SUBTASK: Control System Modification

EDF PAGE NO. 1 OF 21

SUBJECT

INSPECTION OF THE SPARE PROTOTYPE CONTROL ROD DRIVE AND LISTING THE ACCEPTABLE PARTS

ABSTRACT

The spare prototype PBF control rod drive was removed from bonded storage, disassembled and the parts were inspected by a Quality Division inspector. The inspector's QDR's on the parts were dispositioned by Jack Klein, Richard Freeman and Earl Taylor and a list of acceptable parts to be used in the spare CRD for reload core was prepared.

The Quality Inspector's QDR's are attached to this EDF. Rejected parts shown on the QDR's will be scraped.

DISTRIBUTION (COMPLETE PACKAGE): J. W. Bacon, R. A. Freeman, T. E. Howell, J. Klein, R. S. Marsden, R. W. Marshall, T. B. McLaughlin, M. L. Russell, M. K. Shane, E. F. Taylor, E. L. Wills

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AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
Earl F. Taylor	Design Engr.	[signature]	2-1-77	R W Marshall Jr	2/5/77

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PROJECT FILE NO. ______

EDF SERIAL NO. 1349

FUNCTIONAL FILE NO. ______

ENGINEERING DESIGN FILE

DATE January 31, 1977

PROJECT/TASK PBF Reload Core/Core Design and Fabrication

EDF PAGE NO. 1 OF 2

SUBTASK Poison Section Design and Fabrication

SUBJECT

POISON SECTION SPIDER DESIGN CONCEPT

ABSTRACT As part of the poison cooling and worth assessment the possibility of a poison spider arrangement was investigated. The poison rods should be detachable from the spider arms since the holddown quadrants prevent a continuous spider arm--poison rod assembly. The poison rods have a diameter equal to or smaller than the fuel rods and are placed within existing grid patterns of the canisters. The poison rods move up or down with the drive units and can have rod followers if and where required.

Page 2 shows the possible arrangement on how detachable poison rods can be achieved. The captive bolt arrangement is similar to the arrangement used for the holddown quadrant tie down studs presently used on PBF.

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[signature]	2-2-77	[signature]	2-1-77	RWMarshall Jr	2/3/76

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PROJECT FILE NO.

EDF SERIAL NO. 350

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO.

DATE February 4, 1977

PROJECT/TASK PBF Reload Core

SUBTASK Stress Analysis

SUBJECT

PBF SEISMIC ANALYSIS INFORMATION

ABSTRACT

PBF seismic analysis information is reported as follows:

(a) seismic analyses performed to date for PBF

(b) standards used as a basis for establishing structural adequacy for the above analyses

(c) guidelines for future seismic investigations

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R. A. Goodell				R W Marshall	3/3/77

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PROJECT FILE NO

351

FUNCTIONAL FILE NO 45300-332-300

PROJECT/TASK PBF Reload Core

DATE February 3, 1977

SUBTASK Control System Modification

EDF PAGE NO 1 OF 4

SUBJECT

5000 SCFM CRCA COMPRESSOR COST ESTIMATE AND SCHEDULE

ABSTRACT

A cost estimate, drawing and a schedule for the proposed 5000 SCFM control rod cooling air compressor installation are attached.

The compressor has a 900 horsepower motor requiring 4160 volt, three phase electrical power. The PBF-620 electrical plant will have to be modified with a large 13,800 volt to 4160 volt transformer with associated switchgear, wire, and fittings. The electrical modification is estimated to cost $400,000 of which the amount assignable to the compressor installation is $75,000. The remainder of the $400,000 will provide power to other plant modifications and upgrade the existing electrical plant.

The $500,000 total includes a considerable contingency allowing for escalation of prices for a year or more as well as for uncertainties in the estimating process.

Engineering costs shown in the estimate cover preparation of a design data package, seismic analysis, preparation of compressor bid package, evaluation of Title I design and engineering overview and coordination of the project.

During Title I design drill probes will be made to ascertain the amount of lava involvement.

As now proposed, the compressor building construction would not affect the existing corrosive waste line.

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R. A. Freeman	R. W. Marshall	C. R. Toole
J. Klein	B. K. Pope	H. A. Wilkin

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W. G. Lussie
E. L. Wills

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R. A. Freeman	PBF	[signature]	2/10-77	R W Marshall	2/11/77

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(Rev. 8-76)

FILE NO.

EDF SERIAL NO. 352

GWA NO. 45300-335-302

DATE 2/8/77

TASK PBF RELOAD CORE

SUBJECT

ROM COSTS TO FABRICATE
ONE EACH 406587-1 IN-PILE
PRESSURE TUBE ASSEMBLY

LGJ-1-77

ABSTRACT

Per telecon with Dale Shannon of Ametek Straza Industries, 2/8/77 and author, the following ROM costs to fabricate subject assembly was verbally submitted:

Fabrication as defined in 406587		163.0 K each
Non reoccuring costs, planning, tooling, etc.		169.0 K lot
	Total	332.0 K

Note: These costs are valid if contract is awarded during second quarter of 1977 and work is completed during 1977/1978.

Mr. Shannon is submitting above in letter form to author with a copy to R. W. Marshall.

DISTRIBUTION

R. W. Marshall, J. Klein, L. G. Johnston, H. W. Spaletta

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L. G. Johnston (signature)	3350	(signature)	8 Feb 77	R W Marshall (signature)	2/8/77

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PROJECT FILE NO.

EDF SERIAL NO. 353

FUNCTIONAL FILE NO. 45300-332-300

PROJECT/TASK PBF Reload Core

DATE February 10, 1977

SUBTASK Control System Modification

EDF PAGE NO 1 OF 6

SUBJECT

CONTROL AND TRANSIENT ROD SHROUD REMOVAL PROCEDURE

ABSTRACT

A proposed procedure for removing a control rod or transient rod shroud is attached, together with sketches of two tools. The procedure includes two emergency operations to stop leakage. The first covers the possibility of leakage into the subpile room while the shroud is still in place. In this case liquid nitrogen is used to freeze seal the bottom head-shroud joint.

One attached sketch depicts a liquid nitrogen lance which will convey the liquid nitrogen to the area to be sealed.

The second emergency is the possibility of leakage when the shroud has been removed. This emergency is covered by an expandable plug tool which is placed alongside a shroud before any work is done on the shroud-bottom head interface.

The procedure and sketches will be furnished to R. M. Brown, PBF Operational Documentation for use in case shroud removal becomes necessary.

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E. L. Wills

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R. A. Freeman	PBF Des. Eng.	[signature]	2/10/77	RWMarshall	2/11/77

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ENGINEERING DESIGN FILE

PROJECT FILE NO

EDF SERIAL NO 354

FUNCTIONAL FILE NO

PROJECT TASK PBF Reload Core

DATE February 11, 1977

SUBTASK

EDF PAGE NO 1 of 5

SUBJECT

FATIGUE LIFE EVALUATION OF PBF RELOAD CORE FUEL ROD END PIECE

ABSTRACT

Fatigue life evaluation of the Reload Core fuel rod end piece indicates that the fuel rod end piece will be suitable for approximately 600 stress cycles (600 reactor heatup-cooldown cycles) based upon published fatigue data for zircaloy-4. This fatigue life prediction is not an ASME code evaluation.

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DISTRIBUTION (SUMMARY PAGE ONLY): R. W. Marshall, R. S. Marsden, E. L. Wills

AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
D. K. Morton	Applied Mech	R. A. Goodell	2/11/77	R W Marshall	2/17/77

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PROJECT FILE NO. ______

EDF SERIAL NO. 355

ENGINEERING DESIGN FILE

FUNCTIONAL FILE NO. ______

PROJECT/TASK: PBF Reload Core

DATE: February 15, 1977

SUBTASK: ______

EDF PAGE NO. 1 OF 21

SUBJECT

IN-PILE TUBE STRESS ANALYSIS

ABSTRACT

This EDF documents the analysis performed to determine primary stresses for the PBF "Reload Core" IPT. Four regions of the pressure tube were modeled: (1) lower head, (2) experiment region, (3) lateral support region, & (4) nozzle region. The only load considered was design pressure of p = 3400 psi, except in the nozzle region where stresses due to piping loads were investigated. Results indicate that primary stresses will not exceed allowable values as established per ASME code rules for Class 1 Components. Note that local primary stresses in the nozzle region (that may be produced by piping loads) were not included in making the above evaluation. Also note that the corrosion allowance of 0.010" for tube O.D. & I.D. was not included since this information was not provided prior to preparation of the models.

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R. S. Marsden, C. A. Moore, E. L. Wills

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C.K. C. Kido	Applied Mech.	R.G. R. A. Goodell	2/11/77	RWMarshall Jr	2/17/77

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 356

FORM EGAG-2631 (Rev. 8-76)

GWA NO. 45300-322-100

TASK PBF Reload Core - Physics

DATE February 15, 1977

SUBJECT

WORTH OF PWR-TYPE POISON RODS IN THE OUTER POSITIONS

ABSTRACT

A preliminary examination has been made of the use of PWR-type poison rods in the outer rod positions.

A preliminary PWR-type poison rod design using B_4C as the poison was adopted. An array of these rods was placed in the fuel matrix at approximately the present outer rod positions. PDQ quarter core diffusion theory calculations were made for rods-in and rods-out (using water followers) cases. These yield reactivities, rod worths and power distributions. Similar results are also provided for an air-cooled B_4C-TiH_2 rod. All calculations were made for 8% oxide fuel at 977 K (1300°F) with no shims and shaper and with 611 K (640°F) water in the IPT.

Summarizing the results:

1. The k_{eff} values with the outer rods in are about the same for the PWR-type and B_4C-TiH_2 rods.
2. The k_{eff} values for the PWR rods-out case with water followers is considerably larger than for the B_4C-TiH_2 case with air followers. This yields reactivities and rod worths which are 3.1% $\Delta\rho$ greater for the PWR-type rods than for the B_4C-TiH_2 rod.
3. The power peaking for the PWR-type case is not excessive and can be further controlled by low enrichment zones.

These results indicate that the PWR-type pins warrant further study. A negative factor which must be considered is the degradation of test power similar to that seen for water followers in EDF-335.

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Idaho

ENGINEERING DESIGN FILE

FILE NO.
EDF SERIAL NO. T357
GWA NO. 45300-322-100
DATE February 16, 1977

TASK PBF RELOAD CORE - PHYSICS

SUBJECT

UTILIZATION OF CORE-1 POISON SECTIONS IN THE RELOAD CORE

ABSTRACT

Control-rod reactivity-worth calculations were performed to reassess the effectiveness of the B_4C poison sections (core-1 design) in the PBF Reload Core. This study was necessary because of changes in core design since the last study and because of the small shutdown margin that exists with the air-cooled B_4C poison sections in the oxide core.

Also considered, during this study, was the effect of water coolant for the B_4C poison sections.

Main conclusions that were reached during this study are listed below.

The air-cooled B_4C poison sections, in conjunction with fixed shimming, are capable of controlling the reactor during normal operation. The shutdown margin during the stuck-rod, voided IPT case is very marginal however, and it is foreseeable that core power may be restricted below 50 MW for some tests.

The water-cooled B_4C poison sections, in conjunction with fixed shimming, provide adequate control for both normal operation and the unanticipated stuck-rod, voided IPT case. This system has a very significant impact on power distribution, test performance, and enrichment, however, and these considerations have not been fully assessed at the present time.

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ENGINEERING DESIGN FILE

FILE NO. C358

EDF SERIAL NO.

GWA NO.

DATE February 15, 1977

TASK PBF Reload Core - Safety Analysis

SUBJECT PBF Reload Core Accident List

ABSTRACT Attached is the accident list which has been generated for the PBF Reload Core.

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FORM EG&G 2631
(Rev. 8-76)

FILE NO.
EDF SERIAL NO. "362"
GWA NO. 45300-335-501
DATE February 16, 1977

TASK PBF - Transient Rod Components

SUBJECT

FABRICATION OF PBF POISON RODS FROM ENRICHED BORON CARBIDE

ABSTRACT

Several vendors were contacted regarding their capabilities to procure B^{10}, convert it to B_4C, and produce poison rods for PBF. The B^{10} is quite expensive and Isotope Sales Division, Oak Ridge National Laboratory, is the only domestic supplier. The B^{10} must be converted to B_4C powder suitable for hot pressing. It is difficult to produce B_4C from elemental boron. The cost of producing the inner and outer rods will be nearly $400,000, and if solid rods are to be used, the cost will be $1,250,000.

Material must be provided for excess stock which will cost between $37,000 and $123,000 in addition to the above figures. Most of this cost can be recovered during salvage, however.

The vendors contacted were quite reluctant to offer quotations on components fabricated from B^{10}, as they have little or no experience in dealing with large pieces fabricated from this material. In each case, the need for some development work was indicated.

This EDF supplements EDF 275 and 310 on the same subject.

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R. G. Ambrosek, W. G. Reuter, R. P. Wadkins, W. O. Olsen, F. Wheeler

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FILE NO.

ENGINEERING DESIGN FILE

EDF SERIAL NO. 363

FORM EGAG-2631 (Rev 8-76)

GWA NO. 45300-322-100

DATE February 17, 1977

TASK PBF Reload Core - Physics

SUBJECT

REVIEW OF THE WORTH OF GADOLINIUM NITRATE HEXAHYDRATE POISON IN THE POISON INJECTION SYSTEM

ABSTRACT

A study was made to determine the worth of the present concentration of Gadolinium Nitrate Hexahydrate [$Gd(NO_3)_3 \cdot 6H_2O$] in the PBF Reload Core. A conservative model of the Reload Core was chosen to make this study. The core configuration was as follows: 293 K (68°F) UO_2 fuel at 8% enrichment; 20.1168 mm (0.792 in) pitch; 611 K (640°F) water in the IPT; and all rods were out. The thin film of water that normally exists around the rod annulus was not represented in this study; therefore, the rod annuli were worth less in the model than in reality. Results indicate that the present concentration of $Gd(NO_3)_3 \cdot 6H_2O$ [3.9988×10^{-6} atom/b-cm] is inadequate for the Reload Core. Per ANCR-1011 a 5$ subcritical requirement is imposed on the poison in the Poison Injection System. To meet the requirement the poison should be worth about-20$ or about-14.54% $\Delta\rho$. However, the results show that the poison is worth only-4.47% $\Delta\rho$ or -6.15$ in the Reload Core.

Another case was studied in which the Gadolinium concentration was increased by a factor of 5 to 2.0×10^{-5} atoms/b-cm. Results show that the concentration is worth about -14.76% $\Delta\rho$ or -20.31$. Previous calculations have shown that the Reload Core will have about -10.8% excess reactivity in the core and about -0.68% in voiding the IPT (worst case). Therefore, the Gadolinium poison will have to be able to "counter-act" the -11.48% excess reactivity and maintain the reactor at 5$ subcritical. Using 2.0×10^{-5} atom/b-cm concentration of Gadolinium, only about -3.28% $\Delta\rho$ or -4.51$ remains to maintain the reactor subcritical. So at the present pitch, a concentration of 5 to 6 times the present Gadolinium concentration would be necessary.

Another aspect of the requirements in ANCR-1011 is that the poison in the Poison Injection System "will render the PBF at least 5$ subcritical for any core and poison rod configuration". A study varying the pitch of the fuel cell and the concentration of the Gadolinium has not been made; but based on the results using a pitch of 20.1168 mm (0.792 in), an educated guess of 7 to 8 times the present concentration of Gadolinium may be required to fully satisfy the requirements of ANCR-1011.

Further information is contained in the attached pages.

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TASK PBF HEAVY WALL IPT ASSEMBLY

DATE February 17, 1977

SUBJECT

COST ESTIMATE PBF IPT ASSEMBLY

WITH HEAD AND INTERNALS

LGJ-2-77

ABSTRACT

This cost estimate was compiled using the following drawings:

1.	400230 Pressure Tube Assembly	484.0 K
2.	406683 Closure Head Assembly	25.0 K
3.	402043 Upper Flowtube Internal	15.0 K
4.	402044 Center Flowtube Internal	6.0 K
5.	402045 Lower Flowtube Internal	2.0 K
6.	402046 Catch Basket	20.0 K
	TOTAL	552.0 K

The above costs are for subcontractor work only, which includes material, labor, and processing.

Page 2 itemizes detail costs of items 1 thru 6.

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GWA NO. 45700-030-400

DATE February 22, 1977

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TASK PBF Reload Core - Physics

SUBJECT

ENERGY DEPOSITION IN B_4C - TiH_2 POISON SECTIONS

ABSTRACT

An estimate has been made of the heat generation rates in air-cooled, titanium hydride moderated boron carbide poison rods in the PBF Reload Core. The calculational method combines a transport calculation of supercells, composed of a poison rod and a surrounding annulus of fuel, with two-dimensional diffusion calculations for the reactor with various rod configurations. Thus, it combines detailed power distributions within the poison rods with the overall power distributions due to differing rod patterns.

Results for the two types of calculations are presented in tabular form. A simple formula is provided for combining these results to yield heating rates for each material in each rod for a given rod configuration.

This study is incomplete since it applies only to cases in which individual rods are either completel/ in or out. Further analysis is required to treat partial insertions.

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FEFPL PROJECT

ENGINEERING DESIGN FILE

FILE NO.

EDF SERIAL NO. 367

GWA NO.

TASK PBF RELOAD CORE

DATE February 23, 1977

SUBJECT

TEMPERATURE DISTRIBUTION FOR ROD BOWING ANALYSIS

ABSTRACT

COUPLE code was used to obtain a planar steady-state temperature distribution for an inner PBF reload core fuel rod adjacent to the filler for the case of unborated canister walls. The planar power distribution in the fuel was obtained from Reference 1. The temperature distribution reported here was for the rod hot plane with a normalized power of 1.366, (Reference 2). Axial temperature profile may be obtained by performing similar analysis at different axial locations. The temperature distribution was required for the PBF reload fuel rod bowing study.

In this study, COUPLE showed that the maximum fuel temperature was 5311.9°F. The maximum fuel temperature difference was 531°F between nodes 40 and 52 and the maximum cladding temperature difference was 22.92°F between nodes 79 and 91.

Note: This work was stopped when the reload core effort was cancelled. The maximum fuel temperatures reported herein are too large. This correction was not attempted due to the cancellation of the reload core work.

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FILE NO.

EDF SERIAL NO. 368

GWA NO.

DATE February 24, 1977

TASK PBF Reload Core - Core Design

SUBJECT

FLOW-3 Evaluation of Fuel Canister Design Alternatives

ABSTRACT

SUMMARY

Modifications to the PBF fuel canisters and possible removal of the flow skirt were evaluated using the computer code FLOW-3. The code was used to calculate the cooling flow between canisters with the grid spacer slots removed and with 0.25 inch and 0.188 inch tooling holes. Flow was also calculated with the flow skirt removed. The final calculation was made with gamma heating in the canister wall equivalent to 2 watts/gm. There was an error in unheated perimeter for some nodes. Corrections were to be made when final calculations were made with final physics parameters. Due to cancellation of the Reload Core project these corrections were not made.

CONCLUSIONS AND RECOMMENDATIONS

Review of the results lead to the following conclusions:

1) The flow skirt is required to prevent possible stagnation at the upper end of the fuel canisters as flow is shown to reverse when the flow skirt is removed.

2) Tooling hole size of 0.188 inch is acceptable. Therefore, there is no reson to increase the hole size to 0.250 inch.

3) The fuel canisters can be reorificed with acceptable flow distribution between the canisters if the spacer blade slots are removed.

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FILE NO.
EDF SERIAL NO. 370
GWA NO. 45300-322-100
DATE March 1, 1977

TASK PBF Reload Core - Physics

SUBJECT

INITIAL ENRICHMENT OF TEST PINS FOR PWR IRRADIATED 36-PIN HIGH ENRICHMENT TEST

ABSTRACT

A study was made to determine the initial enrichments of fuel pins for a PWR irradiated 36-pin high enrichment test such that after irradiation of 40,000 MWD/MTU, the pins would meet the following requirements: (1) Peak linear power of 21 kW/ft can be attained by the pins in the 36-pin test; (2) The radial power distribution over the 36-pin test should be relatively flat.

It was determined that the initial enrichments of the test pins in the two outer rows that met the requirements were 50% and 20%, respectively if the inner-most row contained 93% enrichment pins.

For the conditions defined in this report, it was found that the test power degradation, attributable to 40,000 MWD/MTU burnup in the test rods, was about 33% for a low enriched test and about 12% for a high-enriched test.

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EDF SERIAL NO. 371

FORM EG&G-2631 (Rev. 6-76)

GWA NO. 45300-322-100

TASK PBF Reload Core Physics

DATE March 7, 1977

SUBJECT

PBF RELOAD CORE THREE-DIMENSIONAL NEUTRONICS MODEL DEVELOPMENT

ABSTRACT

A three-dimensional PDQ-7-II neutron diffusion theory model of the proposed PBF Reload Core has been developed and is available for use. The model includes capabilities for analysis of thermal-hydraulic reactivity feedback, fuel depletion, transuranic element production, and fission-product poisoning. The model has been extensively verified and has been applied to some preliminary Reload Core design calculations.

The attached report, RE-N-77-014, transmits the results of the above efforts.

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TASK PBF RELOAD CORE

DATE March 9, 1977

SUBJECT

IPT Forging - Status Report

(RLG-2-77)

ABSTRACT

Revisions are required to Requisition 186690-2, Special Provisions, Revision D to assure compatability of Wyman Gordon's capabilities, and EG&G requirements.

The present status of the forgings and necessary revisions are attached to this EDF.

DISTRIBUTION F. P. Blair, D. D. Keiser, J. Klein, C. Krivanec, E. W. Lyon, R. W. Marshall, H. W. Spaletta, ERDA-ID: J. L. Wallace, P. E. Litteneker

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GWA NO. 45700-030-400

DATE March 15, 1977

TASK PBF Reload Core Physics

SUBJECT

REACTIVITY INSERTION DUE TO VOIDING THE IN-PILE-TUBE

ABSTRACT

A study was done to determine the effect on the Reload Core of voiding the In-Pile-Tube (IPT).

33-group S_4 transport calculations were made for the Reload Core radial model. Several calculations were done with the IPT completely voided as has been the usual practice in the past. The large central void region representing the IPT was treated using the methods outlined in ANCR-1337, Approximate Calculations for the Reactivity Effects of Voids in Nuclear Reactors. Several calculations were also done with the test cooling water removed but leaving dry test fuel pins in place. Calculations of this type have not been reported in the past.

The results of these calculations are summarized in the attached report.

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EG&G Idaho, Inc.

PROJECT FILE NO.

EDF SERIAL NO. 381

FUNCTIONAL FILE NO.

DATE March 24, 1977

EDF PAGE NO 1 OF 22

ENGINEERING DESIGN FILE

PROJECT/TASK PBF Reload Core Safety Analysis

SUBTASK Kinetics Analysis

SUBJECT

RELAP4 KINETICS MODEL FOR THE PBF RELOAD CORE

ABSTRACT

A RELAP4 model of the PBF Reload Core was prepared to perform the kinetics safety analysis for the core. This report discusses the procedure and parameters used to develop the model.

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R. G. Ambrosek, W. R. Carpenter, R. A. Dimenna, W. G. Lussie, R. P. Wadkins

AUTHOR	DEPT	REVIEWED	DATE	APPROVED	DATE
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EDF SERIAL NO [illegible]382[illegible]

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DATE March 24, 1977

PROJECT/TASK PBF Reload Core Safety Analysis

SUBTASK Kinetics Analysis

EDF PAGE NO 1 OF 16

SUBJECT

Comparison of the PBF Reload Core RELAP and HYDRAX Kinetics Models

ABSTRACT

Because the PBF Reload Core HYDRAX kinetics model could not account for heat transfer and thermohydraulic effects in its reactivity feedback calculations, it was replaced with a RELAP model. The first task of the new model was to assess the validity of the previous HYDRAX work via a RELAP/HYDRAX calculational series. The results of this series are contained here and show the comparison as favorable, however, sufficient time was not available for a detailed analysis.

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FILE NO. ______

EDF SERIAL NO. 212

GWA NO. 45073-320-020

DATE August 5, 1976

TASK PBF RELOAD CORE-PHYSICS

SUBJECT

FUEL ROD DESIGN SPECIFICATION - Enrichment and Cladding OD Tolerance

ABSTRACT

The Reactor Physics Section has the responsibility of specifying the enrichment of the UO_2 for the driver-core fuel. The attachment summarizes the basis for selection of the required enrichment and discusses the impact, on the physics design, of the tolerance on the cladding outer dimension.

It is estimated that the U-235 enrichment of the primary fuel will lie between 6.6% and 9% with 7.7% as the expected value based on present information. The low-enrichment fuel (to be used as a core power shaper) is estimated to have a U-235 enrichment of approximately 3% to 4%.

It is recommended that the tolerance on the cladding outer dimension be relatively tight since the neutronics of the reactor are very sensitive to this dimension. A tolerance of ± 2 mils should be adequate for purposes of the physics design.

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APPENDIX C

PROJECT MANAGER'S FILE INDEX
OF THE PBF RELOAD CORE PROJECT

PROJECT MANAGER'S FILE

1.0 Backup Costs for PPS and Control System

2.0 Reload Core Closeout

3.0 Letters - ERDA-ID

4.0 Langford Letter File

5.0 Al/Zirc Corrosion

6.0 PBF Management Schedule Technical Support Program

7.0 IPT Fabrication

8.0 Requirements

9.0 Monthly Project Management Meeting

10.0 Canisters

11.0 PSDDs

12.0 Control and Transient Rod Mods

13.0 Safety Analyses

14.0 Fuel Procurement

15.0 Fuel Assembly Design Specifications

16.0 Drawing Lists

17.0 Cost Estimate of January 1977

18.0 Cost Estimate of Langford's before 7-1-76

19.0 Schedules of January 1977

20.0 Aeroject/EG&G Responses to ERDA Comments

21.0 J. Klien and D. J. Langford, PBF Reload Core Performance Assessment Study, TR-717

22.0 R. L. Greenleaf, PBF Reload Core Preliminary Proposal, TR-854, June 7, 1976

23.0 R. W. Marshall, Jr., Closeout Report of the PBF Reload Core Project, TFBP-TR-288, August 1978

24.0 Reload Core 9.4 PBF Design and Fabrication Division File, Correspondence from January 1974 thru December 1976

25.0 Miscellaneous Reload Core Information

26.0 PBF Reload Core FY'77 GWAs

1. Record Storage Receipt

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2. RELOAD CORE - Project Manager's File - 18.0 to 26.0	Review 3 yrs Destroy 6 yrs					
3. RELOAD CORE - Langford Files - A-1 to K-5	Review 3 yrs Destroy 6 yrs					
4. RELOAD CORE - Langford Files - K-6 to N-31	Review 3 yrs Destroy 6 yrs					

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APPENDIX D

D. J. LANGFORD PBF RELOAD
CORE PROJECT ENGINEERING FILE

LANGFORD INDEX

K-3 IPT Fabrication Design Specification/Requirements

K-25 Fuel Handling Design Spec/Requirements

K-30 Loop-Design Specification/Requirements

K-31 Core I IPT - Design Requirement/Specifications

M-2 IPT Forging - Design

M-3 IPT Fabrication Design

M-7 CR Drivers Design

M-12 Catch Baskets Design

M-21 Core Design

M-23 Control Electronic System Design

M-25 Fuel Handling Design

M-26 C.S. Switch - Design

M-30 Loop Design

M-31 Core I IPT - Design

Ma-2 Zirconium Based Alloys for IPT

N-1 Fuel Rod Analysis

N-3 IPT Fabrication Analysis

N-21 Core Analysis

N-25 Fuel Handling - Analysis

N-30 Loop - Analysis

N-31 Core I - In-Pile Tube

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LIST BOXES NUMERICALLY 1. RELOAD CORE - Project Manager's File - 1.0 to 17.0	Review 3 yrs Destroy 6 yrs					
2. RELOAD CORE - Project Manager's File - 18.0 to 26.0	Review 3 yrs Destroy 6 yrs					
3. RELOAD CORE - Langford Files - A-1 to K-5	Review 3 yrs Destroy 6 yrs					
4. RELOAD CORE - Langford Files - K-6 to N-31	Review 3 yrs Destroy 6 yrs					

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PAGE 1 OF 13

BRANCH TFSP-Administrator Control Program

SECTION DOCUMENTATION & CONTROL PBF-601

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES Review	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY: 1. BOX 1 Blue line Drawings 407565, 406587, 407612	6 years	13-11-c	12-31-83		25885	1C
2. Reload Core RWM'S Log & Notes & Action Items						
3. Control Rod Cooling 4. EDF's 213, 278, 307, 310,						
315, 317, 322, 326, 330, 335, 341 5. AGENDA for PBF						
Reload Core Dec. 8. 1976 6. Tech. Report RE-E-76-038						
12-29-76 PBF Thin Wall IPT Components Normal Operating						
Transient Thermal Analyses for LOCE Testing 7. Reload						
Core Requirements 8. Axial Power Distribution Studies for						
the PBF Reload Core 6-22-76 9. Cost Budget Analysis 1-77						
10. Tech. Report-854 6-7-76 11. PBF [illegible] Core Project						
Schedule W. G. Lussie 5-77 12. Final Forms 189afor FY-1977						
Crocker-252-1976 13. Diagram on PBF Reload Core-Fuel Canisters from Core 1 Canisters						

I CERTIFY THAT NO CLASSIFIED MATTER IS CONTAINED IN THIS SHIPMENT — Jim Artis (signature), SECTION SUPERVISOR — DATE 4-6-78

I CERTIFY THAT THE ABOVE RECORDS WERE RECEIVED BY RECORDS MANAGEMENT — Bruce Crockett (signature) — DATE 4-12-78

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SECTION: DOCUMENTATION & CONTROL PBF-601

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE): [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION BOX NO.	LOCATION SPACE
			TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL			
LIST BOXES NUMERICALLY: BOX 2 Reload Core	6 years	13-11-C	Review 12-31-83		25886	1C
1. PBF reload core closeout						
2/ Reload core williams/Kiehn letter						
3. Preliminary - PBF system disign description in-pile						
tube assy reload core SDD 3.5R 4) Preliminary PBF system						
design description reload core reactor control and						
protective system SDD 7.5R 5) Préliminary PBF system						
design description reload core reactor core system SDD 4.2R						
6) Literature review on Titanium hydride RE-E-77-110						
7) Literature review on Boron Carbide RE-E-77-111						
8) PBF reload core preliminary proposal						
9) PBF reload core performance assessment study						

233b

I CERTIFY THAT NO CLASSIFIED MATTER IS CONTAINED IN THIS SHIPMENT: [signature] SECTION SUPERVISOR DATE 4-?-78

I CERTIFY THAT THE ABOVE RECORDS WERE RECEIVED BY RECORDS MANAGEMENT: Bruce Corbett DATE 4-12-78

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SECTION DOCUMENTATION & CONTROL PBF-601

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL — RETENTION PERIOD EXPIRES Review	DATE OF DESTRUCTION	LOCATION BOX NO.	LOCATION SPACE
LIST BOXES NUMERICALLY 1. BOX 2 (cont) Reload Core	6 years	13-11-c	12-31-83		25886	10
10) Reload core preliminary SDD						
11) Reload core preliminary proposal TR-854						
12) Requirements references from preliminary proposal						
TR-854 13) Preliminary PBF reload core test program						
TR-815 14) Letter - Assessment of cost and						
performance of columbia-DNB tests (S-2613)-ELW-2-77						
15) Proposal program to obtain critical heat flux data						
for PBF 16) PBF DNB test specification PBF reload core						
17) Oversights not included in 1-7-77 estimate						

I CERTIFY THAT NO CLASSIFIED MATTER IS CONTAINED IN THIS SHIPMENT ____ (signature) SECTION SUPERVISOR DATE 4-...-78

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REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY			Review			
1. BOX 3 Reload Core	6 years	13-11-c	12-31-83		25887	1F
1. R. W. Marshall Jr. letter log 1-7-76 - 3-15-77						
2. PBF reload core complete listing of reload core						
drawings at time of shutdown of reload core project EDF-359						
3. PBF reload core unreleased designs and calculations						
at time of shutdown of reload core project EDF-361						
4. PBF reload core fuel rod assy spec ANC-50106A						
5. Letter PBF reload core : Physics status report						
Whlr-7-76 6. PBF reload core fuel rod MKS-41-76						
PBF reload core fuel rod assy (INS 10-M-100) spec						
ANC-50106 7. Reload core GNA report for March 1976						

233d

I CERTIFY THAT NO CLASSIFIED MATTER IS CONTAINED IN THIS SHIPMENT

[signature] SECTION SUPERVISOR DATE 4-7-78

I CERTIFY THAT THE ABOVE RECORDS WERE RECEIVED BY RECORDS MANAGEMENT

Bruce Aabott DATE 4-12-78

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SECTION: DOCUMENTATION & CONTROL PBF-601

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CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	SPACE
			Review			
LIST BOXES NUMERICALLY: 1. BOX 3 (cont) Reload Core	6 years	13-11-c	12-31-83		25887	1F
8. PBF reload core preliminary design review & project						
managment meetings MKS-43-76 9. Letter PBF reload core						
fuel rod spec and drawing WED-184-76 Drawing #406263						
10. Technical report safety assessment report PBF						
reload core 11. Review of PBF reload core purchase						
description Stea-5-76 12. PBF core storage DJL-6-76						
13. Barksdale pressure switches (information)						
14. 10-2 configuration work neccessary to change						
mechanical drawing 15. PBF reload core physics status						
report Whlr-8-76 16. Letter PBF reload core safety						
assessment report WED-224-76						

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REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION BOX NO.	LOCATION SPACE
			Review			
LIST BOXES NUMERICALLY 1. BOX 3 (cont) Reload Core	6 years	13-11-c	12-31-83		25887	1F
17. Letter PBF reload core physics status report						
Whlr-9-76 18. Progress report PBF reload core						
hardware Wlms-11-76 19. Final design review of as						
built drawings & DCN's EFT-2-76 20. Engineering						
documents transmittal report of final design review PBF						
reload core fuel rod. 21. PBF core storage DJL-10-76						
22. Letter Reactor fuel storage requirements DJL-11-76						
23. Letter transmittal of canister drawings for						
evaluation COC-86-76 24. PBF reload core in-pile						
tube INS #10-M-103 ANC 50105 25. Drawing #406546 1-3						
26 LTR- PBF core storage CRT-55-76 & RWM-15-76						

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CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	SPACE
LIST BOXES NUMERICALLY: BOX 3 (cont) Reload Core	6 years	13-11-c	12-31-83		25887	1F
27. Lre PBF reload core in-pile tube spec ANC 50105 MKS-63-76 28. Ltr proposed PBF reactor canal extension [illegible] JEL-21-76 29. Ltr fuel rod clad material impact on schedule WED-238-76 30. Ltr PBF reload core project management meeting minutes WED-231-76 31. Engineering document transmittal design review on spec 50105 & pressure tube IPT drawing 406546 reload core						
32. Ltr May project management meeting PBF reload core DJL-12-76 33. Ltr PBF design change DJL-13-76						
34. Ltr PBF reload core project management meeting minutes WGL-10-76.						

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SECTION DOCUMENTATION & CONTROL PBF-601

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CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY			Review			
BOX 3 (cont) Reload Core	6 years	13-11-c	12-31-83		25887	1F
35. Ltr PBF reload core fuel rod assy. spec. ANC 50106						
and drawing 406263 36. PBF preliminary design descript-						
ion PSDD 4.2A reload reactor core system 37. LTR PBF						
second core reactor physics calculations for an enlarged						
test space with the ETR type drwer core Whlr-1-75						
38. Ltr justification for objecting to use of 440 SS						
inside PBF in-pile tube HWSc-1-75 39. Ltr Care II						
Zircalogy 4 PBF-RR-4-75 40. Meeting report on core II						
IPT size flow through tube and LOCA requirements						
41. PBF core II IPT design pressure analysis. 42.Ltr						
PBF core II conceptual design meeting 1-14-75 Coh-1-75						

233h

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SECTION DOCUMENTATION & CONTROL PBF-601

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
			Review			
LIST BOXES NUMERICALLY: 1. BOX 3 (cont) Reload Core	6 years	13-11-c	12-31-83		25887	1F
43. General work authorization core II IPT design pressure						
44. Ltr cost estimate for PBF core II reactor vessel assy						
RR-16-75 45. Work description second core PBF						
46. Ltr program plan WED-29-75 47. Materials						
techrology laboratory report and data transmittal						
#LR-75-2-1 48. Ltr PBF core II IPT design pressure						
WED-40-75 49. Ltr PBF core II reactor physics status						
report GWA Whlr-2-75 50. Ltr Project status meeting						
PBF core II DJL-1-75 51. Ltr Zirconium 2.5% niobium						
test program to determine 700°F strenghth and ductility						
as a function of engineering strain rate Dix 2-75						

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SECTION DOCUMENTATION & CONTROL

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [x] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY			Review			
1. BOX 4 RELOAD CORE SEE ATTACHMENT	6 years	13-11-c	12-31-83		25888	1F
Spec. P-8 -PBF Erection & Installation of General Piping						
April 3, 1968. 2) Spec. P-10 PBF & PW Loop For Nondestructive						
Testing 8/31/65 3) Spec. P-3-PBF Welding-Stainless Steel						
9/27/65. 4) Spec. P-4-PBF Welding-Carbon Steel 10/17/65.						
5)Spec. P-5-PBF & PW Loop Welding Materials-Stainless Steel						
6/19/67. 6) Spec. P-6-Welding-Stainless Steel to Carbon						
Steel 6/7/67. 7) IPT Thermal & Stress Reports Book 1-4 1975.						
8)PBF-IPT Catch Basket-1973. 9) Core II Engineering Support						
Task M-1. 10) Fission Heating-1975. 11)Design Studys						
12) Core II Sketches. 13)Canal Enlargement March 11, 1975						
14)RELOAD CORE 1976-1977						

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SECTION: DOCUMENTATION & CONTROL

REQUESTED DISPOSITION OF MATERIAL (CHECK ONE) [X] STORAGE [ ] DESTRUCTION

CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY: BOX 5 RELOAD CORE	6 years	13-11-c	Review 12-31-83		25889	2F
1) 11.25-Trading Stamp Collection or Cash rebates 6/8/77						
2)11.26 Direct Labor & Overhead Cost Budget 3/77						
3)12.0 LOFT 1976 4)13.0 GRIST 1976 5)14.1 SPERT 1975						
6)14.2 TRA 1976 7)14.3 TSB Bldg. 1976 8) 15.15 Job Bidding						
Procedure 1976 9) 15.16 Labor Distribution 1977 10)15.17						
Req. for Extended Work Week 11) 15.18 Employment Plan						
12) 15.19 Personnel General 13)15.20 AAP Monthly Report						
14) 16.0 Argonne 15) Major Organization Monthly Actions						
16) Action Items Closed 1976-1977 17) Action Items from						
176 to 400 1976 18)Action Items Closed 1975 from						
15 to 175 - 1975						

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CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	SPACE
LIST BOXES NUMERICALLY			Review			
1. BOX 6 SEE ATTACHMENT RELOAD CORE	6 years	13-11-c	12-31-83		25890	4F
1) Buff Book-1976 2) Accounting Calendar						
3) Overall Program-1976 4) Budget Review-1976						
5) Procurement-1977 6) Communication Rate-1976						
7) Government Surplus Disbursement 1976						
8) Five Year Calendar Capital Plan -1974						
9) Construction Cost Estimate Report -1975						

2331

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CONTENTS AND DATES (INCLUDE NECESSARY IDENTIFICATION FOR FUTURE REFERENCE)	OFFICIAL RETENTION PERIOD	ERDA MANUAL APPENDIX 0230 ANNEX "C"	TO BE COMPLETED BY RECORDS MANAGEMENT PERSONNEL: RETENTION PERIOD EXPIRES	DATE OF DESTRUCTION	LOCATION: BOX NO.	LOCATION: SPACE
LIST BOXES NUMERICALLY			Review			
1. Box 7 RELOAD CORE SEE ATTACHMENT	6 years	13-11-c	12-31-83		25891	4F
1) Fuel ort PBF to other Facility						
2) Reposi ng PBF Drives-1976						
3) Core Changeover Procedure (DRAFT) Jerry Flynn & D. Fischer						
4) Reload Core Changeover Procedure (First Draft)						
Jerry Flynn 5) SDD 7.5A RCCPS Parts A & B Reload						
Core COntrol & Protective System						
8) Study for Onsite PBF Fuel Storage						

I CERTIFY THAT NO CLASSIFIED MATTER IS CONTAINED IN THIS SHIPMENT — [signature] SECTION SUPERVISOR — DATE 4-7-78

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2. <u>File Folder Cover Sheets</u>

File a-1 Subject Functional Requirements

Number	Date	Document	Originator	Action
1	11/4/75	PBF Reload Core Meeting		
2	11/5/75	PBF Reload Core (draft)	D. A. Hoatson	
3	12/5/75	Reload Core Meeting Nov. 4-5 Commitments & Agreements	R.E. Swanson KRSO/1122-75	
4	12/8/75	Ltr. Supplement to RES Program letter #6 for ANC	Herbert J.C. Kouts	
5		Agreements & Commitments - Reload Core		
6	11/22/74	J G Crocker to R.E. Swanson Functional Requirements for PBF Core II		
7	4/29/75	J F Pearson to R W Barber PBF Reload Core	QSR:E0:RE:033	
8	5/2/75	TWX - RW Barber to R Glenn Bradley		
9	5/7/75	Ltr. R.E. Swanson to W E Dunker PBF Reload Core	R E Swanson RSO/521-75	
10	6/9/75	Same as ai-	R E Swanson RSO/625-75	

File A-1 Subject Functional Requirements

Number	Date	Document	Originator	Action
11	7/18/75	Ltr. RG Crocker to WE Burker Rest. Rod Power Requirements for Core II	RG Crocker (CRO-184-75)	
12	7/28/75	Ltr.: Same as Above		
13	7/30/75	Commitments and Agreements - PBF Reload Core -		
14	8/1/75	RW Barker to R Glenn Bradley - Same title as Above	RW Barker (RSRC:TS128)	
15	8/18/75	Ltr RG Crocker To WE Burker PBF Reload Core program	RG Crocker (CRO-383-75)	
16	11/5/75	RW Barker to R Glenn Bradley PBF Reload Core Meeting Nov 4-5 75, Commitments and Agreements	RW Barker (RSRC-TS230)	
17	[redacted] 11/5/75	RB Foulds to RW Barker Trip Report of TJ Walker to ANC on Sept. 16-19 1975	RB Foulds (RSR:EO:RE070)	

File A-1 Subject Functional Requirements

Number	Date	Document	Originator	Action
18	11/4-5/75	Agreements & Commitments PBF Preload Core ERDA Hq. Germantown		

File 11 Subject PROGRAM INFORMATION

Number	Date	Document	Originator	Action
1	–	LOCA MOD RELAP 4 STUDIES		
2	–	PLANNED TESTS	–	
3	–	ADDITIONAL INFO ON FUTURE TFBP PROG		
4	–	PHASE 1 OF THE PROPOSED PBF-PCM TEST PROGRAM		
5		TEST REQ. AND OBJECT FOR PHASE B		
6	4-16-73	LTR: OFFICE SIZING FOR THE PCM PWR SINGLE ROD HARDWARE - GALE - 3-73	L.G. GALE	
7	5-16-74	SCOPING + SENSITIVITY STUDY OF FUEL ROD BEHAVIOR DURING A VARIETY OF LOCA CON	THERMAL REACTOR SAFTEY PROG DIV.	
8	8-11-75	REF: PBF RELOAD CORE COMMITMENTS + AGREEMENTS, ERDA HEADQUARTERS DISC.	D.J. LANGFORD	
9	10-11-75	NOTES ON MEETING ON TEST REQUIRMENTS	CROCKER, BURDICK, COHEN, M^cKARDELL, DURKEE, LANGFORD	
10	11-13-75	PROGRAM INFO. NEEDED FOR IMPILE TUBE GAMMA HEATING + ASME CLASS 1 ANALYSES	E.E. BURDICK	
11	4-1-76	LTR. LOCA HEATUP TEST SAFTEY CONCERN	J.R. LARSON	
12	4-6-76	LTR PRELIMINARY FRAP T ANALYSIS OF FUEL ROD'S RESPONSE DURING PROPOSED PBF LOCA BLOWDOWN TEST USING RELAP 4 COMPUTED BONDARY CONDITIONS TOL-5-76 EER-3-76	E.L. TOLMAN E.E. ROSS	

File A-2 Subject PROGRAM INFORMATION (CONT'D)

Number	Date	Document	Originator	Action
13	4-6-76	LTR. COOLANT TEMPERATURE VS. AXIEL TEST POSITION · RPW-4-76	R.P. WADKINS	
14	4-12-76	LTR. LOCA BLOW-DOWN TEST, LOC 11 REQUIREMENTS.	JR LARSON	
15	4-15-76	LTR DOCUMENTATION FOR TEST PCM 2, 3 AND 4	RE. SWANSON	
16	4-21-76	LTR: LOCA BLOW DOWN MEASUREMENT SPOOL FLOW RESISTANCE	J.R. LARSON	
17	4-29-76	LTR: PBF RELOAD CORE PROGRAM.	J.G. CROCKER,	
18	6-15-76	LTR. TRANSMITTAL OF PBF RELOAD CORE PRELIMINARY PRO-POSAL	J.R. CROCKER.	
19	6-11-76	ltr J G Crocker to G L Wood Preliminary PBF Reload Core Program PLAN	J G CROCKER CCRO-119-76	
20	—	Tabled Reviews of the proposed PBF-PCM test program		
21	1/9/75	ltr. J G Crocker to RE Swanson Functional Requirements for Flow Blockage mods.	J G Crocker CCro-9-75	

File A-2 Subject Program Information

Number	Date	Document	Originator	Action
22	1/15/75	ltr J G Crocker to W E Larkee LOCA and (Flow) Blockage Functional Requirements	J G Crocker (CRC-16-75)	
23	4/29/76	[redacted] J G Crocker to W E Larkee PBF Reload Core Program	J G Crocker (CRC-[redacted] 87-76)	
24	5-76	Primary Core PBF Assy. Interim Summary Description		

File A-2 Subject Program Information

Number	Date	Document	Originator	Action
25	9/14/70	Design Criteria for PBF IPT Internals		
26	6/26/74	LOCA meeting notes AEC/HQ		
27	1/15/75	ltr. J G Crocker to WE Drivee LOCA [illegible] & Flow Blockage Functional Requirement	J G Crocker (Cro-16-75)	
28	2/25/75	ltr. J G Crocker to RE Swanson PBF LOCA Simulation loop ECC pump	J G Crocker (Cro-67-75)	
29	3/12/75	ltr. J G Crocker to WE Drivee LOCA loop mod Functional Requirement Priorities	J G Crocker (Cro 87-75)	
30	8/30/75	J G Crocker to WED TFBF Experiment Coolant Condition Requirements	J G Crocker (Cro-197-75)	
31	8/31/75	F H Tingey to DA Walker Revised PBF Test Program Requirements	F H Tingey (T-358-75)	

File A-2 Subject Program Information

Number	Date	Document	Originator	Action
32	10/23/75	Inlet Flow Blockage Behavior		
33	10/22/75	Tech Report PSDD - IBF - LOCA Blowdown Modifications		

File A-3 Subject Design Requirements/Considerations

Number	Date	Document	Originator	Action
1		Report LOCA Blowdown Test Train Design Status		
2	9/5/76	Ltr: ER Goffaux to WR Bird PBF Requirements	ER Goffaux (ERG-77-75)	

File C-1 Subject ERDA-NRC CORRESPONDENCE

Number	Date	Document	Originator	Action
1	12/12/75	Action Item Core II Safety Assesment		
2	1/14/76	TWX — R.W. Barber to R.G. Bradley	RW Barber	
3	1/26/76	LTR. H. J.C. Kouts to R.W. Barber PBF Experiment assembly and Checkout loop Project	Herbert J.C. Kouts	
4	1/28/76	LTR. R.W. Barber to R.G. Bradley Clarification of work scope for 189A No. A-6056	~~R.W. Barber~~ R.W. Barber (RSRC: PM22)	
5	2/20/76	Notegram W. G. Swett to Dist.		
6	3/9/76	LTR. R.W. Barber to R.G. Bradley PBF loop Coolant System Hydrostatic Test	R.W. Barber (RSRC: TS46)	
7	4/26/76	LTR. R.E. Swanson to W.E. Dukee. PBF loop Coolant Pump - External Purge.	R.E. Swanson (RSO/294-76	
8	4/29/76	TWX L.S. Tong to R.W. Barber	L.S. Tong	
9	5/3/76	LTR R.E. Swanson to F.H. Tingey PBF management meeting 244	R.E. Swanson RSO\337-76	

File C-1 Subject ERDA\NRC Correspondence

Number	Date	Document	Originator	Action
10	5/5/76	LTR. RS Goldberg TO RJL	RS Goldberg	
11	5/12/76	TWX W.V. Johnston TO RW Barber	W V Johnston	
12	5-14-76	PROGRAM GUIDANCE PROCEDURES FOR BUDGET DEVELOPMENT	C.E. WILLIAMS.	
13	5-14-76	LTR: PREPARATION OF PROPOSAL FOR GAST-2 FACILITY	R. R. WRIGHT.	
14	6-8-76	LTR: DISTRIBUTION OF PBF RELATED DOCUMENTS	R.E. WOOD	
15.	6-9-76	LTR PBF NOTIFICATION OF CHANGE REPORT	RE WOOD	
16.	3-30-76	LTR: ANC/TFBP AGREEMENTS AND COMITMENTS MARCH 3-12, 1976, VISIT	R.W. BARBER.	
17	5-27-76	LTR: COMMUNICATIONS RELITIVE TO ID. REACTOR PROGRAMS	C.E. WILLIAMS.	
18	6/8/76	LTR: RE Wood TO JC Ricker Schedule for Summer Shut-down		
19	6/14/76	TWX - WV Johnston to RW Barber Potential Corrosion in PBF Reactor Core	W V Johnston	

File C-1 Subject ERDA-NRC Correspondence

Number	Date	Document	Originator	Action
20	6/15/76	Ltr. R.E. Wood to W.M. Jussie PBF Upload Can Jail Cladding Collapse Problem [illegible] Consultants meeting	R E Wood	
21		Reports Required by AECM [illegible] 6101		
22	4/30/75	Twx RW Barber to R Glenn Bradley PBF [illegible]	RW Barber	
23	6/11/75	TWX RW Barber to R Glenn Bradley Visit of BL Rich		
24	6/18/75	Ltr: RE Swenson to [illegible] Visit of Barry Rich to INEL	0250/638/75	
25	6/23/75	R Glenn Bradley to CK Jasper Review of RSR and RRD [illegible] Behavior work at INEL	R. G Bradley	
25	7/11/75	TWX RW Barber to RG Bradley PBF Design Review meeting	RW Barber	
26	8/7/75	TWX RW Barber to R Glenn Bradley J Tuwarez visit		

File C-1 Subject ERDA-NRC Correspondence

Number	Date	Document	Originator	Action
27	10/8/75	Ltr: RE Swanson to WE Dirkee Overdue PBF Commitments	RE Swanson RSO/980:75	
28	10/20/75	TWX RW Barber to R Glenn Bradley		
29	10/28/75	Ltr: RE Swanson to WE Dirkee Visit of DA Hoatson to PBF		
30	10/29/75	Ltr: RB Foulds to RW Barber Trip Report of T. J. Walker to ANC on September 16-19, 1975	RB Foulds RSR:EO:RE070	
31	12/2/75	Ltr: LS Tong German + French Reports	LS Tong	
32	1/2/76	Ltr: RE Swanson to J A Crocker PBF midyear Review	RE Swanson RSO/6-76	
33	3/10/76	Ltr: R Glenn Bradley to C.K. Leeper Approval of the Power Burst Facility Planning & Reporting	R Glenn Bradley	

File C-1 Subject ERDA-NRC Correspondence

Number	Date	Document	Originator	Action
34	6/22/76	Ltr. C.E. Williams to K. Luger Guidelines for Computer Priorities	C.E. Williams (CKL-142-76	

File C-32 Subject POWER REACTORS CORRESPONDENCE

Number	Date	Document	Originator	Action
1	12/30/75	ACTION ITEM PROJECT MANAGEMENT PLAN - PBF RELOAD CORE - TO - BKP	R.E. Swanson (RSO\1205-75)	
2	2/17/76	ACTION ITEM DESIGN RIGOR MATRICES - TO - DJL	B.W. Marguglio (BWM-26-76)	
3	2/19/76	Action Item PBF Loop Coolant System TO DJL	R.E. Swanson (RSO\97-76)	
4	2/19/76	Action Item PBF Experiment Assembly and Checkout facility TO DJL	R.E. Swanson (RSO\84-76)	
5	2/19/76	Action Item Review of Semi Annual non-[illegible] Personnel Control factors - DJL	B.D. Yates (BDY-12-76)	
6	2/23/76	Action Item Request for PBF DCCS Departure cards	R.E. Swanson (RSO\98-76)	
7	2/24/76	LTR Travel Expense Reduction	G E Marx (Marx-20-76)	
8	2/27/76	Action Item FCF-549 PBF CATCH BASKET 4X Hardware	R.E. Swanson (RSO\113-76	
9	3/2/76	Action Item Foreign objects in PBF Reactor Vessel	V.A. Walker (RSO\132-76)	

File C-32 Subject POWER REACTORS CORRESPONDENCE

Number	Date	Document	Originator	Action
10	3/4/76	Ltr. B.K. Pope to J.D. Lemon + J.C. Griffith — Unidentified Drawing List	T.E. Curry (Pope-33-76)	
11	3/12/76	Action Item — PBF Thermal Swell Accumulators — Design Variations	R.E. Swanson (RSO\165-76)	
12	3/18/76	Action Item — PBF Loop Coolant System Hydrostatic test	R.E. Swanson (RSO\170-76	
13	3/18/76	Action Item — PBF Loop Coolant System agreements + commitments	R.E. Swanson (RSO\176-76)	
14	3/22/76	Action Item — Funding Priorities Account #44072	R.E. Swanson (RSO\179-76)	
15	3/22/76	Action Item — minutes from monthly managment meeting — Acquisition + Reduction System	R.E. Swanson (RSO\187-76)	
16	3/22/76	Action Item — Review of REP # 5-2710 Remote operated Globe valves	R.E. Swanson (RSO\185\76)	

File C-2 Subject POWER REACTORS CORRESPONDENCE

Number	Date	Document	Originator	Action
17	3/25/76	Action Item Late preparation of PBF ESA'S and EOP'S	R E Swanson (RSO\209-76)	
18	3/30/76	Ltr. J.A. Turner to R.E. Simonds Revised Fiscal Year 1977 GPP Priority List.	J.A. Turner (JAT-185-76)	
19	4/1/76	Action Item FCF-544 Removal of Blowdown function on Overpressure and mod. to level Rate-of-Change on the PBF pressurizer	R.E. Swanson (RSO\230-76)	
20	4/1/76	Action Item PBF Loop Pump	R.E. Swanson (RSO\242-76)	
21	4/7/76	Action Item PBF SDD 3.1 Loop Coolant System	R.E. Swanson (RSO\259-76)	
22	4/7/76	Action Item FCF-493 PBF Gas Collection Hood Handling	R E Swanson (RSO\240-76)	

File C-~~3~~ 2 Subject POWER REACTORS CORRESPONDENCE

Number	Date	Document	Originator	Action
23	4/8/76	Action Item FCF-540 Loop Gas Detection System	R.E Swanson (RSO\258-76)	
24	4/13/76	Action Item FCF-568 TR Servo Control using Supplemental Linear #1 Neutron power signal (temporary)	R.E Swanson (RSO\282-76)	
25	4/13/76	Action Item FCF-549 PBF Catch Basket 4x Hardware	R.E Swanson (RSO\285-76)	
26	4/19/76	Action Item PBF Program Plans	G Marx	
27	4/20/76	Action Item Planning for PBF outage during July and Aug. 76	R.E Swanson (RSO\304-76)	
28	4/23/76	Action Item PBF Corrosive Waste Disposal	R.E Swanson (RSO\315/76)	
29	4/28/76	Ltr. H.B. Barkley to J.H. Rengey PBF Test Documentation Schedule	H.B. Barkley (HBB 86-76)	

File C-[redacted] 2 Subject POWER REACTORS CORRESpondence

Number	Date	Document	Originator	Action
30	5/3/76	Action Item FCF-567 Red Mike Speakers in Office Trailers	R.E Swanson (RSO\323-76)	
31	5/4/76	ltr WC Durkee to RE Swanson Fuel Rod Clad Material - Impact on Schedule	D.J Langford (WEO-238-76	
32	5/28/76	ltr HBBarkley to CK Jasper Power Reactors proposed Business plan objectives for TQ + FY 77	HB Barkley (HBB-108-76	
33	6/4/76	ltr. WG Lussie to RE Wood PBF Reload Core prelim. Safety [redacted] assessment update	DJ Langford (WGL 23-76)	
34	6/2/76	TAG ITEM PBF Reload Core fuel Rod assy.		
35	6/10/76	ltr. WG Lussie to JOY Creeden PBF Reload Core Program plan		

File C-2 Subject Power Reactors Correspondence

Number	Date	Document	Originator	Action
36		List of open GWA's	DW Meacham	
37		Memo of understanding Interface between Power Reactors and Facilities Development for GPP and Line Item Construction		
38	5/12/75	Ltr: WE Nyer to RE Swanson PBF Ruptured core performance assessment study	WE Nyer (WEN-225-75)	
39	5/30/75	Ltr. WE Nyer to RE Swanson Funding Requirement for PBF Ruptured Core First Quarter FY-76	DJ Langford (WEN-259-75)	
40	7/28/75	Ltr WE Nyer to RE Swanson PBF Ruptured Core performance assessment study Recommendation	WE Nyer (WEN-353-75)	
41	10/1/75	WE Nyer to RE Swanson LOCA Blowdown & RC piping mat...	Jack Klein (WEN-426-75)	

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File C-2 Subject Power Reactors Correspondence

Number	Date	Document	Originator	Action
42	10/30/75	Ltr: W E Durkee to R E Swanson PBF Reload Core Recommendations	W E Durkee (WED-521-75)	
43	10/31/75	Outgoing Telecommunication Message PBF Reload Core Performance Assessment Study Drafts	W E Durkee (WED-525-75)	
44	12/2/75	Ltr: G E Marx to H B Whalley PBF TECH. SUPPORT and OPERATIONS Mid-year Review INFORMATION	G E Marx (Marx-138-75)	
45	1/6/75	Monthly Highlight Report		
46	5/28/76	Ltr. H B Barkley TOCK Leeper Power Reactors Proposed Business Plan Guidelines for TQ and FY-77	H B Barkley (HBB-108-76)	
47	2/9/76	Ltr. H B Barkley to [illegible]	H B Barkley (HBB-[illegible]-76)	

File C-3 Subject ANC CORRESPONDENCE

Number	Date	Document	Originator	Action
1	9-18-75	LTR: PRELIMINARY PBF RELOAD CORE ACCIDENT LIST AND DAMAGE CRITERIA.	D.J. LANGFORD.	
2	9-25-75	LTR: MEETING PBF RELOAD CORE ACCIDENT LIST	D.J. LANGFORD.	
3	2-4-76	LTR: REQUISITION F213878 FOR SERVICES OF FRANK PETREE FRNK PETREE RESUME	B.K. POPE	
4	4-20-76	LTR: ASSIGNMENT OF PROJECT COORDINATOR FOR PBF-TFBP LOC EXPERIMENTS.	R.W. MILLER.	
5	5-11-76	LTR: SPECIAL USE OF GOVERNMENT VEHICLE MC-BR-8-76	J.N. McBRIDE	
6.	5-25-76	LTR. BUISNESS PLAN OBJECTIVES FOR TQ AND FY-77 HB BARKLEY LTR TO WE BURKEE ET. AL.	W.G. LUSSIE	
7	6-7-76	LTR: PBF RELOAD CORE PRELIMINARY PROPOSAL	D.J. LANGFORD	
8.	6-17-76	PBF REACTOR BUILDING, SPERT IV STUDY - HAT-2-76	H.A. TRAUE	
~~9.~~	~~6-7-76~~			
10	10/9/73	Ltr to H.W. Campen from Nuclear Services & Construction Co Introduction of NSC Co. 256		

File C-3 Subject AEC CORRESPONDENCE

Number	Date	Document	Originator	Action
11	5/26/76	Ltr. GE Marx To CR Tiele & WG [illegible] Comments of PBF Management Schedule	G.E. Marx (Marx-72-76)	
12	6/18/76	RE Wood to Dist Correspondence With HQ		
13	6/23/76	Ltr. Dist Monthly Construction Project Highlights Report	J.C. King	
14	7/30/75	R Tripp To Branch + Division Managers Cost Estimating And Planning For Procurement Actions		
15	10-15-75	GD Westcott To Assistant General Managers Division and Branch Managers Definition of Design for General Plant Projects	G D Westcott (GDW-135-75)	
16	10-28-75	DJ Langford To Dist. Review Draft TR 717 PBF Reload Core Performance Characteristics	D J Langford (DJL-14-75)	

File C-3 Subject AEC Correspondence

Number	Date	Document	Originator	Action
17	11/12/75	Ltr: DK Sorensen Assistant General Managers Division and Branch managers — Compliance with Davis Bacon Act.	DK Sorensen (DKS-344-75)	
18	10-30-75	Ltr: MF Howes to Assistant General Managers, Division Managers — Controller Approval of Cost Data	MF Howes (Howes-325-75)	
19	11-24-75	Ltr: HE Marx To W Kudlue — Continuing Resolution Funding Problems	HE Marx (Marx-133-75)	
20	1-20-76	Ltr: EP Eales to ANC Employees — INEL Code Configuration Management	EP Eales (EPE-8-76)	
21	5-19-76	Ltr: DJ Langford to List — Abbreviations for PBF Documents	DJ Langford (DJL-16-76)	

File C-3 Subject ANC correspondence

Number	Date	Document	Originator	Action
88	5/25/76	Memo: FL PETREE To DJ IAN; Ford Summary of work	FL PETREE	

File D-1 Subject DNB COLUMBIA

Number	Date	Document	Originator	Action
1		DNB Correlation of PBF conditions		
2	-	Phone no. of Joe Casterline	Rich Gottula	
3	12/10/76	LTR. R.P. Wadkins to DJL — PBF DNB Tests Literature Review	R.P. Wadkins (RPW-25-75)	
4	1/2/76	LTR. R.G. Ambrosek to DJL — Transmittal of PBF DNB Test Spec.	R.G. Ambrosek (AMB-1-76	
5	"	"	"	
6	1/2/76	LTR. R.G. Ambrosek to W.I. Schindler, Sole source Justification for PBF DNB Test	R.G. Ambrosek (AMB-2-76)	
7	1/14/76	LTR. R.G. Ambrosek to R.P. Wadkins — Tubing Spec for PBF DNB Tests	R.G. Ambrosek (AMB-3-76)	
8	1/19/76	LTR. R.B. Ringer to E.W. Lyon — PBF DNB Tests	R.B. Ringer (RR17-76)	
9	1/21/76	LTR. W.I. Schindler to [illegible] Meyer Request for proposal for performing PBF Departure from Nucleat Boiling Tests (DNB)	W.I. Schindler (WIS-3-76)	
10	1/25/76	LTR. F.S. Kriz to R.E. Simonds — Request for approval to issue letter special research support agreement (SRSA) UAS 2613 to Columbia U. (CU) authorizing [illegible]		

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File D-1 Subject DNB - Columbia

Number	Date	Document	Originator	Action
10 (CONT.)	1/28/76	Time items and performance of Engineering Services Related to PBF DNB Tests	F J KRIZ (KRIZ-14-76)	
11	1/30/76	LTR. W. C. DURKEE to R. E. SWANSON PBF Columbia DNB Test Spec.	[redacted] D. J. LANGFORD (WED-54-76)	
12	4/2/76	LTR. F. J. KRIZ to R. L. SIMONDS - Request for Approval of Mod. #1 to Letter Special Research Support Agreement (SRSA) #2-2613 with Columbia U. (CU) for Performing Engineering Services and Procurement of Material in Preparation for PBF ~~Department~~ DNB Test.	[redacted] W I Schindler (KRIZ-52-76)	
13	5-14-76	LTR: PBF DBN TESTS RPW-6-76	R. P. WADKINS.	
14	5/14/76	Ltr. R P Wadkins to W I Schindler PBF DNB Case	R P Wadkins (RPW-6-76)	
15	6/14/76	Ltr. J E Costerline to R P Wadkins Columbia U.	J E Costerline	
16		Appendix D Columbia Study prepared		

File D-1 Subject DNB-Columbia

Number	Date	Document	Originator	Action
17	11/20/75	Ltr RP Wadkins to DJ Kriz Sole Source PBF CHF Test	RP Wadkins (wad-23-75)	
18	11/19/75	R-M ambrose to D J Langford PBF Preload Core DNB Test Specifications	ambrose (amb-29-75)	

File D-2 Subject Materials Information

Number	Date	Document	Originator	Action
1		Report		
2		Reuters Matl Test		
3	Aug, 1961	Report The Galvanic Behavior of Materials in Reactor Coolants	D.G. Sammarone	
4		Report Thermal Property Data for 62 ZrO_2-30 UO_2-8 CaO at High Temperatures		
5	Aug, 1964	Power Burst Facility Loop Conceptual Design Study No. S-1		
6	Apr 10, 1972	Ltr. Sensitization of Stainless Steels - When Is it Dangerous? HWSc-110-72	H.W. Schutz	
7	July 1975	Report Investigation of Cause of Cracking in Austenitic Stainless Steel Piping		
8	Aug 6, 1975	Notegram 316 Stainless as ... 263 ...	Howard Schutz	

File D-2 Subject Materials Information

Number	Date	Document	Originator	Action
9	Dec 24, 1975	Ltr. Commitment from Materials Technology Branch to Supply Mechanical Property Data to PBF - Kei-158-75	D.D. Keiser	
10	Feb 27, 1976	Ltr. Review of Loca-Blowdown and Reload core Piping Material - Spal-3-76	H.W. Spaletta	
11	Feb 27, 1976	Ltr. Recommended Solution Heat Treatments for PBF Valve Stubs HWSc-1-76	H.W. Schutz	
12	Apr. 7, 1976	Report Transmittal of Fatigue and Elevated Temperature Design Values for Heat Treated Inconel 718	W.G. Reuter	
13	Apr. 19, 1976	Ltr. Valve Fabrication. DKS-41-76	D.K. Sorensen	
14	4/21/70	[illegible] Advanced Materials Div. to H. Shutz		
15	11/75	Technical Bulletin Bomb [illegible] [illegible]		

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File D-2 Subject Materials Information

Number	Date	Document	Originator	Action
16	4/19/76	ltr. D.K. Sorensen to H. Campin Loaus Fabrication	DK Sorensen (DKS-91-76)	
17	6/15/76	ltr: R.L. Wood to W. H. Jensen PBF Release Core Fuel Cladding corrosion problem Consultants Meeting		
18		ltr: WU Johnston to Dist Potential Corrosion problem in PBF Release Core	WU Johnston	
19	6/21/76	ltr. J.J. Kriz to R.L. Simmonds		

File E-1 Subject MANPOWER REQUIREMENTS/PROJECT

Number	Date	Document	Originator	Action
1	* —	RAM COST ES ATES FOR PBF RELL CORE 10 CONTROL RODS 12 TRANSIET ROD CONTROL CONCEPT		
2	—	RELOAD CORE, PHYSICS TASKS		
3	—	PBF CORE FABRICATION FY 77 TOTAL DIRECT MANPOWER BY 1898.		
4	.	THERMAL FUEL BEHAVIOR PROGRAM/ PBF		
5	—	CORE II SUMMARY		
6	—	FY-76 + 3MTHS		
7	.	JUSTIFICATION FOR OPERATING COSTS + EQUIPMENT OBLIGATION		
8	—	CONFIGURATION - WORK NECESSARY TO CHANGE/MECHANICAL DRAWINGS		
9	—	A 6044 OPERATIONAL SUPPORT		
10	—	RELOAD CORE, TOTAL MAN-MONTHS NECESSARY		
11	—	FUNCTIONAL BUDGET CODING SHEET.		
12	—	RELOAD CORE ADMINISTRATION + SAFTY ANALYSIS		
13	8-6-74	LTR. ESTIMATED MANHOURS AND WORK SCOPE FOR PBF CORE II WAD-23-74	R. P. WADKINS	
14	10-24-74	ANNUAL FORCAST SUMMARY	DWM.	

File E-1 Subject MANPOWER REQUIREMENTS / PROJECT

Number	Date	Document	Originator	Action
15	11-21-74	ANNUAL FORE-CAST SUMMARY	DWM	
16	12-31-74	ANNUAL FORE-CAST SUMMARY	D.W.M.	
17	3- 75	CALCULATION WORK SHEET: CORE II, INSTR-ELECTRICAL (189 INPUT)	B.J. NORMAN.	
18.	3-5-75	LTR: FY-76 PBF CORE II PHYSICS PROGRAM	G.K. WACHS.	
19	3-6-75	PBF CORE II COMPONENT/COMPUTER MAN HOURS.		
20	7-15-75.	PBF PROJECTS - THERMAL - PBF LOCE ANALYSIS ESTIMATE FOR IPT AND PIPING		
21	8-21-75	LTR: SCEDULE FOR PBF CORE II SCOPING	R.G AMBROSECK	
22.	8-27-75	ANNUAL FORE-CAST SUMMARY: RELOAD CORE ADMIN-ISTRATION AND SAFTY ANALYSIS.	D.J LANGFORD.	
23	8-21-75	"	"	
24.	9-11-75	COMMENTS ON 189a A6056, PBF CORE FABRICATION DATED 9-1-75		
25	9-16-75	ANNUAL FORECAST SUMMARY: RELOAD CORE ADMINISTRATION AND SAFTY ANALYSIS.	D J LANGFORD	
26	9-28-75	BUDGET REVIEW	D.J LANGFORD	
27.	9-24-75	LTR REVISED PBF CORE FABRICATION 189a-CRC-220-75	J.G. CROCKER.	

File E-1 Subject MANPOWER REQUIREMENTS / PROJECTS.

Number	Date	Document	Originator	Action
28	12-1-76 → 4-1-76	PBF RELOAD CORE TASKS (THERMAL ANALYSIS)		
29	1-14-76	LYNN TO DJL MAN-DEPARTMENT BREAK DOWN		
30	2-6-76	LTR. PRELIMINARY 189 a's AND CAPITAL PLANNING	J.G. CROCKER.	
31	3-1-76.	LTR: NRC, TO RW BARBER. FY 76 MIDYEAR ~~NUCLEAR~~ NUCLEAR REGULATORY RESEARCH ORDER NO. 6C-76-014 FY 77 PROGRAM ASSUMPTIONS FOR AEROJET NUC. CO.	D.F. KNUTH.	
32	3-17-76	FUNCTIONAL BUDGET CODING SHEET.		
33.	3-24-76.	LTR. REQUESTS FOR APPROVAL OF BODY SHOP PERSONNEL	F.J. KRIZ	
34	3-76	SCHEDULE 189a JUSTIFICATION FOR OPPERATING COSTS AND EQUIPMENT OBLIGATIONS		
35		A 6056 RELOAD CORE FY 1976. (MARCH → JUNE)	D.J. LANGFORD.	
36	—	PBF Reload CORE Proposed Schedule FOR FIRST QUARTER Fy-76		
37	5/28/76	PBF Reload Core Program Plan For TQ.		

File E-1 Subject Manpower Requirements/Projects

Number	Date	Document	Originator	Action
38	5/13/76	Manpower Forecast: Support Organizations		
39	6/24/76	Ltr: F J Kriz to R.E. Simondo Request for approval of Body Shop Personnel	F J Kriz (Kriz-109-76)	
40	1/29/76	Ltr: D.W. Mecham to F J Kriz Job Shopper Personnel	D.W. Mecham (D.W.M-5-76	
41		Changed Organizational ledger numbers		
42	12/19/75	Tech Management Branch Policy		

File 6-3 Subject Schedules

Number	Date	Document	Originator	Action
1		Pert Chart Core Hardware		
2		Schedule Two year Project Management and Safety Analysis		
3	Nov. 25, 1975	Pert Chart Rev. 18		
4		PBF Reload Core Schedule		
5		PBF Reload Core Schedule		
6	Aug. 22, 1975	Ltr. PBF Reload Core: Revised Performance Assessment Study Schedule - WED-466-75-	W.E. Durkee	
7		Ltr Reload Core Design Schedule - WED-618-75-	W.E. Durkee	
8	Feb 26, 1976	Pert Chart		
9	Mar. 16, 1976	Ltr. Management Schedule for PBF Facility and Technical Support Programs Mary-35-76	G.E. Mary	

File E-3 Subject Schedules

Number	Date	Document	Originator	Action
10	Apr 21, 1976	Ltr Management Schedule for PBF Facility And Technical Support Programs - Marx-58-76	G. E. Marx	
11	Apr 21, 1976	Ltr. Management Schedule for PBF Facility and Technical Support Programs - Marx-58-76	G. E. Marx	
12		Schedule - Two Year Project Management and Safety Analysis		
13	Apr 30, 1976	Pert Chart Rev. 16		
14	5-17-76	TFBP/PBF COORDINATION MEETING MINUTES		
15	5-18-76	LTR: MANAGEMENT SCHEDULE FOR PBF FACILITY AND TECHNICAL SUPPORT PROGRAMS.	G.E. MARX	
16	6-18-76	LTR. COMMENTS ON PBF MANAGEMENT SCHEDULE	G.E MARX.	
17	— 6/18/76	Anc administration and SAFETY ANALYSIS		
18	8/20/75	LTR: WENZURREE TO R.E. SWANSON Schedule of PBF Reload Core Performance Assessment Study	D J Langford (Wed-241-76	

File E-3 Subject Schedules

Number	Date	Document	Originator	Action
19	8/22/75	LTR: WEDURKEE Re SWANSON PBF RELOAD CORE: REVISED PERFORMANCE ASSESSMENT STUDY SCHEDULE	W. J. LANGFORD (WED-400-75)	
20	10/22/75	PERT CHART PBF FACILITY TECHNICAL SUPPORT PROGRAMS		
21	4/30/76	PERT CHART PBF FACILITY TECH SUPPORT PROGRAM		
22	6/9/76	Ltr. B.K. POPE TO DIST. UPDATE PERT CHART	F. M. MIECHIE (BKP-103-76)	
23	6/14/76	Ltr. GE MARX TO WC LESSIE & CR TOOLE Management Schedule for PBF Facility and Support Programs	G. E. Marx (marx-77-76)	

File E-4 Subject BUDGET

Number	Date	Document	Originator	Action
1	6/30/75	MAN HOURS, COMPUTER HR'S FOR FISCAL YR.	P. P.	
2.	4/76	RELOAD CORE GWA. REPORT FOR APRIL '76		
3	4/76	BUDGET REVIEW	D.J. LANGFORD	
4	5/76	MAY 'QUICK LOOK'	D.J. LANGFORD	
5	5/25/76	PBF. OVERALL PROGRAM		
6	6-15-76	LTR. TRANSFER OF COSTS ME-13-76	D.W. MECHAN	
7	—	RSR 189A INFO 75 mid YEAR guidance FY 76 program assumptions		
8	—	Schedule 189A justification for operating Costs & Equipment obligations.		
9		Ltr. WE Dukes to AE Marx PBF TS & operations mid year Review	D W Mecham (WED-590-75)	
10		Final Submittal Schedule 189A justification for operating Costs & Equipment obligations		

File i-4 Subject Budget

Number	Date	Document	Originator	Action
11	11/21/75	Budget variance Report for Oct-75		
12	12/5/75	Ltr: W.C. Durkee to G.E. Marx PBF Long-Range Projections	D.W. Mecham (WCD-604-75)	
13	4/76	Schedule 189A		
14	5/30/76	Cost Data		
15	6/22/76	Five year Forecast Summary	D W MECHAM	

File G-1 Subject PROJECT DESign RIGOR MATRIX

Number	Date	Document	Originator	Action
1	—	Design REPORT RElOAd CORE		
2	—	DRM II RElOAd CORE		
3	—	TWO-YEAR Schedule RElOAd CORE	D.W. Mecham	
4	—	Tables Modification Rigor MATRIX (2)		
5	—	"		
6	1/7/75	Ltr. W.E. DURKEE TO R.E. Swanson PBF RElOAd CORE PROJECT MANAGEMENT PLAN	D J LAngFord (WED-8-76)	
7	1/30/76	Ltr. W E DURKEE TO R E Swanson PBF RElOAd CORE PROJECT MANAGEMENT PLAN	D J LangFord (WED-53-76)	
8	2/4/76	Ltr. W.E. Durkee To H B Barkley DEsign RigoR MATRICES	D.C. HendRickson (WED 101-76)	
9	4/8/76	Ltr. R E Swanson To H B Barkley PBF REACTOR SAFETY APPRAISAL	R E Swanson (RSC\271-76)	

File G-1 Subject Project Design Rigor Matrix

Number	Date	Document	Originator	Action
10		WORK STATEMENTS PBF RELOAD CORE		

File G-2 Subject GWA's REPORTING

Number	Date	Document	Originator	Action
1	—	PRELIMINARY FEBRUARY COSTS		
2	—	ANC / ENGINEERING DIVISION APPLIED MECHANICS BRANCH		
3.	—	INEL / REQUESTS FOR SERVICES.		
4	2-/75	BUDGET REVIEW	D.J. LANGFORD.	
5	3/75	BUDGET REVIEW		
6.	5-13-75	PBF RELOAD CORE STRESS ANALYSIS.	D.J. LANGFORD	
7.	5-18-75	REFERENCE TO GWA # 45071-330-105		
8.	5-31-75	BUDGET REVIEW		
9	6-10-75	LTR. REQUISITION F190348-BE-27-75.	J. M. BEESTON.	
10.	7-15-75.	PBF PROJECTS. TABLE		
11.	10-8-75	LTR: BIWEEKLY REPORT OF MANTIME AND COMPUTER TIME	S. J SEIBER.	
12.	12-16-75	MEMO: MAN HOURS LEFT AT THIS TIME	J. HILL	
13.	12-17-75	LTR: BIWEEKLY REPORT OF MANTIME AND COMPUTER TIME	S. J SEIBER.	
14	12-29-75.	"	S. J SEIBER	
15.	12-29-75	MEMO. MAN HOURS LEFT AT THIS TIME	J. HILL	
16.	1-1-76	BIWEEKLY TECH. REPORT	H. G KROUS	

File G-2 Subject GWA'S REPORTING

Number	Date	Document	Originator	Action
17.	1-11-76.	PBF RELOAD CORE STRESS ANALYSIS		
18.	1-12-76	MEMO: MANHOURS LEFT AT THIS TIME	J. HILL	
19.	1-16-76	ANC/ ENGINEERING DIVISION APPLIED MECHANICS BRANCH		
20.	1-26-76.	MEMO: MANHOURS LEFT AT THIS TIME	J. HILL	
21	2/76	RELOAD CORE GWA. REPORT I		
22	12-22-75	MEMO. MAN HRS LEFT	J. HILL	
23	2/76.	BUDGET REVIEW	D.J. LANGFORD	
24	2-10-76.	LTR: JANUARY COST/ BUDGET COMMENTS	D W MECHAM	
25.	3-/76	BUDGET REVIEW	D.J. LANGFORD	
26	3-11-76.	CHART OF MEN VS TIME (MONTHS)		
27.	3-18-76.	ANC/ENGINEERING DIVISION APPLIED MECHANICS DIVISION.		
28.	3-18-76	"	"	
29.	4-6-76.	LTR: MARCH COST/ BUDGET COMMENTS	D.W. MECHAM	
30.	4-19-76	CHART: MEN VS. START TO FINISH.	LANGFORD	
31.	4-20-76	LTR: BIWEEKLY REPORT OF MANTIME AND COMPUTER TIME	S.J. SEIBER.	

File G-2 Subject GWA'S REPORTING (CONT'D)

Number	Date	Document	Originator	Action
32	4-21-76	TRANS FER OF COSTS	D. W. MECHAM.	
33.	4-26-76.	PUBLICATIONS + REP. DEV. REQUEST FOR SERVICES	D. J. LANGFORD	
34.	5-4-76.	LTR. BIWEEKLY REPORT OF MAN HOURS AND COMPUTER TIME	S. J. SEIBER.	
35	10-22-75	LTR: [redacted] S J Seiber TO D J Langford BiWEEKly REPORT OF MANTIME + COMPUTER Time	S J Seiber (SEI-10-75)	
36	11-5-75	SAME AS Above	SEI-12-75	
37	11-10-75	Request for update for GWA's To Mat. Tech. Branch PBF Zircalloy Alloy Material Program.		
38	11-10-75	Request FOR UPDATE FOR GWA's TO MAT. TECH. Branch PBF 1/4" Inconel IPT Mat. Study		
39	12-2-75	BiWEEKly REPORT OF manTime + COMPUTER Time		
40	1-11-76	TASK Sheet PBF Reload Core STRESS Analysis		
41	5/18/76	BiWEEKly REport OF Computer Time + manTime	S. J. Seiber	
42	6/2/76	Same as above	"	
43	6/15/76	Same as above	"	

File C-3 Subject Project Management Meeting

Number	Date	Document	Originator	Action
1	2/15/76	LTR. W.E. Ducker To R.E. Swanson PBF Reload Core Monthly Management Meetings	J. Klein (WED-112-76)	
2	3/31/76	LTR. MK Shane To dist PBF Reload Core Preliminary Design Review and Project Management Meetings	J. Klein (MKS-43-76)	
3	5-11-76	LTR: MAY PROJECT MANAGEMENT MEETING - PBF RELOAD CORE	D.J. LANNFORD	
4	5-21-76	LTR: PBF RELOAD CORE PROJECT MANAGEMENT MEETING MINUTES.	WA. LUSSIE	
5	6-17-75	Meeting - PBF Reload core		
6	10-21-75	TWX: RW BARBER To R Glenn Bradley and arrange presentation at Germantown to present results of performance assessment and conceptual design status of PBF Reload core.		
7	10-28-75	LTR. RE Swanson To WE Ducker PBF R.C. Design Review Meeting	RSC/1015-75	
8	11-4-75	Attendees of Germantown Meeting		

File G-3 Subject Project Management-Meeting

Number	Date	Document	Originator	Action
9	4-6-75	LTR. DJ Langford To Dist. Reload core modifications Required.	EF Taylor (DJL-15-75	
10	11-25-75	Lt. DJ Langford To Dist. Reload core Mod. STATUS REVIEW meeting	Jack Klein (DJL-18-75	
11	6-21-76	WG Lussie to RE Wood PBP Reload core Project manage-ment meeting	J. Klein (WGL-10-76)	
12	7/23/76	Aug. Proj. Mngmt. meeting	J Klein (MARSH-9-76)	

File H-1 Subject REACTOR PHYSICS.

Number	Date	Document	Originator	Action
1	--	LTR. TO D.J. LANKFORD. - PHYSICS ANALYSIS FOR THE RELOAD CORE WITH STAINLESS STEEL CLADDING.		
2.	12-2-74	LTR: PHYSICS CALCULATIONS FOR ~~PBF~~ 16-ROD LOCA TEST IN PBF	A. J. SCOTT	
3.	10-1-75	LTR. PBF RELOAD CORE - PHYSICS STATUS REPORT	F.J. WHEELER.	
4	12-3-75	LTR: PBF RELOAD CORE; REACTOR PHYSICS STATUS REPORT	F.J. WHEELER.	
5	12-16-75	LTR: PBF RELOAD CORE; ALTERNATE CONTROL ROD DESIGN.	W.O. OLSON.	
6	1-15-76	LTR: PBF RELOAD CORE PHYSICS STATUS REPORT GWA. H5073-320-07	F.J. WHEELER.	
7.	1-22-76	LTR: PBF ~~RELOAD~~ CONTROL ROD AND TRANSIENT ROD CONSTANTS.	W.O. OLSON	
8.	2-3-76	LTR. PBF RELOAD CORE; PHYSICS STATUS REPORT	F.J. WHEELER.	
9.	2-10-76	LTR: PBF RELOAD CORE - ROD BOWING STUDY	D.E. WESSOL	
10.	2-17-76	LTR: PBF RELOAD CORE; PHYSICS STATUS REPORT	F.J. WHEELER.	
11.	3-17-76	LTR: PBF RELOAD CORE - POWER DISTRIBUTION OF INNER FUEL ROD	D.E. WESSOL	
12.	4-2-76	LTR. PBF RELOAD CORE, PHYSICS STATUS REPORT	F.J. WHEELER.	

File H-1 Subject REACTOR PHYSICS

Number	Date	Document	Originator	Action
13.	4-18-76	LTR: PBF RELOAD CORE REACTIVITY STUDY	R.T. McCRACKEN	
14	4-22-76	LTR: PBF RELOAD CORE; PHYSICS STATUS REPORT	R.J. WHEELER	
15	6-3-76	LTR: FEASIBILITY STUDY - PBF RELOAD CORE WITH STAINLESS STEEL CLADDING	F J WHEELER.	
16	4-17-76	LTR: PBF RELOAD CORE; PHYSICS STATUS REPORT	F J WHEELER.	
17	—	Physics Analysis for the Reload Core with SS Cladding	W. Olsen	
18	6/3/76	Ltr. FJ Wheeler to DJ Langford Feasibility Study - PBF Reload Core With SS Cladding	F J Wheeler (Whr-11-76)	
19	—	TABLE DESCRIPTION OF CORES FOR WHICH COMPARISON PERFORMED(C)		
20	5/8/75	LTR: TS Bohn TO DJ LANGFORD GAMMA HEATING in PBF CORE 1.5 ZIRCONIUM IPT	TS Bohn (TSB-1-75)	

File H-1 Subject Reactor Physics

Number	Date	Document	Originator	Action
21	6/6/75	LTR: FS Wheeler TO S. Cohen PBF Reload Core Reactor Physics Status	Wheeler (Whlr-9-75)	
22	6/17/75	STATUS REVIEW SUMMARY PBF Reload Core Reactor Physics	DJ Wheeler	
23	6/19/75	Ltr: DJ Wheeler To S. Cohen PBF Reload Core Estimate of Reactivity Effect to to IPT Vending	D. J. Wheeler (Whlr-10-75)	
24	8/5/75	Ltr. DJ Wheeler to DJ Langford PBF Reload Core Reactor Physics Report	DJ Wheeler (Whlr-16-75)	
25	8/15/75	Ltr. DJ Wheeler to DJ Langford PBF Reload Core Reactor Physics Status Report	DJ Wheeler (Whlr-17-75)	
26	9/9/75	Ltr. DJ Wheeler to DJ Langford Same title as above	DJ Wheeler (Whlr-21-75)	
27	9/23/75	Same ↑	DJ Wheeler (Whlr-22-75)	

File H-1 Subject Reactor Physics

Number	Date	Document	Originator	Action
28	9/30/75	LTR: W.O. Olsen TO FJ Wheeler PBF Reload Core Void Effects And Test Performance	W.O.Olsen (WOO-1-75)	
29	10/1/75	LTR: DW Nigg To FJ Wheeler PBF Reload Core PDQ And SCAMP 1-D Physics Calculations	DW Nigg (DWN-1-75)	
30	10/16/75	LTR: DW Nigg TO FJ Wheeler PBF Reload Core Enriched And Depleted Test Performance	DW Nigg (DWN-2-75)	
31	10/31/75	LTR: F.J Wheeler TO DJ Langford PBF RLC Reactor Physics Report	FJ Wheeler (Whlr-26-75)	
32	11/17/75	LTR: Same As Above	FJ Wheeler (Whlr-31-75)	
33	11/11/75	LTR: DW Nigg TO DJ Langford Fission Source Dist. In PBF Oxide Rod	DW Nigg (DWN-4-75)	
34	6/22/76	LTR: GS Gill TO DJ Langford Axial Power Dist. Studies For The PBF Reload Core	GS Gill (GSG-1-76)	

File H-1 Subject Reactor Physics

Number	Date	Document	Originator	Action
35	6/22/76	LTR: G.S. Gill TO D.S. Langford Rod, Cladding and Enrichment Responsibility for the 2nd Reload Core	G. S. Gill (GSG-2-76)	

File H-2 Subject THERMAL ANALYSIS - REACTOR SYSTEMS

Number	Date	Document	Originator	Action
1	12-24-75	LTR: THERMAL EVALUATION OF PBF CORE II ACCIDENTS	R.L. CHAPMAN	
2	2-27-76	"TECHNICAL REPT" THERMAL ANALYSIS PELLET DISHING AND RADIAL GAP RECOMENDATIONS FOR PBF RELOAD CORE	R.L CHAPMAN	
3	4-8-75	LTR: THERMAL ANALYSIS OF LOCA EXPERIMENT IN PBF FOR A FLOW BLOCKAGE ACCIDENT	R.L CHAiMAN	
4	4-20-76	LTR: PBF RELOAD CORE SAFTY ASSESSMENT REPORT.	R.W BARBER	
5.	6-/72	LTR EFFECT OF FISSION GAS RELEASE ON FUEL ROD INTERNAL PRESSURE	R.L. CHAPMAN	
6.	6-8-76	LTR. PBF [illegible] BLOWDOW[illegible] TION" S.[illegible]	[illegible] SHANE	
7	3/3/75	Ltr. [illegible] to D. [illegible] Therm[illegible] of Loca [illegible] in PBF [illegible] Control Rod Withdrawal Accident	[illegible]	
8	4/8/75	Ltr. RL Chapman to D. Langford Thermal Analysis of LOCA Experiment in PBF for a Flow Blockage Accident	R L Chapman (RLC-5-75	
9	6/21/76	Ltr. R.L Chapman to D. Langford PBF Reload Core Fuel Rod Design [illegible]		

File H-2 Subject [illegible] Analysis - Reactor Systems

Number	Date	Document	Originator	Action
9	9/11/74	Ltr: [illegible] to [illegible] PBF Core II	[illegible] (JLL-67-74)	
10	9/3/75	Ltr: [illegible] Watkins to BK [illegible] PBF Systems [illegible] Analysis	R.F. Watkins (Wat-29-75)	
11	10/1/75	Ltr: [illegible] to [illegible] R.F. Watkins PBF activities in [illegible] Analysis Branch	[illegible] (JLL-34-75)	
12	10/28/75	Ltr: R.F. Watkins to [illegible] PBF Core II — [illegible] Analysis Status Report	R.F. Watkins (RFW-22-75)	
13	6/21/76	Ltr: RL Chapman to [illegible] Thermodynamic Effects of Using Stainless Steel Cladding RLC-7-76		
14	6/21/76	Ltr: RL Chapman to [illegible] PBF Reload Core Fuel Rod Design Considerations		

File H-3 Subject THERMAL ANALYSIS - COMPONENTS

Number	Date	Document	Originator	Action
1	6-26-75	TECHNICAL REPORT (THERMAL ANALYSIS) HYDROX FLUID REACTION LOAD CALCULATIONS AND SEMISCALE PSS TEST DATA - PRELIMINARY COMPARISONS	E.C. LEMON, C.F. CARMICHAEL, K.M. PERRY	
2	3-22-76	LTR: PBF - IPT LOCE WHAM MODEL - CFC-3-76	C.F. CARMICHAEL	
3	4-19-76	LTR: PBF-IPT ISOLATION VALVE CLOSURE WATER HAMMER PRESSURES.	C.F. CARMICHAEL	
4	2/4/76	Tech. Report LOCA Temp. Response of a PBF In-pile Tube #2 Nozzle	W. C. Kettenacker	

File H-4 Subject Stress Analysis

Number	Date	Document	Originator	Action
1	6/17/76	[illegible]		

File H-6 Subject Materials Technology

Number	Date	Document	Originator	Action
1	8/27/75	Memo. H.W. Spaletta to DJL — Estimate for IPT design	H.W. Spaletta	
2	9/5/75	Ltr: H.W. Schutz to J. Klein Relative Corrosion Resistance of 300 Series Stainless Alloys in PBF Primary and Loop Coolant System	H.W. Schutz (HWSc - 7 - 75)	

File H-8 Subject DESIGN ENGINEERING

Number	Date	Document	Originator	Action
1	5-27-76	LTR: PROGRESS REPORT PBF RELOAD CORE HARDWARE	S.A. WILLIAMS	

File H-9 Subject COMPUTER SCIENCE

Number	Date	Document	Originator	Action
1	4/16/76	LTR. J.V. christiano To DJL — Progress REPORT	J.V. ChriSTiANO (JVC-2-76)	
2	—	Schematic of PBF loop		
3	—	Charts		
4	—	LCS m System Flow Element Breakdown		
5	-	Original Relap Input	Mary Johnson	
6	6/22/76	ltr. J.V. Christiano to D.J. Langford Transmittal of a Relap 4 Calculation of LPT System Behavior During a Blowdown case C condition	J.V. Christiano	
7	8/10/74	LTR. LD Schlenker TO RT Chariton GWA-41660-810-201 Support Info.	LD SCHLENKER (SCHL-11-74)	

File H-10 Subject Kinetics

Number	Date	Document	Originator	Action
1	11/3/75	LTR. Bob Carpenter to DJL	Bob Carpenter	
2	1/9/76	Rough draft Relap/4 model of PBF Core I	G.A. Dimenna	
3	3/29/76	LTR. W.R. Carpenter to DJL — PBF Core I Relap/4 Kinetics Model	W.R. Carpenter (Carp-3-76)	
4	—	Plant Protection and Control Systems Modifications for PBF R.C		
5	—	brief discussion of Reload Core	JW Sielinsky	
6	—	Section VA Test Series Control Requirements for the Reload Core Assessment Study	JW Sielinsky	
7	7/22/75	PBF Reload Core 10 Control Rod 2 Transient Rod Control Concept		
8	7/25/75	ltr: JW Sielinsky to D.J. Langford PBF Reload Core Bi-weekly Report	JW Sielinsky (Siel-74-75)	

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File H-10 Subject KINETICS

Number	Date	Document	Originator	Action
9	9/30/75	PBF HYDRAX CORE II RUNS MADE TO DATE	Bob CARPENTER	
10	11/3/75	LTR: Bob CARPENTER TO D.S. LANGFORD Relap-4 Reactivity Equation change info	Bob Carpenter	
11	11/7/75	LTR: Bob Carpenter to Dave Langford A summary of the PBF Hydrax Computer Runs July, August, September 75	W.R. Carpenter (Carp-7-75)	
12	11/14/75	LTR: Bob Carpenter to W H Rettig Request for Relap-4 Programming Changes	W.R. Carpenter (Carp-8-75	

File *A 11* Subject *SAFETY*

Number	Date	Document	Originator	Action
1	–	LIST: PBF CORE II ACCIDENT LIST (PRELIMINARY)		
2	–	LIST: PBF ACCIDENT LIST		
3	–	PBF DAMAGE CRITERIA		
4	–	ACCIDENTS FOR EVALUATION OF PBF RELOAD CORE (ROUGH DRAFT)	R. CHAPMAN	
5.	–	SAFTY ASSESSMENT REPORT		
6.		OPPERATING HISTORY	–	
	12-19-74	[illegible]AL REPORT N[illegible] PRESSURE PUL[illegible]ANALYSIS OF CORE II IN-PILE TUBE	D.J. LANGFORD.	
8.	3-3-75	LTR: THERMAL ANALYSIS OF LOCA EXPERIMENT IN PBF DURING A CONTROL ROD WITHDRAWL ACCIDENT	R.L. CHAPMAN	
9.	7-16-75	LTR: MAXIMUM PRESSURE PULSE ANALYSIS FOR 1 AND 9 PWR RIP DISPERSION INSIDE 6.1 INCH RELOAD CORE IN-PILE TUBE	H.G. KRAUS.	
10.	9-5-75	MESSAGE: PBF ACCIDENT LIST	R.G. AMBROSEK	
11	9-12-75	LTR: PRELIMINA PBF CORE II ACC LIST AND DAMAGE CRITERIA	R.G. AMBROSEK	
12.	9-18-76	LTR: PRELIMINARY PBF RELOAD CORE ACCIDENT LIST AND DAMAGE CRITERIA	D.J. LANGFORD	

File H-11 Subject SAFETY (CONT'D)

Number	Date	Document	Originator	Action
13.	9-18-75	LTR: PRELIMINARY PBF RELOAD CORE	D.J. LANGFORD	
14	10-1-75	LTR: ACCIDENT TO BE EVALUATED FOR PBF RELOAD CORE SCOPING	R.G. AMBROSEK.	
15	8-26-75	LTR: PRESSURE GENERATON FROM SINGLE TEST ROD FAILURE	Z.R. MARTINSON	
16.	11-7-75	LTR: PRESSURE GENERATION FROM SINGLE TEST ROD FAILURE	Z.R. MARTINSON.	
17.	11-25-75	LTR: PBF CORE II SAFTEY ASSESSMENT	R.W. BARBER.	
18	1-14-76	LTR: RADIAL PULSE LOADING ON PBF-IPT CATCH BASKET	C.F. CARMICHAEL.	
19	3-31-76.	LTR: ACCIDENT LIST FOR PBF LOOP SYSTEM	R.G. AMBROSEK.	
20	4-2-76	TECHNICAL REPORT (PRELIMINARY) THERMAL ANALYSIS, SAFETY ASSESSMENT REPORT - PBF RELOAD CORE	R.L. CHAPMAN	
21.	4-2-76	"	"	
22.	5-17-76	LTR: PBF RELOAD CORE SAFETY ASSESSMENT REPORT	R.E. SWANSON.	
23	5-18-76	LTR: DOWNWIND DOSE CALCULATIONS PBF 50MW OPERATION	J.R. FIELDING	
24.	5-18-76.	"	"	

File H-11 Subject SAFETY

Number	Date	Document	Originator	Action
25	5/25/76	Tech. Report Safety Analysis [illegible] PBF [illegible] [illegible] [illegible]	S. J. COOK	
26	6/25/76	LTR: JR Fielding To [illegible] Langford Review and Radiological Doses PBF EXPERIMENT	JR Fielding (FIEL-55-76)	
27	—	LTR: DRAFT W.E. [illegible] TO RC [illegible] PBF EXPERIMENT SAFETY ANALYSIS	E.V. [illegible]	
28	—	Report PBF Release [illegible] — Use of Transient [illegible] [illegible] for Safety [illegible] [illegible]	JW [illegible]	

File 3-K Subject: IPT FABRICATION design Specification/Requirements

Number	Date	Document	Originator	Action
1	5/5/76	LTR. W.E. DURKEE TO R.E. SWANSON PBF IPT design Spec.	M.K. SHANG CWED-239-76	

File 25-15 Subject Fuel Handling Design Spec/Requirements

Number	Date	Document	Originator	Action
1	4/30/76	ltr. DJL to Lloyd Barker. Reactor Fuel Storage requirements	Jack Klein (DJL-11-76)	
2	5/5/76	ltr. ES Goldberg to DJL. Piqua Elk River Spent Fuel Shipping Cask.	E. S. Goldberg	
3.	—	AMERICAN NATIONAL STANDARD ADMINISTRATIVE GUIDE FOR PACKAGING AND TRANSPORTING RADIOACTIVE MATERIALS		
4	—	AEC MANUAL — TRANSMITTAL NOTICE "SAFETY STANDARDS FOR THE PACKAGING OF FISSILE AND OTHER RADIOACTIVE MATERIALS.		
5	—	DRAWINGS & PARTIAL Spec on Fuel Handling SYSTEM		
6	—	TRANSMITTAL NOTICE — SAFETY STANDARDS FOR THE PACKAGING OF FISSILE AND OTHER RADIOACTIVE MATERIALS		
7	—	CASK INFO		
8	—	Partial spec		

File 25 K Subject Fuel Handling Design Spec./Requirements

Number	Date	Document	Originator	Action
9	—	Shielded Shipping Casks for Spent Reactor Fuel elements		
10	5/18/76	Ltr. J N Davis to E J Hanaford — PBF Core Storage	J N Davis (JND-113-76)	

File 30-15 Subject LOOP - DESIGN SPECIFICATION / REQUIREMENTS

Number	Date	Document	Originator	Action
1	3/10/76	Ltr. W.E. Durkee To R.E. Swanson PBF IPT DESIGN SPEC.	D J Langford (WED-135-76)	
2	3/10/76	Ltr. R.W. Barber To R.G. Bradley PBF Loop Coolant System Agreements And Commitments	R.W. Barber (RSRC: TS68)	
3	4/9/76	Design Analysis Spec. PBF IPT	D.K. Fischer D.J. Langford	
4	4/9/76	Ltr. R.E. Swanson to J.G. Crocker Agreements & Commitments March 3-12, 76 Visit of Dr. R. Van Houten	R.E. Swanson RSC\281-76	
5	5-17-76	LTR AGREEMENTS AND COMMITMENTS FROM MANAGEMENT MEETING	R.E. SWANSON.	
6	3-31-76	LTR. ACCIDENT LIST FOR PBF LOOP SYSTEM	R G AMBROSEK.	
7	—	TABLE: FAILURE MODE AND EFFECTS ANALYSIS REPORT.		
8		PARTIAL DRAFT Design Spec PBF LCS		

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File 30-K Subject Loop · Design Specification / Requirements

Number	Date	Document	Originator	Action
9	12/5/75	TWX PBF Project	RB Barber	
16	1/12/76	TWX		

File 31-K Subject CORE I IPT - DESIGN REQUREMENT/SPECIFICATIONS.

Number	Date	Document	Originator	Action
1	5-5-76	LTR: PBF IPT DESIGN SPEC.	N.E. DURKEE	

File 2. M Subject IPT Forging - Design

Number	Date	Document	Originator	Action
1		Report Monolithic Forging	R.B Ringer	
2		4.0 Exceptions, Administrative, Terms, Comments And Clarifications		
3	Aug. 8, 1975	Cost Estimate PBF In. Pile Tube	M.K. Shane	
4	Sept 8, 1975	Ltr. Technical Requirements and Detailed Cost Estimates PBF 0.250 Inch Wall Inconel 718 In-Pile Tube - LGJ-13-75	L.G. Johnston	
5	Oct. 31, 1975	Ltr. Technical Requirements and Detailed Cost Estimates PBF 0.250 Inch Wall Inconel 718 In-Pile Tube - Spal-12-75	H.W. Spaletta	
6	Nov 5, 1975	Ltr. In-Pile Tube PBF Program Subcontract S-2431	Victor J. Furio	
7	Nov 13, 1975	Forgings Quotation		
8	Nov 18, 1975	Procurement Evaluation for Thin Walled PBF IPT - DJL-17-75	D.J. Langford	

File 2-M Subject IPT Forging - Design

Number	Date	Document	Originator	Action
9	Nov 24, 1975	Ltr. Request for Proposal No. S-2431 - PBF In-Pile Tube	R.E. Swanson	
10	Nov 25, 1975	Ltr. PBF In-Pile Tube - FPB-116-75	F.P. Blair	
11	Nov 25, 1975	.25 Inch Wall IPT - DJL-19-75	DJ. Langford	
12	Dec 1, 1975	Ltr. Request for Proposal No. S-2431 - PBF In-Pile Tube	R.E. Swanson	
13	Dec 3, 1975	Ltr. Recommendation on Procurement of 1/4" Inconel IPT for PBF - WED-603-75	W.E. Dorkee	
14	Dec 9, 1975	Ltr. PBF - IPT Forging And Fabrication Proposal - RR-203-75	R.B. Ringer	
15	Mar 15, 1976	Ltr. PBF Inconel 718 IPT - Kei-23-76	D.D. Keiser	
16	Mar 1, 1976	Ltr. Qualification of 718 Inconel PBF Inpile Tube Assy Weldments - RYC-2-76	R.Y. Creer	
17	Mar 16, 1976	Ltr. PBF Inconel 718 IPT - Spal-5-76	H.W. Spaletta	

File 2.M Subject IPT Forging - Design

Number	Date	Document	Originator	Action
18	Mar 16, 1976	PBF Inconel 718 IPT - Spal-5-76	H.W. Spaletta	
19	Apr 1, 1976	PBF Reload Core IPT Forging Procurement - WED-185-76	W.E. Durkee	
20	Apr 1, 1976	PBF Inconel 718 IPT - Spal-8-76 (Revision to Spal-5-76, Mar 16, 1976)	H.W. Spaletta	
21		Drawing PBF Core I IPT #2		
22	5/23/75	Ltr. W.E. Durkee to R.E. Swanson Back-up IPT for Core I	M.K. Shane (WED-248-75)	
23	6/25/75	Ltr: W.E. Durkee to R.E. Swanson PBF ~~CORE~~ Reload Core IPT Zirconium Alloy Material Program Draft		
24	8/13/75	Ltr. D.J. Langford To Dist. PBF Reload Core 1/4" Inconel IPT	D.J. Langford (DJL-5-75)	

File 2-M Subject IPT Forging - Design

Number	Date	Document	Originator	Action
25	8/13/75	WJ Langford to DD Kaiser Zirconium 2½% Niobium IPT Program	WJ Langford (WJL-6-75)	
26	8/21/75	IPT meeting minutes		
27	9/8/75	Ltr. JG Johnston to WJ Langford Technical Requirements & Detailed Cost Estimates PBF 0.250 Inconel 718 IPT	JG Johnston (JGJ-13-75)	
28	9/23/75	Ltr. RB Ringer to WJ Langford and MC Shane PBF ¼ inch wall IPT Inconel 718 also Dwg's	Ralph Ringer (RR-142-75)	
29	10/24/75	Cost Estimate ¼" Wall PBF IPT		

File 3-M Subject IPT Fabrication Design

Number	Date	Document	Originator	Action
1	1/27/76	Ltr. DJL dist. PBF Preload Core IPT	D. J. Langford (DJL-2-76)	
2	2/12/76	Ltr. WGL & RSC Fabrication Investigation PBF Thin Wall IPT	W. A. Fussie (WCD-83-76	
3	2/26/76	Ltr. WAL TO RSO Investigation into the Fabrication of the 1/4" Inconel IPT for the PBF Preload Core	W A Fussie (WED 94-76	
4	10/22/75	Tech. Report Selection of material and Fabrication Method for 0.25 inch thick Wall IPT	H. G. Brown, W M Reuter, J G Johnston	

File 7-M Subject CR Drives Design

Number	Date	Document	Originator	Action
1	~~7~~ 2/12/76	Ltr S.A. Williams to DJL Weekly Progress Report - CR Drive Mods.	S.A. Williams (Wlms - 2-76	
2	2/23/76	Ltr S.A. Williams to DJL - Weekly Progress Report CR & TR Drive Mods	S.A. Williams (Wlms - 3-76)	
3	4/26/76	Ltr. E.F. Taylor to Dist. Final Design Review Meeting of As Built Drawings & DCN's	E.F. Taylor (EFT-2-76)	
4	4/26/76	~~[illegible]~~ Ltr. S.A. Williams to DJL Progress Report PDF Reload Core Hardware	S.A. Williams (Wlms - 1-76	
5.	3 4-76.	LTR WEEKLY PROGRESS REPORT - CONTROL ROD DRIVE MODIFICATIONS	S.A. WILLIAMS.	

File 12-11 Subject CATCH - BASKETS - DESIGN

Number	Date	Document	Originator	Action
1	2-26	REPORT ON DECLUSSION OF CATCH BASKET.	L. WILTERMOOD	

File 21-M Subject Core Design

Number	Date	Document	Originator	Action
1	6/10/76	Ltr. McShane to Dist Briefing Ltrs Ding's and DLR's Information Presentation	E.F. Taylor (MKS 77-76)	
2		3x20 Fuel Pins	RT McCracken	

File 21-M Subject Core - Design

Number	Date	Document	Originator	Action
1		Figure - BOL Uniform T		
2		Dwg. PBF Reload core LOCA 36 Rod TEST TRAIN		

File 23-M Subject Control Electronic System - Design

Number	Date	Document	Originator	Action
1	Feb 18, 1976	QA Auditors on Numbering System		
2	Feb 19, 1976	Ltr. Request for Approval of Consultant Agreement No. S-68-56 for Consultant Services of Mr. Frank Petree - Kriz -22-76	F.J. Kriz	
3	Mar 1, 1976	Ltr. Services and Equipment for the PBF Reload Core modifications (ORNL)	L. C. Oakes	
4	Mar 5, 1976	Modifications for PBF Reload Core Reactor Control and Protective System	F. Petree	
5	Mar 12, 1976	Ltr Extension of PO 5592, with ORNL - Pope -81-76	B. K. Pope	
6	Mar 22, 1976	Memo Phone call to John Andersen at ORNL	F. Petree	
7	Mar 24, 1976	Memo PBF Control Rod Connections		
8	Mar 29, 1976	Memo Excess Experimental Reactivity	F. Petree	

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File 23-M Subject Control Electronic System - Design

Number	Date	Document	Originator	Action
9	Mar 30, 1976	Memo Phone call to John Anderson	F. Petree	
10		Title ?	DJL - -76	
11	Apr 2, 1976	Ltr. PBF Design Change	John L. Anderson	
12	Apr 13, 1976	Memo PBF Reload Core Thermal Time Constant	F. Petree	
13	Apr 30, 1976	Memo Summary of RCPS Modifications for PBF Reload Core	F. Petree	
14	—	LTR FROM F PETREE TO JOHN ANDERSON	F. PETREE	
15	—	" INSTALLATION SUMMARY RELOAD CORE CONTROL SYSTEM	"	
16	5/25/76	Memo FL Petree to DJ Langford Summary of work	F I Petree	

File 25-M Subject Fuel Handling - Design

Number	Date	Document	Originator	Action
1		Storage Evaluation Report for Core II storage.		
2		PBF Fuel Handling & storage Preliminary		
3		Spert II storage Option IA utilizing the south tank. Option IB sharing the north tank		
4	Jan 8, 1976	Ltr. Request for use of PWR Charger - Pope-8-76	Pope-8-76	
5	Jan 9, 1976	Ltr. Request for use of PWR Charger - Pope-9-76	Pope-9-76	
6	Apr 20, 1976	Ltr. USS Savannah Equipment Availability	William H. Hannum	
7	Apr 29, 1976	Letter on Shipping casts from Nuclear Engineering Co, Inc.	Robert A. Snyder	
8	Apr 30, 1976	Ltr. PBF Core Storage DJL-10-76	D.J. Langford	
9	May 3, 1976	Ltr. Proposed PBF Reactor Canal Extension - JEL-31-76	J.E. Langford	
10	May 3, 1976	Ltr. PBF Core Storage CRT-55-76 & RWM-15-76	R.W. Miller C.R. Toole	
11	May 5, 1976	Ltr. Piqua/Elk River Spent Fuel Shipping Cask	E.S. Goldberg	

File 25-M Subject FUEL HANDLING - DESIGN.

Number	Date	Document	Originator	Action
12.	4-23-76	LTR: PRELIMINARY INVESTIGATION OF FUEL TRANSFER CASK AVAILABILITY	D. J. LANGFORD	
13.	5-13-76	LTR: REACTOR MODIFICATION FUNDING REQUESTS FOR FY '77	V.A. WALKER.	
14.	5-17-76	LTR: PBF REACTOR BUILDING, SPERT IV CRANE STUDY STATUS REPORT	J.E. LANGFORD	
15.	5-17-76	LTR: PBF CASK MODIFICATION AND QUALIFICATION COST ESTIMATE	D.R. SWOPE	
16	6-1-76	LTR: PBF REACTOR BUILDING, SPERT IV CRANE STUDY STATUS REPORT	J.E. LANGFORD.	
17	6-1-76	LTR: PBF RELOAD CORE FUEL STORAGE	W.G. LUSSIE.	
18.	—	PROPOSED CANAL EXPANSION - (DRAWINGS)		
19	—	CANISTER DIMENSIONS (TABLE 1)	—	
20	—	List of Subcontracts & memo.		
21	—	Cask info	W.C. Swift	
22	—	"		
23	—	PBF Reload Core Study		
24	—	Report for SLSF Fuel TRANSFER SYSTEM	JE Piper, TJ Hill	
25	—	Preliminary [illegible] description [illegible] TREAT [illegible]		

File 25 M Subject Fuel Handling - Design

Number	Date	Document	Originator	Action
26		Fig. 2 Present canal Configuration		
27		Section 8 Initial Core Installation + Check-out		
28		Preliminary for Storage of [illegible] PBF Core in PBF Canal		
29		Section 7 Core [illegible]		
30		Cask loading and Transportation to Either SPERT II or SPERT IV		
31		Using SPERT II for Storage of a PBF Core		
32		Using SPERT IV for Storage of a PBF Core		
33		Replacement of Core I with Core II [illegible] + Canisters + Storage of both in PBF Canal		
34	5/3/76	[illegible] CR Tools to Fig 1 PBF Core Storage	BR Dabell - [illegible] (CRT-55-76 RWM-15-76)	

File 25-M Subject Fuel Handling Design

Number	Date	Document	Originator	Action
26	----	KET SP 5469		
27	----	Puk Charges	Elmer Carley (L.A.)	
28	—	Shipping cask Inventory		
29	—	Homogeneous Cannister arrangements		
30	—	Transport cask info		
31	—	PBF cask		
32		Safety standards for the packaging of Fissile and Other Radioactive material		
33	—	Cask info. Transport equipment & fuel accident		
34		Study for on-site PBF fuel storage		
35	July 73	KET Standard S-6.7 ament 2 Hoisting rigging of critical components [illegible]		

File ______ Subject Fuel Handling Storage

Number	Date	Document	Originator	Action
36	12/8/75	SPERT Standards Transmittal		
37	4/27/76	Ltr. R.J. Langford to L. Merrian	W.C. Swoft (WCS-5-76)	
38	5/3/76	Ltr. J.E. Langford to R.J. Langford Proposed PBF Reactor Canal Extension	J.E. Langford (JEL-21-76)	
39	5/17/76	Ltr. D.R. Swope to R.J. Langford PBF Cask Mod. and Qualification Cost Estimate	D.R. Swope (SWC-5-76)	
40	5/18/76	Ltr. J.M. Davis to R.J. Langford PBF Core Storage	J.M. Davis (JMD-113-76)	
41	6/15/76	Ltr. J.E. Langford to R.J. Langford PBF Reactor Bldg. SPERT IV Crane Study Status Report	J.E. Langford (JEL-31-76)	

File 2-ma Subject

Number	Date	Document	Originator	Action
1		Zirconium based alloy for IPT		
2		ZR based alloy		
3		"		
4	4/18/75	Commitment		
5	5/23/75	Backup IPT for core I	W E Durkee (WED-200-75	
6	6/8/75	use of a ZR alloy IPT for PBF	W.G. Reuter	
7	6/10/75	PBF Reload Core IPT material selection	J. G. Reardon	
8	"	"	"	
9	6/11/75	PBF Reload Core ZR Alloy material development plan		
10	6/11/75	PBF Reload Core IPT material selec.		
11	6/19/75	PBF Reload Core IPT material selection implementation of ERDA correspondence	R.E. Swanson RSC/645-[illegible]75	
12	6/1/75	Data necessary for deciding on material & fabrication requirements for an IPT		
13	6/23/75	use of a Zirconium alloy In-pile Tube for PBF	W. G. Reuter	

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File 2-Ma Subject

Number	Date	Document	Originator	Action
.14	6/25/75	Ltr, WED to RSO PBF Preload Core IPT ZR-Alloy material program	DSL for WED	
15	6/26/75	Ltr WED to RSO PBF Preload Core IPT ZR-alloy material program	DSL for WED (WED-304-75)	
16	10/14/75	Use of a ZR-Alloy IPT for PBF		
17	"	"		
18	"	"		
~~[illegible]~~ 19	~~[illegible]~~ 4/13/76	Ltr. RSO to Cro Documentation for tests PCM 2, 3, & 4	R.E. Swanson (RSO/284-76	

File 26-M Subject CS. SWITCH - DESIGN.

Number	Date	Document	Originator	Action
1		Report Switching Positions of Control Rod Drive 4 And Transient Rod Drive 2		
2	12/17/75	Telephone Conversation	E.F. Taylor	
3		Model Evaluation		
4	1/7/76	Ltr E.F. Taylor to Rice. Switching Positions of Control Rod Drive 4 and Transient Rod Drive 2	E.F Taylor (EFT-1-76)	
5	3/22/76	Ltr D N Mueller Mech. Development Lab - to DSL assoc functions	D N Mueller	
6		Core Exchange Option 1		
7		Use of TR Drives to compensate for the fission product poisoning for the PBF [illegible] RC		
8		Temporary switching of CR Drive #3 and TR Drive #2		
9		Rod Drive mods		
10		10 2 configuration 323		

File 30.1c Subject LOOP - DESIGN (CONT'D)

Number	Date	Document	Originator	Action
18	3/4/76	agreements and commitments		
19	3/10/76	Ltr. NE Pace to E.V. Mobley PBF mixing tee conceptual design for flow blockage experiment	NE Pace (NEP-2-76)	
20	3/11/76	Partial draft design spec. Loop coolant system.		
21		Failure mode and effects analysis report		
22		Same as above		
23	—	Accident list for PBF loop system		
24	3/31/76	Ltr. [illegible] to MK Shane Accident list for PBF loop system	[illegible] ([illegible]-6-76)	
25	5/19/76	Ltr. RE Heffner to [illegible] Loop system control study	RE Heffner (RE-82-76)	

File 31-M Subject CORE I IPT - DESIGN

Number	Date	Document	Originator	Action
1	June 11, 75	Ltr. Backup IPT for Core I PBF (Iconel 718)	R.B. Ringer (RR-80-75)	
2	June 20, 1975	Ltr. Backup Ipt for PBF	J.E. Pearson, Jr.	
3	Mar 29, 1976	Ltr. PBF "Heavy-Wall" IPT- Comparison of Code vs Anc Stress Limits - Go-2-76	R.A. Goodell	
4	Apr 30, 1976	Ltr. Backup In-Pile Tube for Core I - WED-200-75	W.E. Dorkee	

File 1-N Subject Fuel Rod Analysis

Number	Date	Document	Originator	Action
1	4/1/76	Ltr. R.J. Chapman to J.M. Tulinsky Average fuel temp. in PBF Reload Core	R.J. Chapman CRJC-7-76	

File 3-N Subject IPT Fabrication Analysis

Number	Date	Document	Originator	Action
.1		PBF IPT Gamma Heating		
2	12/19/74	Tech. Report Max. Pressure pulse Analysis of core II IPT		
3	3/12/75	Tech. Report Max. Pressure pulse analysis Core II IPT		
4	2/18/76	ITR T.E. Young to N.E. Pace — Heating of PBF IPT after Shutdown	T.E. Young (Yng 2-76)	
5	5/11/76	Ltr. G.H. Thewes to R.D. Ambrosek PBF Loop Coolant System Failure Modes and Effect Analysis, Component failure fault tree	G H Thewes GHT-7-76	
6	1/30/75	Ltr. Qu Barker R Glenn Bardsley PBF Gamma Heating of the IPT		

File 21-N Subject Core Analysis

Number	Date	Document	Originator	Action
1		Xy PDQ model of the PBF Reload Core		
2	2/27/76	Tech. Report Pellet Dishing and radial gap recommendations for PBF Reload Core		
3	3/26/76	Ltr. WED to RSD PBF Lead Rod test to centerline melting	W. A. Lussie for WED. EWED-171-76	
4	4/15/76	Calculation work sheet - PBF Core pressure drop		
5.	1-5-76	LTR. TOODEE CALCULATIONS OF FUEL DENSIFICATION INFLUENCE ON THE PBF FUEL PIN MELT RADIUS.		

File 25-N Subject FUEL HANDLING — ANALYSIS

Number	Date	Document	Originator	Action
1	6-16-76	LTR. PBF RELOAD CORE FUEL HANDLING, SHIELDING - LKP 8-76	L. K. POPPE	

File 30-N Subject LOOP - ANALYSIS

Number	Date	Document	Originator	Action
1		Cables Failure Mode & Effects Analysis Report		
2	3/2/76	Tech. Report PBF IPT Flow Tube Spider Clamp Pull Test Report	W B Polkinghorn	
3	4/6/76	LOCA Figures	B J NORMAN	

File 31-N Subject CORE I - INPILE TUBE

Number	Date	Document	Originator	Action
1	3/17/76	Tech Report PBF IPT flow tube assembly faulted condition analysis	S. J. Cook	
2	3-23-76	LTR: PBF IPT LOCE/ECC TESTS UPDATE OF STRESS REPORT TR-363-90-1-76	R.A. GOODELL	
3	2-13-73	TECHNICAL REPORT FEASIBILITY STUDY FOR PBF IPT LOCE/ECC TESTS.		