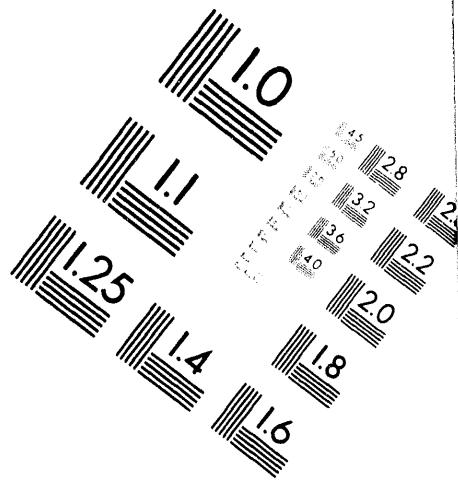
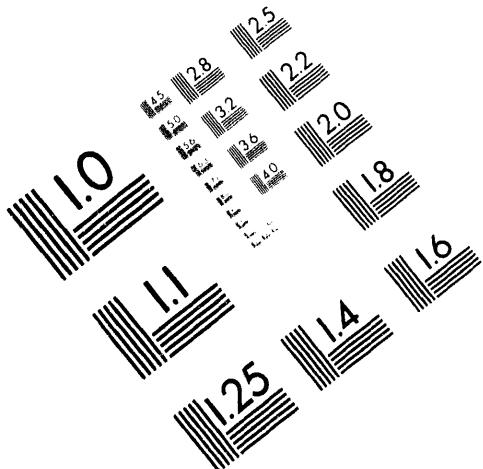




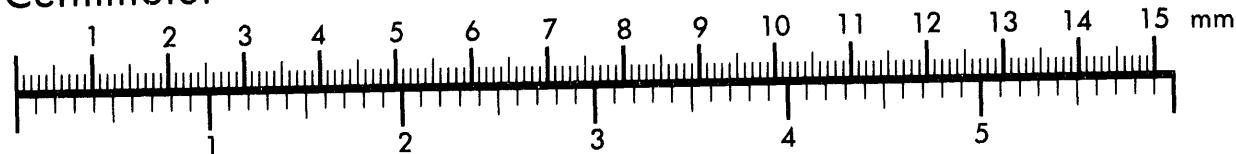
**AIIM**

**Association for Information and Image Management**

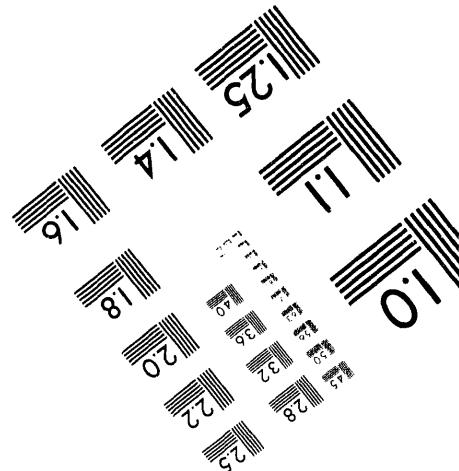
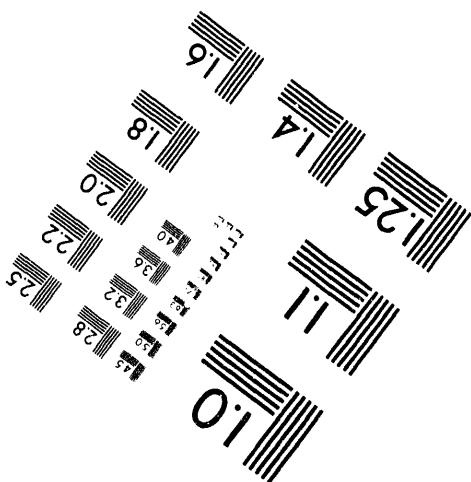
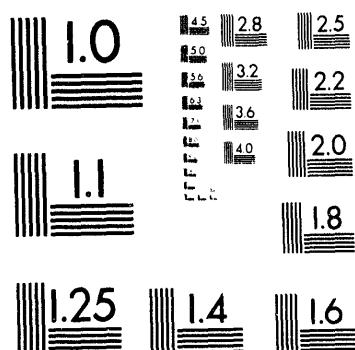
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**Inches**



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1 of 1

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-1-

DUN-5299 RD  
Hanford Category C-65  
Copy No. 1

~~DUN RECORDS DISPOSITION~~

~~Indefinite Retention~~

~~Destruction after 10 years~~

~~Authorizing Agent~~

Date.....  
U. S. AEC Division of Classification

SECTION V

REACTOR INCIDENT FILE

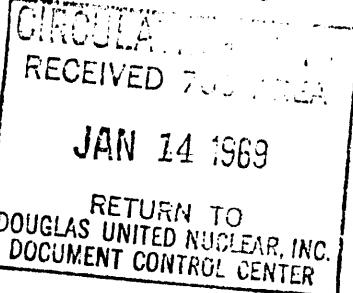
GENERAL INFORMATION

From 1945

D. L. Hirschel  
1/10/69 ~~RECEIVED~~

MAY 27 1994

OSTI



By  
Process Engineering Unit

*This document classified by  
A. K. Hardin.*

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S-73  
U. S. AEC Division of Classification~~

~~DECLASSIFIED~~

By Authority of PR-24  
WA Shriver 1/13/94  
192 K1000 1/13/94  
PM Eick 1-13-94

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This document consists of 9 pages. No. 1 of 1 copies. Series A.

### C REACTOR FUEL FAILURES 2562 C AND 3361 C

#### INTRODUCTION

C Reactor was shutdown over a 20 minute period at 2058 hours on 10-27-67.

The reactor was shutdown because of an excessive Panellit pressure increase on tube 2562. Subsequent examinations revealed that a fuel element rupture had occurred in process tube 2562, and the element was stuck within the process tube.

The maximum force required to remove the rupture was 28,000 pounds, thus exceeding the force limit of 12,000 pounds specified by Process Standards.

When applying the higher-than-normal forces for stuck charge or tube removal, it is necessary to consult Process Guide HW-56000 on "Stuck Charge and Tube Removal Forces - C Reactor." Subsequent to the stuck slug and tube removal it is then important to evaluate the adequacy of the Process Guide.

#### PURPOSE

The purpose of this report is to present some of the data, action taken, and development concerning this particular fuel failure.

#### GENERAL DISCUSSION

Tube 2562 was charged on March 26, 1967 with I & E natural fuel elements with lot number KJ687Q. The charge makeup included 19 bumpered pieces located in GROUP I: Excluded from automatic downgrading and declassification.

~~SECRET~~ ~~DO NOT~~

the downstream section, 12 non-bumpered pieces in the upstream section, and 1 watermixer piece in the 8th position from the rear of the column. This column was initially scheduled for a goal exposure of 1450 MWD/ton. DUN-2992, "Production Test Authorization - 084, Evaluation of Fuel Performance at High Exposures Supplement A," S. A. Wood, September 15, 1967, (Secret) extended the goal to 2000 MWD/ton. At the time of the fuel element failure on October 27, 1967 the exposure ~~level~~ was approximately 1957 Mwd/ton.

Inlet temperature was ~~about~~ averaging 152 C prior to the time of the rupture. The reactor was operating at an equilibrium power level of 2145 m.w. Tube 2562 had a tube power of 1380 KW with an outlet temperature of 118 C prior to the shutdown.

- 1 At 1930 hours on 10-27-67 a full scale gamma monitor point was noted. *25.7 hours*
- 2 At 2000 hours a water sample had been taken and checked out negative.
- 3 Panellit pressure on this tube had gradually increased 10 pounds over the previous 16 days of operation. A further increase of 13 pounds was noted prior to the rupture with 7 of the 13 pounds occurring in the final 3 1/2 hours before the reactor was shutdown. There were no other indications of a ruptured fuel element prior to the shutdown.
- 4 Following the shutdown a survey of the nozzle on the rear face indicated that tube 2562 had a radiation reading (1.5R/hr) five times that of adjacent tubes.

The fuel column was stuck and could not be discharged in the normal manner using the charging machines. The downstream dummies and 11 downstream fuel

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**DECLASSIFIED**

~~SECRET ROUGH DRAFT~~

-3-

elements were flushed from the tube. A backseating force of 6000 pounds was applied and resulted in no movement of the fuel column. The ribs were cut up to a distance of 17' - 6" from the rear flange of the tube. A rear dummy gunbarrel was installed and the front Vanstone flange was removed. A force up to 20,000 pounds was applied to the upstream end of the charge. The tube and charge moved 4 1/2" toward the rear and the charge moved an additional 1 1/2".

A force of 25,000 pounds was applied from the front, but the charge could not be removed. It was backseated again with 6500 pounds. A force of 27,000 pounds was applied from the front resulting in some movement. A backseating force of 16,000 pounds was applied which resulted in movement of 7 1/4" towards the front. A force of 28,000 pounds was then applied from the front and was sufficient to remove the charge.

Much difficulty was then experienced in removing the process tube. The following is a summary list of activities associated with removal of the tube. These are listed in order of performance.

10-30-67

1. Following the charge removal, tube 2562 was flushed with water for five minutes to clean the tube before splitting.
2. The tube was split 3.5 feet from front to rear at which point the splitter stuck and was removed.
3. Tube was split a distance of 19 feet from the rear and one cutter blade broke.
4. Another splitter was pulled entire length of tube. One cutter blade was broken. A maximum of 6500 pounds was applied in pulling the splitter.

~~Tube had not been completely split.~~

~~SECRET ROUGH DRAFT~~

10-31-67

1. Inserted a bare push pole from front to rear using a maximum force of 8000 pounds. A splitter was installed on the end of the pole and pulled towards the front of the reactor with a maximum force of 6000 pounds. At 24' the splitter stuck.
2. Pushed splitter to rear and the tube parted approximately 14 feet from the rear.
3. The 14 foot tube section was removed and the splitter and push pole were pulled from the channel.
4. Removed front gunbarrel and a 7' - 8" section of tubing came out with the gunbarrel. A dummy gunbarrel was installed in the front.
5. The push pole and splitter was again inserted and resulted in removal of a 16 inch section of tube.
6. A 3000 pound force was applied to the front of the tube but resulted in no movement of the process tube.
7. A 1 inch pole was inserted from the front to the rear end and a splitter attached. The splitter was pulled to the front with a maximum force of 6000 lbs. Both splitter blades were partially broken.
8. Two 12 foot lengths of 3/4 inch pipe were inserted in the front and rear of the tube to keep the tube from collapsing. Pushed on tube with 10,000 pounds and split tube appeared at inner end of rear gunbarrel.

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~~SECRET ROUGH DRAFT~~  
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-5-

11-1-67

1. A force of 16,000 pounds moved tube 1'8". Tube collapsed at upstream end. Channel blocked with chunks of graphite at 10'10 1/2" from front. The first piece of tubing is 10'4 1/2" from front.
2. Broken graphite was vacuumed up to 16'6" from rear.

11-2-67

1. Drilling and boring operations were attempted from the front until the drill broke at 13'8" from front. The drill and pieces were removed. Borescoping showed that the drill had gone on top of the tube and 10 inches past the end of the tube.

11-3-67

1. Vacuumed a lot of graphite. Graphite kept falling down and blocking channel.
2. Vacuuming, boring, drilling, and borescoping operations continued.

11-4-67

1. Vacuuming, boring, drilling, and borescoping continued.
2. A 14" section of tube was removed with a push pole.

11-5-67

1. A heavy duty splitter was used to split the tube from rear to front. The tube came out the front and was pulled into a burial can.
2. The graphite in the channel had received quite a bit of damage so the channel was made into an air channel. The final borescope examinations revealed the following.

~~SECRET ROUGH DRAFT~~

"The channel was blocked with broken graphite 27'7" from the rear. There was no metallic material visible in the channel. At 22 feet from the rear, a trunion block was broken, but it was possible to get the borescope past the broken graphite. Maintenance personnel examined the front of the channel and reported that the channel was clear to 11 feet at which point it was blocked with broken graphite."\*

Process Engineering examined the fuel pieces following the discharge <sup>and compiled the</sup> ~~the~~ following notes: ~~were~~

<u>Piece</u>	<u>Description</u>	<u>Relative Weasel Reading</u>
32	Brown film covering	0.17
31	Brown and silver	0.23
30	Brown and silver, slight ledge corrosion	0.33
29	Brown and silver	0.43
28	Brown, heat and rough surface on top of element	0.50
27	High heat on top and rough surface	0.58
26	Brown and silver, mixer piece	0.58
25	High heat on top and rough surface	0.70
24	High heat on top and rough surface	0.80
23	Black, heated appearance	0.86
22	Brown and heated	0.92
21	Dark, silver heavy galled marks, male end cap appears to have started to extrude into the hole of the drilled aluminum piece used for backseating	1.00

\* Letter, Results of Borescope Examination of 2562 C, LV Barker to EJ Filip  
November 21, 1967

**DECLASSIFIED**

~~SECRET~~ ~~ROUNDED~~ ~~BART~~

-7-

<u>Piece</u>	<u>Description</u>	<u>Relative Weasel Reading</u>
20	Bad side-unclassified rupture	0.98
19	Silver, black, heavy galled marks	1.00
18	Heavy galling	0.95
17	Dark grey, heavy galling 80%	0.87
16	Dark brown, heavy galling	0.80
15	Dark brown, heavy galling	0.80
14	Light brown, heavy galling 60%	0.76
13	Dark brown, heavy galling	0.73
12	Light brown, heavy galling 60%	0.73
11	Light brown, heavy galling 70%	0.71
10	Brown, moderate galling 50%	0.69
9	Silver, moderate galling 60%	0.62
8	Silver, heavy galling	0.57
7	Silver, heavy galling 80%	0.50
6	Silver, galled	0.41
5	Silver, heavy galling 80%	0.32
4	Silver, heavy galling 80%	0.26
3	Silver, heavy galling 80%	0.19
2	Silver, heavy galling 80%	0.14
1	Silver, female end cap deformed, element mushroomed slightly on end	0.08

Examples of mechanical damage are shown in the photographs at the back of this report. Photographs are also included of the ruptured fuel element and of the upstream piece in the column. Some deformation of the fuel element where the 28,000 pound force was applied can be noticed.

~~SECRET~~ ~~ROUNDED~~ ~~BART~~

~~SECRET~~ DECLASSIFIEDB. Tube 3361 (12-27-67)

A Panellit scram occurred on gauge 3361 at 0330 on 12-27-67. A temperature map was being run at the time of the scram. This map indicated that the tube outlet temperature had increased 9 C to 119 C just prior to the scram. Prior to the scram no indication was received on the gamma monitor or on the 107 Basin activity instruments. Gas activity had been going up at a steady rate since 0000 hours. Increases in gas flow or pressure had been unable to stop the activity increase.

Tube 3361 was charged on March 26, 1967 with I & E Natural fuel elements with Lot Numbers KJ678A. The charge makeup included 19 bumpered pieces located in the downstream section, 12 non-bumpered pieces located in the upstream section, and 1 watermixer piece in the 8th position from the rear of the column, ~~as shown on figure I.~~ This column was initially scheduled for a goal exposure of 1450 mwd/ton. DUN-2992, "Production Test Authorization - 084, Evaluation of Fuel Performance at High Exposures Supplement A," SA Wood, September 25, 1967, ~~extended the goal to 2000 mwd/ton. At the time of the fuel element failure on December 27, 1967 the exposure level was approximately 2160 mwd/ton.~~

Inlet temperature was averaging 8.0 C prior to the time of the rupture. The reactor was operating at an equilibrium power level of 2380 mw. Tube 3361 was operating at an average tube power of 1357 kw during the operating period prior to the rupture.

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-9-

The fuel column was stuck and could not be removed in the normal manner. The downstream dummies and 13 downstream fuel elements were flushed from the tube. Solid aluminum dummies were inserted and a backseating force of 16,000 pounds resulted in 6" movement of the fuel column. The ribs were then cut up to the ruptured fuel piece. On 12-29-67 the rupture and remaining fuel pieces were removed by applying a force of 22,000 pounds from the front. The tube was split and 16 feet of tube removed out the rear. Loose graphite was noted at 14 feet from rear.

On 12-30-67 a splitter was again pulled from rear to front. The tube could not be held and was eventually completely pulled out the front. Borescope examinations showed a piece of crumpled tube at 23'10" from rear.

On 12-31-67 a borescope examination revealed a piece of process tube 15'5" from the rear and several graphite chunks in the channel. Graphite and tubing was removed with a push pole. A piece of tubing still remained in the channel and broaching was attempted to remove the piece. The broach broke leaving two or three cups of the cutting blade in the channel. These pieces were removed, but a 1/2" by 4" piece of process tube had fell into a graphite void and could not be removed. On 12-31-67 memorandum of Process Standards Relaxation No 7-5M Graphite Temperature Control for Uncooled Aluminum in Reactor was obtained verbally. This memorandum was authorization to waiver Process Standard C-040, Section 40.01E concerning uncooled aluminum.

The channel was then made into an air channel.

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NOV 27 1967

K. L. HLADEK

November 21, 1967

E. J. Filip, Manager  
C Processing  
L. V. Barker, Supervisor  
Irradiation Testing

RESULTS OF BORESCOPE EXAMINATION OF 2562C

AE Demers  
JW Hedges  
KL Hladek  
RH Steach  
RS Peterson  
File  
LB

The following describes the results of the borescopic examinations made in process tube and channel 2562C during the outage in late October.

The upstream element of the fuel charge was examined after attempts had been made to push out the charge. The imprint of the push rod, which had a smaller diameter than the fuel piece, was visible in an arc from about 3 o'clock to 10 o'clock. No evidence of distortion or "mushrooming" of the outer circumference could be seen. At the 8 o'clock position, a small amount of cladding material was swaged about 1/16" into the bore of the fuel element.

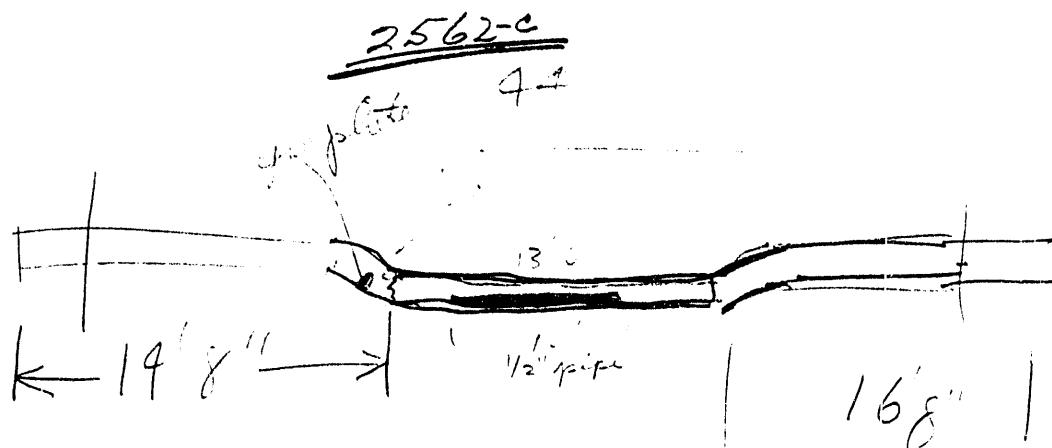
The process channel was examined after the tube had been removed. The channel was blocked with broken graphite 27' 7" from the rear. There was no metallic material visible in the channel. At 22' from the rear, a trunion block was broken, but it was possible to get the borescope past the broken graphite. Maintenance personnel examined the front of the channel and reported that the channel was clear to 11' at which point it was blocked with broken graphite.

L. V. Barker, Supervisor  
Irradiation Testing

LVB/k

Clemento Wagg  
Haged Weicker

McLay Bott  
Lander Hatch  
Reid Vlad  
Filip Tong  
Sleach



graphite in rear of tube, good.  
lost at least 1 tube block in front

May have just one graphite block in front of tube.  
Front of tube angled.

2<sup>nd</sup> block in front the many - may be cut and bent in  
4 pieces of which 1 is bent in 2

core bit shattered - most of piece out.  
probably ~~the~~ haven't gone as far as will drill -  
they weren't in that far.

1 1/8" with extra drill and 2" carbide bit  
(not sharpened)

1 1/8" bit

1. Bubble
2. 1/2 spin out
3. ~~shattered~~ 2" down
4. Splitter

October 24, 1967

Mr. J. R. Kelly

Because of a recent decision by the Board of Directors regarding a new office floor  
space, I am unable to be present at the meeting.

*Robert N. Steach*

Robert N. Steach  
1000 Peachtree Street  
Atlanta, Georgia 30309

cc: Mr. Tolson

Mr. Tolson  
Mr. Felt  
Mr. Bishop  
Mr. Tavel



54-3000-101 (9-59)

# DON'T SAY IT ... Write It!

DATE October 30, 1967

TO E. R. Marx

FROM Ken Hladek

## STUCK FUEL FAILURE

Please prepare a report on this incident for formal issue. Included should be a detailed discussion of the events, the results of investigations, examinations, etc., photos of elements, tube, etc., and conclusions and recommendations. Please give this top priority.

cc: File (2) ←

11/3

"SOME LEARN FROM EXPERIENCE, SOME NEVER RECOVER FROM IT"

+

+

54-3000-101 (9-59)

333 Aly.

**DON'T SAY IT ... Write It!**

DATE \_\_\_\_\_

TO Ken

FROM Emmett

3023

These are some photographs for the 2562 report. A description is written on the back. Copies of these are in my desk at 105C.

There should be one other picture. IT is of the male end of the upstream piece in the column. I thought it was of interest to show that the male end of that piece showed no damage.

There are also 4-90° side photos of the rupture piece. I have only sent you 2 samples here.

That should be all the photos that were taken.

+

"SAFETY IS NO ACCIDENT"

+

54-3000-101 (9-59)

**DON'T SAY IT ... Write It!**

DATE 10-13-68

TO D L Hirschel

FROM KCH

I'd like to discuss this with you. Please look it over and then we'll talk.

Thank.

+

"TO MAKE LIFE LAST, PUT SAFETY FIRST"

+

~~Wanted to do~~ 1/15/64

Low Pressure will form by

Did you know we have had 3 natural  
gasoline failures this year?

DR - 3/19/64

H 7/10/64

C - 10/25/64

Single Down over

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**SERIES AND COPY NO.**

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November 4, 1964

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**TITLE**

DOUBLE CHARGE OF TUBE 2598  
DURING THORIA FRINGE LOAD, 105-KW

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BAMBOO, INC.

## LOCATION

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DATE

**SIGNATURE AND DATE**

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November 4, 1964

A. R. Maguire, Manager  
KE-KW Reactor Sub-Section

DOUBLE CHARGE OF TUBE 2598  
DURING THORIA FRINGE LOAD, 105-KW

A meeting was held in the 1704-K Conference Room on October 19, 1964 at 1:00 p.m. to investigate the subject event. The meeting chairman was E. J. Filip. Others in attendance were:

J. Arp  
D. Bush  
M. A. Clinton  
R. G. Clough  
R. D. Hickman  
K. L. Hladek

A. R. Maguire  
B. J. McMurray  
R. D. Miller  
R. V. Myers  
J. Owsley  
S. A. Wood

GENERAL

On October 16, 1964 on the 4-12 Shift, an attempt was made to charge thoria fuel elements into tube 2598, although it had just previously been charged with a full column of thoria elements. Charging was in progress on the fringe loading of thoria and the tubes to be charged had been probed to verify that they were empty and had their rear caps on so that each charge could be seated against the rear cap, by hand, immediately following the charging of the thoria into the tube. The charging machine stalled with 14 8-inch dummies and 51 thoria fuel elements in the tube. The charging machine head contained two more elements and the charging machine ram was stalled on a row in a magazine containing 5 thoria fuel elements. The 7 thoria elements were removed from the magazine and machine head and moved to storage as rejects. The 51 thoria elements in the tube were subsequently pushed out, caught on the rear, and held for inspection. At the time of the meeting, no report on the extent of damage to the thoria elements had been issued, although they had been observed to be slightly bulged in some instances. Charging was resumed and proceeded to completion without further complications.

*Not all the material in this report  
was discussed as it is presented  
herein. Many of the items  
discussed were expanded  
Baseball future*

MHC  
11/12/64

~~SECRET~~  
**GROUP I**  
~~Excluded from automatic  
downgrading and declassifi-  
cation.~~

with no mention of Mr. Arp's  
prior experience - when  
boulders discussed. - when

~~CONFIDENTIAL~~

A. R. Maguire

-2-

November 4, 1964

Description of Events by J. Arp, Supplemental Crew Supervisor

Mr. Arp was the processing supervisor assigned to the far side charging machine. The Union type machines were in use. Mr. Bush was assigned to the far machine as a technical observer from R & E. (The near machine was manned by R. D. Hickman from R & E and H. V. Colton from KW Processing).

The following is Mr. Arp's recollection of the sequence of events which led up to the error:

1. Tube 2598 was charged as intended.
2. The machine was not unhooked from the nozzle of 2598 because the machine operator was aiding the second man on the machine in lowering a new magazine onto the loading section of the machine.
3. Meanwhile the machine automatically cycled a new magazine and charge into the charging position.
4. At the same time the supervisor (Arp) moved to a position in back of the machine (away from the unit face) to attempt to locate the trouble experienced in attempting to load full magazines into the machine.
5. The operator on the machine pushed the button to charge the tube.
6. Mr. Arp questioned whether the tube had not already been charged, but was given a "no" answer by the operator.
7. About this time, the machine stalled due to the tube being full.

The procedure being followed was to:

- a. Hook up to the tube to be charged.
- b. Charge the thoria elements into the tube.
- c. Unhook the machine and move it to allow seating.
- d. Verify seating length, cap and seal tube.
- e. Lower the work platform and start the same procedure on a new tube.

Mr. Arp commented that some of the tubes lacked tube numbers due to the hardware standardization work just completed.

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A. R. Maguire

-3-

November 4, 1964

Description of Events by D. Bush, R & E Observer

Mr. Bush recalled that tube 2698 was charged and completed. He had been handing the thoria tags to the person installing the special caps in addition to maintaining a special check sheet.

The following events then took place:

1. The elevator was moved to 25 row.
2. The machine was connected to 2598 and charging was in progress.
3. Mr. Bush was called away from the machine to answer a question on the intercom regarding his desires regarding lunch. (Frozen dinner was to be put in the oven and he was asked what kind he would like)
4. Upon returning to the machine, a charge was being charged. (At this point, he assumed that the previous charge 2598, was correctly seated, capped and sealed and so indicated on his check sheet.)
5. The machine then stalled and at about the same instant that the machine stalled, he realized that the seal was not obtained from him for 2598 and so could not have been processed as he had assumed.
6. The tubes 2498 and 2598 did not have numbers and so Mr. Bush did not immediately recognize that a charging error was in progress, i.e. 2598 was being double charged instead of 2498 being properly charged.

Comments by B. J. McMurray, KW Building Supervisor, A Shift

Mr. McMurray felt that the missing tube numbers added to the problems on the charge platform due to the size of the Union machine. The Union machine is large and cannot be seen over like the old KIV machines.

Considerable trouble was experienced in that the lighter thoria fuel elements would, on occasion, jiggle out of position. This required extra care and surveillance by the machine operator to prevent charging machine problems.

Mr. McMurray also suggested that consideration be given to the use of a set of check or sequence sheets by the machine operator.

Comments from General Discussion

A. R. Maguire - reviewed his activities while in Washington D.C. and in California before the ACRS and the General Electric Hazards Committee respectively. He mentioned that the principal concern expressed by these two groups was in regard to charging errors, especially since they were very familiar with the events of the problem experienced during the E-N load charging at H Reactor. Mr. Maguire felt he had to convince the committee members that we could prevent errors, and in order to convince the committee, he would have to be convinced himself.

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A. R. Maguire

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November 4, 1964

J. Owsley - commended the people at the meeting for initiating the investigation and indicated that it was significant that the procedure did prevent an undetected error although it did not prevent the error from occurring.

Messrs Arp, McMurray and Bush - referred to the missing tube numbers a number of times, and it was pointed out that the tube numbers were installed prior to the  $E^2$  charging.

M. A. Clinton - pointed out that the pattern was uniform and if indeed the tube numbers were missing, this should have been reason for more caution in performing the charging and observing.

The breakdown came in double charging the same tube rather than charging the wrong one. (One not on the list) J. Arp commented that the procedure was given to the people very late and was dated October 15, 1964. This, it was pointed out by R. V. Myers, was the final procedure signed by R & E and Processing representatives. An earlier procedure was available on October 13 which was essentially the same. Mr. Myers also reminded all present that the signed PITA-31 which authorized the loading was received on October 15, 1964. The procedure called for all persons involved in the charging to have read and understand the "document, PT's, and procedures which govern the thoria loading." On Page 6 of 7 of reference 1, paragraph 5, the procedure calls for a "shift meeting" to acquaint shift personnel with the thoria loading. Thus, even though the issue of the documents, PT's and procedures was later than would have been desired, the intent was that all personnel would take time to become informed.

One additional comment was made by E. J. Filip regarding the specific instructions that speed was secondary to accuracy and in no case should the charging proceed at a rate which compromised any facet of the monitoring or record keeping. This was felt to be well understood by all personnel.

The pertinent information was reviewed by E. J. Filip:

- a. The procedure broke down.
- b. The R & E observer and the Processing representative were out of position while the charging operation was continuing.
- c. The R & E observer assumed the charge in 2598 was correctly seated, capped and sealed, because the machine was apparently charging the next tube.
- d. The Processing (Supplemental Crew) supervisor had some doubt about the tube having already been charged, but allowed the charging to continue at the assurance of the machine operator.

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A. R. Maguire

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November 4, 1964

e. All three R & E observers present at the meeting stated that they were aware that they had the specific authority to stop, slow down, or otherwise control the charging operation.

SPECIFIC RECOMMENDATIONS

*for a result*  
The following recommendations were made ~~at the conclusion of the meeting:~~

a. All tube numbers should be on the front of the reactor, ~~with a~~ minimum ~~of~~ the numbers ~~being~~ the tubes to contain either thorium or support enrichment. *mark the tubes*.

b. A step-by-step charging procedure should be prepared and posted on the machines to be used.

1. Included in this procedure would be specific points requiring the signal to proceed after verification by the supervisor and observer. For instance, it was strongly recommended that the "charge" button be pushed only upon a signal from the supervisor.

2. Verbal call out of the tube numbers by the machine operator as he connects to the tube.

3. Verbal call out of tube numbers by the operator who seals the charge, again as the cap and seal are installed.

c. Magazines should be identified on both sides with the orange color code.

d. The seating poles should be permanently marked with the proper seating length (not with tape) and identified with the orange color.

e. Wrenches and all thorium associated special equipment should be color identified (orange).

f. A charge makeup code such as T-1, T-2, T-3 . . . . %N, be used to prevent several tubes in succession being charged with the same lot number as can occur with present codes. The T codes could be translated during charge makeup. When a J-35 charge is made up, a sheet which has T numbers on it could be filled in: i.e., T-7 = J-35, etc. This would also improve inventory control.

g. A single check sheet for both the supervisor and the observer to maintain together, requiring both signatures in appropriately designated places. This check sheet should be a sheet specifically designed to enforce the procedure developed in B above.

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A. R. Maguire

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November 4, 1964

GENERAL RECOMMENDATIONS

Color coding should be controlled throughout IPD, that is orange for thoria only. It should be recognized that the 300 Area pallets are orange in some cases for natural fuel. A HAPO wide color system would be desirable. The multiple color systems in use throughout IPD were pointedly brought to everyone's attention when the thoria color was arrived at.

Complete information dissemination throughout IPD with regard to a standard IPD thoria charging procedure agreed to by all areas, is to be desired.

Inclusion of the Supplemental Crews Organization on the distribution lists for information regarding charging procedures, control, etc. would be a help to Bob Miller.

Emphasis is necessary on the accuracy required in the thoria charging. The old habits of speed over everything else must be displaced by the proper attitude towards the special thoria load.

*E. J. Filip*  
E. J. Filip  
Manager  
KW Processing

EJF/RVM/kh

cc: J. Arp  
D. Bush  
MA Clinton  
RG Clough  
RD Hickman  
KL Hladek  
BJ McMurray  
RD Miller  
RV Myers  
J. Owsley  
SA Wood  
File (3)

**DECLASSIFIED**

August 16, 1960

R. E. Trumble, Supervisor  
Reactor Engineering  
Research & Engineering Section

REAR FACE CONTAMINATION INCIDENTS

The following excerpt is taken from N. E. Fuller's Management Report and describes the recent incident at KW where the fog spray was used.

"In the process of discharging the rupture from tube #2974 at KW Reactor, a uranium fire occurred in the rear face. The events leading up to the fire were as follows:

The rupture occurred at 10:25 a.m. on July 4. No attempt was made to push the rupture at that time. On July 5, an attempt was made to discharge the rupture with the charge machine. The rupture would not push at 1,000 pounds force. The water was not removed from the tube at this time. On July 6 the water was removed from the charge and preparations were made to push the charge and tube together. Forces up to 6,000 psi were used without success. Permission was then obtained to proceed to 10,000 pounds pushing on the metal. At 10,000 pounds the charge broke loose and began to move. At this point the fog spray was not on, but a hose was tied to an adjacent nozzle and was spraying on the tube. After seventeen pieces came out, a small amount of black crud was observed to come out of the tube. At this point the fog spray was turned on. About 30 seconds later, the rupture piece came out of the tube and momentarily burst into flame, and then fell into the basin. A survey of the area around the building did not reveal any outside contamination nor was the building exhaust system contaminated. It can be concluded that the fog spray system is very effective in controlling spread of contamination in such an incident, but the fog spray will not prevent a slug from bursting into flame."

If you have any further questions, please let me know.

  
S. M. Graves, Supervisor  
Process Engineering

SMG:mf

cc: GE Zima  
SMG-LB

## IRRADIATION PROCESSING DEPARTMENT



February 1, 1960

*W. Benson*  
 R. W. Reid, Manager  
 Process Technology Sub-Section

INCIDENT ON PCCF TUBE 2185

On 12-8 shift of 1/20/60, a leak developed on the Panellit fitting which screws into the nozzle on PCCF tube 2185-DR causing a 14 psig drop on the Panellit gauge. On 3-4 shift, the same day, the fitting blew off entirely but a reactor scram was prevented by bypassing the tripped Panellit gauge before the two minute time delay had elapsed. The tube outlet temperature was put on continuous monitor and was normal. The tube contained five pieces of Pb-Cd plus the normal PCCF downstream seating charge (23 perfs, tubulars and solids or 180"). An attempt was made to cut down the flow of water coming from the 3/8" diameter opening by putting the pigtail ball valve in low flow position. This did no good and the pigtail ball valve was immediately switched back to the high flow position. The switch from high-to-low-to-high flow took about three seconds. When this happened, the control room noticed a 30 unit drop in power level and the outlet temperature went from 20°C to 80°C and right back to 20°C. Evidently the five Pb-Cd poison pieces had washed back into the central portion of the tube momentarily. The fitting was reinstalled successfully however, and everything was returned to normal.

At about 11:20 p.m. that night the fitting blew off again and the same sequence of events was followed again including the high-low-high flow switch for about three seconds; however, the fitting was not reinstalled. The 12-8, 1/21/60, crew put 30 tubulars in the upstream portion of the tube to prevent the poison from back-flushing in preparation for discharging the tube. They then put the pigtail ball valve in the low flow position and about three seconds later opened the rear ball valve. They then noticed radiation surges on the front, and, while that was being checked the reactor had a drop of 300 units in power level over a three-minute period and was scrammed. The scram (about 3:05 a.m.) occurred five to ten minutes after the rear ball valve was opened and the pigtail ball valve was returned to the high flow position 30 seconds to one minute after the scram.

Leak testing on 4-12 shift that day revealed that tube 2185 was the leaker and it would not discharge with the charge machine. All upstream dummies and all but the last eight downstream dummies were splined cut and were all right. Borescoping revealed that the upstream Pb-Cd piece locked all right but that melted Pb-Cd had run down the tube and the center of the eight perfs left in next to the Pb-Cd pieces. However, the tube and pieces were successfully removed on 8-4 of 1/22/60 and the channel was found to be clean and in good condition when borescoped.

- ① Weston will follow through on finding evaluator
- ② Benson to check off tunnel - by Friday 2-12

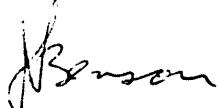
IRRADIATION PROCESSING DEPARTMENT  
**GENERAL ELECTRIC**  
RICHLAND, WASHINGTON

R. W. Reid

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January 1, 1960

An investigation of the condition of the tube and slugs is now in progress. In addition, the possible affect of the gas loop (which is just above this tube) on the incident is being checked. This loop normally stops at full temperature (1100°F) while the reactor is shut down.

  
JL Benson  
Process Engineering Unit

JL Benson:md

January 21, 1960:

Hot Tube - during normal Operation - 105 DR (HW63852, cont)

cause: Personnel error - Failure to recognize that a low flow condition on a PCCF tube with a front nozzle leak would not provide sufficient coolant.

On 1-20-60 a water leak at the panelfit line and nozzle connection of 2185 (PCCF) was found. attempts to repair the leak ~~were~~ made during reactor operation with no success. During these repair attempts, the ball valve was placed on low flow and ~~immediately~~ a power loss of 30 mW was noted. Tube outlet temperature was observed at a maximum of 80°C.

At 2:59 PM the tube had been charged with upstream dummy and again put on low flow, immediately the rear ball valve was opened. At this time the outlet temperature increased from 22°C to 92°C. Results of the above events was melting of the piston and tube leak.

3) December 13, 1957:

With Hot Headers during normal charge-discharge, 105 DR  
(Confidential Undocumented)

Cause: Personnel error during refueling operation or to inadvertent non-adherence to established procedure.

It was noted that shortly after refueling that tube temperatures on cross-headers 23 and 24 were somewhat higher than normal (maximum of 63°C). The header valves for 23 and 24 cross-headers were opened and the temperatures were reduced to 48°C maximum.

During the flushing of tube 2490 it was noted that header 23 and 24 were again higher in temperature than normal (observed 67°C maximum). ~~the~~ <sup>the</sup> supply pressure was increased; at this time it was noted that steam was being emitted from the rear of ten uncapped process tubes on row 23. No action was taken.

On 12-18-57 the reactor scrammed twice to disclose eight ruptures which were found on tube rows 23 and 24.

An analysis of the outage of 12-13-57 was made and showed that a maximum-slug temperature of  $120^{\circ}$

**DATE  
FILMED**

**10/25/94**

**END**

