NOTICE

**CERTAIN DATA
CONTAINED IN THIS
DOCUMENT MAY BE
DIFFICULT TO READ
IN MICROFICHE
PRODUCTS.**

DECLASSIFIED
WITH DELETIONS

HW--50351-Del.

DE93 010218

RESTRICTED DATA

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

This document consists of
15 pages, No. 26 of
26 copies. Series

RE-EVALUATION OF BALL BX RECOVERY SYSTEM IMPROVEMENTS
105-B, D, DR, F AND H

DECLASSIFIED
WITH DELETIONS

CLASSIFICATION CANCELLED AND CHANGED TO

May 27, 1957

BY AUTHORITY OF CG-PR-2
RM-Item 10-14-92
BY J E Savely 10-14-92
VERIFIED BY TL BAKER 10-22-92

R. C. Walker
Reactor Modification Design
IRRADIATION PROCESSING DEPARTMENT

DISTRIBUTION

1. WK Alexander
2. AB Carson
3. RG Clough
4. RL Dickeman
5. WJ Dowis
6. EJ Filip
7. OH Greager
8. AB Greninger
9. CH Gross
10. M. Harty
11. HW Heacock
12. DL Hovorka
13. ET Hubbard

14. RT Jessen
15. DS Lewis
16. AR Maguire
17. WW McIntosh
18. JS McMahon
19. JF Music
20. SL Nelson
21. EW O'Rourke
22. CA Priode
23. W Seebarger
24. RC Walker
25. 300 File
26. 300 File Extra

This Document Classified By

H W K...
Supervisor, Reactor Modification Design

DECLASSIFIED
WITH DELETIONS

MASTER

DISTRIBUTION RESTRICTED TO U.S. ONLY

DECLASSIFIED

HW-50351-DEL
Page 2

May 27, 1957

A. B. Carson, Manager
Process Design Operation
IRRADIATION PROCESSING DEPARTMENT

RE-EVALUATION OF BALL 3X
RECOVERY SYSTEM IMPROVEMENTS
105-B, D, DR, F, AND H

I. Introduction

Since the installation of Ball 3X equipment on the older reactors, several inadvertent ball drops have been experienced, many of which have required considerable recovery time. Furthermore, it is very probable that these recovery times will be significantly increased subsequent to the proposed installation of air accelerated vertical safety rods. Because of this, interest has been expressed by reactor operations personnel toward provision of a ball recovery system which would substantially reduce these outages.

II. Objective

The purpose of this report is to re-evaluate methods for providing an improved ball recovery system and to recommend a method of reasonable cost which would insure reduced reactor outages and personnel exposure subsequent to either an inadvertent or intended ball drop under the conditions which are presently anticipated.

III. Conclusions and Recommendations

Based upon the preliminary design study which is presented herein, it appears that the provision of an Improved Ball 3X Recovery System is not only more feasible than previously supposed, but also that it can be provided at a capital cost which results in a much more attractive amortization period. It should be noted, however, that these conclusions are valid only if all or the major portion of the in-pile modifications can be performed concurrently with reactor outages which will be scheduled for the installation of either the air accelerated vertical safety rods, tube replacement facilities or other impending projects. Under these conditions, the proposed Ball 3X Recovery Improvements can be amortized in approximately 2.6 years with VSR Improvements or 3.2 years without VSR Improvements, but if a separate outage were required for this work, the pay-out period would increase to either 6.1 years or 7.5 years depending upon whether or not the installation of the vertical rod improvements is ultimately authorized.

**DECLASSIFIED
WITH DELETIONS**

HW-50351-DEL
Page 3

Vendor contacts, which were made in connection with this study, have indicated that the possibility of finding a method for providing an opening between the VSR slot and adjacent process tube channel, while not impossible, does not look too promising. On the other hand, vendors have been contacted who are confident that drilling through the process unit from the side so as to intercept the VSR slots can be quite easily accomplished with semi-standard drilling equipment.

Therefore, it is recommended that funds be immediately requested for the initiation of design and the associated development testing and that a serious attempt be made to coordinate the ultimate construction program with that of Project CG-709 (VSR Improvement), or other impending project work.

IV. Background and Justification

A budget study report which was prepared for the FY-1959 Plant Acquisition and Construction Budget determined that the estimated cost of providing improved ball recovery facilities at 105-B, D, DR, F, and H would be approximately \$4,325,000. Based on the assumptions used for this study, this resulted in an amortization period in excess of ten years and it was, therefore, decided by management that this item should not be included in the FY-1959 budget request, but that further study should be made in an effort to reduce the capital investment required. Subsequent study has resulted in a scope which will reduce the budget study estimate by over 60 percent and it is quite likely that the total project cost, based on final design and development, can be reduced even further.

In the four-year period since the installation of the Ball 3X System at the five older reactors, there have been 14 inadvertent ball drops which consisted of a total of 252 hoppers with an associated outage time of 1228 hours. This results in an average of approximately 5.0 hoppers dropped per month of operation with an accompanying recovery time of 4.9 hours per hopper. However, some of the hoppers were dropped during outages and were not charged with any recovery time. Therefore, the analysis presented in this study is based primarily on the last four full drops which have occurred and which required an average recovery time of slightly over 5.9 hours per hopper dropped. It is estimated that this recovery time will be increased to about 6.9 hours per hopper post CG-709, but can be reduced to approximately 1.0 hour per hopper by providing the proposed revisions to the recovery system.

The following criteria were established for the purpose of determining the economic basis for the proposed work, and are based on information supplied by various members of the Research and Engineering and Production Operations:

Average Operating Level During Amortization Period	=	1450 MW
Probable Goal Exposure During Amortization Period	=	800 MWD/T
Conversion Factor	=	0.82 GM(Pu)/MWD

DECLASSIFIED

44-10351-DEL
Page 4

This, therefore, results in an expected annual savings of either \$573,000 under anticipated post CG-709 conditions or \$468,000 annually if CG-709 should not be authorized. However, if the vertical rod improvements are not made or if the Ball 3X Improvements cannot be coordinated with other outages, a total of approximately 1400 hours of reactor outage time would be required for this work. Briefly, the total pay-out period for the proposed project can be summarized as follows:

- (a) 2.6 years if 3X Improvements are concurrent with VSR Improvements.
- (b) 6.1 years if both 3X and VSR Improvements are installed during separate outages.
- (c) 3.2 years if only 3X Improvements are made and are accomplished during other scheduled outages.
- (d) 7.5 years if only 3X Improvements are made and are accomplished during a special outage.

While the economic justification for this program may be somewhat marginal, there is considerable additional justification from the standpoint of improved safety of operation, reduced personnel exposure and improved employee morale. While this type of justification is difficult, if not impossible, to analyze on the basis of an anticipated economic gain or a calculated amortization period, it should be given adequate consideration in evaluating the feasibility of this program. Therefore, the proposed recovery improvements appear quite attractive when considered in light of the proposed vertical rod improvements and, in fact, may even be justifiable under present conditions in view of the high radiation exposures and unsafe working conditions associated with the present system.

V. Description of Proposed Equipment

The large reduction in the estimated project cost results primarily from the change in the manner of handling the balls as they are removed from the reactor. Instead of installing an independent recovery system in each reactor building, it is proposed that the necessary equipment be mounted on a trailer which could be moved from area to area as required. After positioning the trailer in a designated location at the particular reactor, service connections and process tie-ins would be made and ball removal would proceed. It is expected that all balls would be removed within 24 hours allowing six to eight hours for preparation.

Inasmuch as the removed balls would still be quite "hot" even after the extremely high level balls had been separated out, high personnel exposure would probably be incurred if these same balls were used to refill the hoppers on top of the reactor. Therefore, a spare charge of balls (presently available on plant site) which had been previously washed, dried, separated, and allowed to decay radioactively, would be available for this purpose. This phase of the work could start any time after shutdown and would be completed in approximately 8 - 12 hours.

As shown on the reference drawings, the proposed recovery system is based on the use of in-pile removal units which would be installed in holes which had been drilled through the side of the reactor so as to intercept the VSR slots.

DECLASSIFIED

HW-50351-DEL

Page 5

Based on present information, this seems to be the most feasible method of gaining access to the VSR slots, and it also has several desirable advantages over other investigated; e.g., there would be no interference with inlet or outlet face equipment or operational procedures and this method would not require removal of existing process tubes with subsequent enrichment charges.

A. In-Pile Removal Unit (Ref. Dwg. SK-1-2908)

Previous tests have shown that if a charge of balls is dropped through the rod slot into a trough similar to that shown, there will be very little tendency for the balls to roll down the incline of their own accord. However, if a water jet is directed at the toe of the ball stack, it is quite effective in imparting and maintaining sufficient momentum to the balls to clear the VSR slot. Therefore, it is planned to design and test a unit of this principle as indicated by the reference drawing. The individual lines to the water jets would be controlled by solenoid valves and would be operated in sequence starting with the downstream jet.

As the balls and water stream leave the process unit, the water would drain to a crib line and the balls would be fed into a pneumatic conveying header at a controlled rate through a rotary feeder valve.

B. Portable Cleaning Equipment (Ref. Dwg. SK-1-2906)

As the balls enter the trailer in the pneumatic header, they enter a gravity type separator-hopper from which they will then be fed to the washer-dryer at a controlled rate. This hopper would provide several minutes storage in order to maintain over-all flexibility in system operation.

The washer-dryer is essentially a screw conveyor of the type in which the entire drum rotates and moves the balls parallel to its longitudinal axis by means of a helical ribbon which is attached to the inside surface of the drum. As the balls enter this drum, they first pass through a hot water spray which removes any surface contamination and are then passed through the drying section in which forced hot air is used as the drying medium. The contaminated wash water drains to the crib line and the drying air is exhausted to the 105 Building exhaust system.

After being washed and dried, the balls are next directed to the magnetic ball separator which will discriminate between the balls which had entered the reactor on the current drop and the ones which had not been retrieved from past drops. The "high level" balls would be diverted to a storage cask while the "clean" balls would flow by gravity to a large shielded storage hopper. (This storage hopper would be carried on the trailer and set off into a shielded enclosure prior to start of recovery operations). It is anticipated that even though the balls have been washed, a holdup period of 24 - 48 hours will be required for decay of short half-life isotopes before the activity level decreases sufficiently to permit manual handling of balls.

After this holdup period, the balls are then transported pneumatically to another gravity type separator-hopper from which they are then quantitatively distributed in small containers which can be stored in preparation for future needs. The conveying air that is utilized for this entire

DECLASSIFIED

HA-30351-DEL
Page 6

operation is also routed to the 105 Building exhaust system.

VI. Description and Discussion of Alternate Methods

Insofar as handling of the balls is concerned, once they are removed from the reactor, the processing requirements are fairly well established. The only alternate approach to this problem of any significance would be to install ball processing equipment in each of the 105 Buildings. This would not only be extremely costly, as evidenced by the recent budget study estimate, but it is considered to be completely unnecessary. This conclusion seems appropriate when we consider the extremely low probability of having simultaneous ball drops in two or more reactors. However, if we must consider this possibility, it only indicates that the recovery improvements described herein are increasingly desirable since the proposed equipment could effect the ball recovery operation in at least three reactors in less time than is currently required to recover one reactor.

Therefore, the only area of question has to do with the method of gaining access to the bottom of the vertical rod slot and removing the balls. Other than boring through the side shield as recommended, consideration has been given to the possibility of providing an opening between the VSR slots and thirteen process tube channels in Tube Row 1. This method was originally felt to be the most attractive from a cost standpoint as well as offering the unique advantages of a through-pile removal channel. In view of this, a number of potential vendors were contacted to establish the feasibility of their equipment and in two cases, graphite samples were forwarded to them for test cutting. However, none of the known methods for providing this opening now appear to be very practicable and for this reason are not presently considered to be feasible for our program. Methods which have been explored are:

1. Shaped Charges

This is a method which is employed primarily in oil well drilling applications wherein a small charge of powder of specific configuration is detonated within the well casing such that the casing wall is penetrated to relatively controlled dimensions. The necessary opening between the VSR slot and the adjacent process tube channel could very probably be provided in this manner; however, the effect of the detonation on the surrounding graphite could be highly objectionable.

2. Cutting Torch

Equipment is now commercially available which is capable of cutting through concrete, rock and similar material by directing a high velocity, high temperature mixture on the surface to be "drilled". However, there are no known applications which parallel that under consideration and there are, therefore, several associated problems for which a solution is not yet known. Some of these are: (1) physical adaptation of equipment to the limited space available, (2) starting of the torch while it is inserted in the pile and, (3) possible pile contamination resulting from the cutting operation.

DECLASSIFIED

HW-50351-DEL
Page 7

3. Machining

It is conceivable, although presently considered as impracticable, that a machine tool could be devised which would cut the desired opening between the VSR slot and process tube channel. While there is no anticipated contamination problem with this method, it is expected that space limitations would seriously affect such an application.

4. Removal of Graphite Stringer

This method would be accomplished by removing the existing inlet and outlet process tube assemblies, gun barrels and donuts and then coring through the thermal shield and machining out the graphite stringer blocks. This method has the advantage of providing a large hole through the reactor which could be advantageous during a ball removal; however, the geometry of the opening produced is not easily adapted to the subsequent problem of ball removal. In addition, adoption of this method would result in the loss of thirteen fringe zone process tubes in each reactor which must be off-set by enrichment. A further disadvantage is evidenced by the probable limitations that would be placed on other front or rear face work that could otherwise be performed concurrently with ball recovery.

As another alternative solution, consideration was also given to improving the top removal system which is now being used. This method, as presently accomplished, is a highly inefficient, time consuming and unsafe operation. This is due largely to the high radiation levels which are experienced during the operation, especially if there is some equipment malfunction. With the installation of air-accelerated safety rods, it is expected that the over-all problem will be somewhat amplified due to the additional time required for rod removal and reassembly. Therefore, this approach does not appear too attractive since the gains attainable through improvements would be marginal and many of the present problems would still exist.

VII. Development Program Required

It is obvious that any additional equipment for ball removal and handling must demonstrate a much higher degree of efficiency and reliability than the equipment which is presently available. Because of this, the development and testing program for critical system components must be quite conclusive. However, there does not seem to be any more reasonable approach to the problem if the goal is to provide an efficient system at minimum cost.

The two main items of development and test are: (1) the actual drilling through the side of the unit and into the graphite stack so as to intercept the VSR slots, and (2) the in-pile ball removal unit.

A. Drilling Through Side Shield

A tentative specification for the required drilling machine was recently forwarded to several vendors in an effort to establish the feasibility of such a program. As a result of these inquiries, further discussions have been held with some of these vendors, all of which verified the practicability of the proposal. In fact, it appears that semi-standard commercial boring equipment is available at less than one-tenth the cost originally estimated. It would, therefore, seem logical to procure one of these

DECLASSIFIED

EA-50351-DEL
Page 3

machines for the purpose of making test drillings on a mock-up basis. This would provide definite confirmation of the validity of this proposal prior to actual in-pile drilling and would also allow time to eliminate any minor problems which may become apparent.

Inasmuch as the ultimate goal should be to perform the actual in-pile drilling during the CG-709 outage, it will be necessary to expedite these drilling tests as much as possible, and it would seem logical to coordinate this development with a similar program to be initiated in the near future by Equipment Development Operation in support of a project for new organic test facilities.

B. In-Pile Removal Unit

Considerable data has been accumulated from past tests which provides a fairly good basis for predicting the flow characteristics of the 3X balls and testing of this nature is currently being extended by the Equipment Development Operation in support of Project CG-741 (105-C 3X System Modifications). Based on present information, a removal trough which contains water jets appears to be the most effective way of moving the balls, especially where the trough slope is small. However, the prototype in-pile removal equipment should be thoroughly tested prior to procurement of additional units.

Other critical components of this system such as the ball washer-dryer and the "hot ball" separator are also currently under development by the Equipment Development Operation for the 105-C 3X Modifications and it is not expected that any additional development would be required for these items.

VIII. Schedules

A. Proposed Development and Project Schedules

	<u>Start</u>	<u>Complete</u>
Development (See Par. VII)	7 - 57	1 - 59
Scope Design	11 - 57	8 - 58
Detail Design	6 - 58	8 - 59
Procurement	9 - 59	7 - 60
Construction	10 - 59	1 - 61
Beneficial Use (First Reactor)	9 - 60	

B. Schedule Discussion

The construction schedule as shown is based on the goal of coordinating the reactor outages required for the in-pile drilling operation with that of Project CG-709. Inasmuch as funds for additional work will probably not be available until the FY-1960 allocations, the remainder of the work would be performed either during other outages or, as is the case for a large portion of the work, be performed without any effect on pile operation.

IX. Acknowledgements

Appreciation is expressed for the helpful assistance and advice received from

DECLASSIFIED

EW-50351-DEL
Page 9

the many people contacted in the course of this study and in particular, V. R. Hill and J. W. Clinehens of Construction Engineering Operation, H. E. Book and L. W. Lang of Research and Engineering Operation, I.P.D., and D. F. Watson, C. A. Mansius and G. E. Wede of Facilities Engineering Operation, I.P.D.

Reactor Modification Design Operation
IRRADIATION PROCESSING DEPARTMENT

RC Walker:bk

DECLASSIFIED

HW-50351-DE4
Page 10

X. Appendix

A. References

1. HW-41293, "Budget Study Report, FY-1958 Plant and Equipment Budget, Ball 3X Recovery Improvements - 105-B, D, DR, F and H", E. J. Bellarta and L. R. Pierce, January 31, 1956.
2. HW-48075, "Budget Study Report, FY-1959 Plant Acquisition and Construction Budget, Ball 3X Recovery Improvements - 105-B, D, DR, F and H," G. E. Wade, February 1, 1957.

B. Cost Estimate

For the purpose of this estimate, it was assumed that all work would be performed by HAPCO Construction Operation CPFF Contractor and that all in-pile modifications would be performed on a three shift, six day week basis. If these Ball 3 X System Improvements are coordinated with other scheduled outages, no additional reactor outage time would be required. If the 3X Improvements were to be made separately, an outage of 10 - 12 days would be required for B, D, DR and F Reactors and approximately 14 - 16 days for H Reactor.

Total project cost including a two-year escalation and a 35 percent contingency is estimated to be \$1,500,000. See attached sheet for cost breakdown.

C. Drawings

- SK-1-2953 - Engineering Flow Diagram
- SK-1-2907 - General Arrangement
- SK-1-2908 - In-Pile Removal Unit
- SK-1-2906 - Portable Trailer Equipment Arrangement

DECLASSIFIED

EW-50351-DEL
Page 11

COST BREAKDOWN

HALL 3X RECOVERY IMPROVEMENTS - 105-B, D, IR, F & H BLDGS.

STUDY STAGE ESTIMATE

<u>ITEM</u>	<u>AMOUNT</u>
Structural - Including Grib Waste Line, Grib, Cell, etc.	\$ 34,000
Electrical - 105 Building	20,000
In-pile Modifications, all Mechanical Work, and Building Piping	469,000
Service Trailer and Ball Processing Equipment	69,000
Temporary Construction	<u>32,000</u>
Sub-Total	<u>\$ 624,000</u>
Other Direct and Indirect Costs	\$ 189,000
Construction Engineering	65,000
Escalation	105,000
Contingency	302,000
General Overhead	65,000
Design Costs	<u>150,000</u>
Total Project Cost	<u><u>\$1,500,000</u></u>

ER-0216

DECLASSIFIED

FOR ALL EQUIPMENT WITHIN THIS AREA SEE JEC-2000

STUDY

REVISIONS		DATE	
3K-1-2953		8	
NONE		5/14/57	
DESIGNED BY	CHECKED BY	APPROVED BY	
12670			
U. S. ATOMIC ENERGY COMMISSION HAFFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
BALL 3-X SYSTEM IMPROVEMENTS ENGINEERING FLOW DIAGRAM			
3K-1-2953		PAGE 12	
2100-1001			

DECLASSIFIED

HW-50351

-DEL

PAGE 13

GENERAL NOTES
 CONNECTIONS BETWEEN PORTABLE TRAILER
 AND BUILDING SERVICES TO BE MADE WITH
 FLEXIBLE HOSE WITH QUICK COUPLE COUPLERS

STUDY

APPROVED

REVISIONS	1	2	3	4
DATE				
BY				
CHKD				
APPROVED				
SCALE	1" = 1'0"			
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE	NONE			
DATE	8/14/57			
BY				
CHKD				
APPROVED				
PROJECT	JK-F-2907			
TITLE

HW-50351-DEL
PAGE 14

SECTION 'A-A' (SEE SK-1-2907)

STUDY

APPROVED

DESIGN	REVISED	DATE	BY
SK-1-2908	NONE		
SCALE: 1" = 1'-0"		DATE: 11/1/57	
BY: [Signature]		CHECKED: [Signature]	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
BALL BY SYSTEM IMPROVEMENTS IN-PILE REMOVAL UNIT			
SK-1-2908		2/88	

PLAN

Labels in Plan View:

- REAR VIEW CONVEYOR (FACED WITH RUBBER)
- BALL CONVEYOR
- HIGH LEVEL ALARM
- BALL-AIR SEPARATOR COLLECTOR
- SCALE
- 2" STEEL A CHIMNEY
- DRYER BLOWER
- AIR HEATING COIL
- HOT BALL CHUTE
- TO BALL STORAGE HOPPER
- MAGNETIC BALL SEPARATOR
- DRUM
- DRUM TO FEED
- BLAST
- STRENGTHENED PIPE
- WATER-CHARGE BALL CONVEYOR
- OPENING PULVER DOWN TO CASE
- BALL-AIR SEPARATOR COLLECTOR
- HIGH LEVEL ALARM

SECTION "CC"

Labels in Section CC:

- BALL-AIR SEPARATOR COLLECTOR
- ROTARY FEEDER HOUSING
- HOT WATER TO SPRAY NOZZLES IN BALL CONVEYOR
- STEAM HEAT
- HOT WATER HEATER
- COLD WATER FROM SUB-IRRAWADDY

SECTION "DD"

Labels in Section DD:

- BALL-AIR SEPARATOR COLLECTOR
- ROTARY FEEDER HOUSING
- SPRAY NOZZLES
- HOT WATER HEATER

SECTION A-A

SECTION B-B

STUDY

APPROVED

DESIGNED BY: J. H. BARNETT
 DRAWN BY: J. H. BARNETT
 CHECKED BY: J. H. BARNETT
 APPROVED BY: J. H. BARNETT

PROJECT	SK-I-2906	REV	1
TITLE	NONE	DATE	5-11-57
DESIGNER	J. H. BARNETT	CHECKED	J. H. BARNETT
DRAWN	J. H. BARNETT	APPROVED	J. H. BARNETT
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
BALL BOX SYSTEM IMPROVEMENTS PORTABLE TRAILER EQUIPMENT ARRANGEMENT			
PROJECT	SK-I-2906	REV	1
TITLE	NONE	DATE	5-11-57

END

**DATE
FILMED
5128193**