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June 13, 1962

REACTOR SIMULATION STUDY

The following discussion and attached summary report is sent to you to illustrate the type of information that is currently in data processing machine language and available to those who require it. During the progress meetings at which these reports were discussed, several persons indicated a desire to have a documented explanation of the report and a personal copy to scan. This is the answer to these requests.

The reports are comprised of three major sections. The first is a map indicating the number of recordings of data in the category defined by the function number code. The second is a summary of the data, in terms of hours, for each of the functions performed during an outage, except secondary function code number 21 which is the number of tubes associated with the basic function performed. The third is a summary of the secondary functions performed within a basic function class, the associated delay total, and the number of tubes involved for those functions where a delineation by tube count may be of interest.

The function code numbers relate directly to the definitions of the hours expended for charge-discharge, rupture removal, tube leak repair, tube replacement, and so forth. These definitive classes are taken from the distribution records supplied by the various reactor analysts and summarized by the Reports and Statistics group in the IPD Production Operation. The listing and record count map are an enlargement of the summary form designed in April of 1961. The codes are as follows:

	<u>Primary</u>	<u>Secondary</u>
***	1. Charge discharge - normal	1. Same as primary
Functions	2. Charge discharge - special	2. Same
	3. Charge discharge - problem	3. Same
	4. Rupture Removal	4. Same
	5. Water leak repair	5. Same
	6. Tube replacement	6. Same
	7. Tube replacement - abnormal	7. Same
	8. Mechanical Maintenance	8. Same
	9. Instrument Maintenance	9. Same
	10. Electrical Maintenance	10. Same

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	<u>Primary</u>	<u>Secondary</u>
	11. Standard Check	11. Same as Primary
	12. Production Test	12. Same
	13. Project Work	13. Same
	14. Miscellaneous - Other	14. Same
***	15. Cooling Time	15. Same
Delays	16. Startup Time	16. Same
	17. Equipment Breakdown	17. Same
	18. Delays - Man	18. Same
	19. Turco	19. Same
	20. Miscellaneous	20. Same
	21. Probologging	**21. Number of tubes involved
	22. Scrums	

One will notice immediately that the various time elements across any given function code row (primary function) do not necessarily have equal total values. The reason here is that some tasks are distributed according to the function governing or controlling the outage during different periods of the given outage. As an example, the records indicate that tube leak work was performed while normal charge-discharge was governing or the time controlling portion of a given outage. Therefore, one will find the tube leak repair hour requirements in row 1 under secondary function number 5 indicating the leak work was performed during the period when charge-discharge was the outage controlling function. The same distribution pattern will be especially noticeable with regard to associated maintenance time requirements. To determine the amount of time associated with a specific function one should look at the diagonal element for that particular function. For example, tube leak work during tube leak controlling periods will show up on the function row number 5 under secondary function column 5, and so forth.

The number of elements involved in this analysis versus the width of the paper on which to write the information required a slight modification. Therefore, it will be noted that each row is split with regard to the secondary functional relationship. The first fourteen functions are corrective in nature and the remaining are the unavoidable delays required to perform the necessary corrective work. Therefore, each row is broken at this logical point. The corrective first, followed by the associated delays ending with the corresponding tube count.

The third portion of each reactor report is a summary of the corrective time requirements, a summary of the associated delays, followed by the tube count for the period reported.

This report summarizes all the recorded data starting April 1, 1961 to May 15, 1962. This same analysis can be run for any reactor for any incremental period considering any one or combinations of causes for an outage during the above mentioned period. For example, one can get an analysis for B reactor, for the period July 1, 1961 through December 31, 1961 covering the outages for tube leaks and ruptures..

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The last page of the report is a summation of all the hours expended during the period for each of the recovery functions. This summary presents a reasonably good picture of the distribution of the total outage time to the various activities. One can, if he desires, calculate the percentage of time attributed to charge-discharge, rupture removal, mechanical maintenance and so forth. The averages, variance and standard deviation associated with tube count, in this case, are valueless.

Appendix A is an updated analysis which parallels the report HW-57166, but covers the period April 1, 1961 to May 16, 1962.

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OPERATIONS RESEARCH & SYNTHESIS

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CAUSE FUNCTION EXPECTATION REPORT

APRIL 1961 TO MAY 15, 1962

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THIS IS AN EXAMPLE REPORT ILLUSTRATING  
AVERAGE TIME REQUIRMENTS AND EXPECTED  
VARIABLES FOR THE BASIC TASKS REQUIRED  
TO RE-ESTABLISH IN-LINE PRODUCTION STATUS.  
\*\*ALL DATA IN FOLLOWS-EXCEPT SECONDARY FUNCTION#21/TOTAL COUNT.

\*\* INCIDENT EXPERIENCE BY CAUSE FUNCTION \*\*

SECONDARY FUNCTION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FUNCTION 1	31	0	0	0	0	1	0	0	0	0	0	0	0	0	23	23	1	8	0	0	30
FUNCTION 2	9	15	0	0	1	1	0	0	0	0	0	0	0	0	17	17	0	0	0	0	24
FUNCTION 3	0	0	5	0	0	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	5
FUNCTION 4	4	0	0	7	0	1	0	1	0	0	0	0	0	0	7	6	0	0	0	0	5
FUNCTION 5	14	0	0	0	17	2	0	21	3	0	1	0	0	0	24	24	3	8	0	0	18
FUNCTION 6	12	1	0	0	0	10	0	9	5	0	0	0	0	0	16	15	1	5	0	0	16
FUNCTION 7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4	4	0	0	0	0	3
FUNCTION 8	10	0	0	0	0	0	0	44	10	0	0	0	0	0	24	35	1	4	0	0	0
FUNCTION 9	0	0	0	0	0	0	0	0	21	0	0	0	0	0	13	13	1	0	0	0	0
FUNCTION 10	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	1	3	0	0	0	0
FUNCTION 11	0	0	0	0	0	0	0	0	0	1	10	1	0	0	5	5	0	0	0	0	0
FUNCTION 12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	3	0	0	0	0	1
FUNCTION 13	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	0	0	0
FUNCTION 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
FUNCTION 15	01	7	1	0	11	10	0	21	10	1	1	1	0	1	0	0	0	0	0	0	0
FUNCTION 16	01	0	1	0	1	11	0	11	0	1	1	1	0	1	0	0	0	0	0	0	0

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FUNCTION 18	0	0	0	0	4	0	0	4	0	1	0	1	0	0	0	0	0	0	0
FUNCTION 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTION 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUNCTION 21	8	0	0	0	0	5	0	0	0	0	6	0	0	9	9	2	0	0	10
FUNCTION 22	1	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0

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SLARY TICN NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	15	16	17	18	19	20	21							
*****														
FUNCTION 1														
TOT.HOURS EWN	250.1	0.	0.	0.	0.	1.0	0.	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	21	0	0	0	0	1	0	0	0	0	0	0	0	0
AVERAGE EOWN	7.7	0.	0.	0.	0.	1.0	0.	0.	0.	0.	0.	0.	0.	0.
VARIANCE	48.7	-0.	-0.	-0.	-0.	0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	7.0	-0.	-0.	-0.	-0.	0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
FUNCTION 1														
TOT.HOURS EWN	13.0	20.5	0.4	8.7	0.	0.	5271.							
INCIDENTS	22	23	1	2	0	0	30							
AVERAGE EOWN	0.6	0.9	0.4	1.1	0.	0.	176.							
VARIANCE	0.2	0.9	0.	0.4	-0.	-0.	36891.							
STD.DEVIATION	0.5	0.9	0.	0.7	-0.	-0.	192.							
FUNCTION 2														
TOT.HOURS EWN	57.5	54.1	0.	0.	4.0	0.6	0.	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	9	15	0	0	1	1	0	0	0	0	0	0	0	0
AVERAGE EOWN	4.2	3.6	0.	0.	4.0	0.6	0.	0.	0.	0.	0.	0.	0.	0.
VARIANCE	7.2	8.1	-0.	-0.	0.	0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	2.7	2.8	-0.	-0.	0.	0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
FUNCTION 2														
TOT.HOURS EWN	4.4	6.2	0.	0.	0.	0.	706.							
INCIDENTS	17	17	0	0	0	0	24							
AVERAGE EOWN	0.3	0.4	0.	0.	0.	0.	30.							
VARIANCE	0.0	0.1	-0.	-0.	-0.	-0.	556.							
STD.DEVIATION	0.0	0.3	-0.	-0.	-0.	-0.	24.							
FUNCTION 3														
TOT.HOURS EWN	2.7	0.	7.2	0.	0.	0.	0.	2.3	0.	0.	0.	0.	0.	0.
INCIDENTS	1	0	5	0	0	0	0	1	0	0	0	0	0	0
AVERAGE EOWN	1.2	0.	1.5	0.	0.	0.	0.	2.3	0.	0.	0.	0.	0.	0.
VARIANCE	0.2	-0.	0.9	-0.	-0.	-0.	-0.	0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	0.5	-0.	1.0	-0.	-0.	-0.	-0.	0.	-0.	-0.	-0.	-0.	-0.	-0.
FUNCTION 3														
TOT.HOURS EWN	0.4	0.4	0.	0.	0.	0.	1.							
INCIDENTS	0	0	0	0	0	0	0							
AVERAGE EOWN	0.0	0.0	0.	0.	0.	0.	0.							
VARIANCE	0.0	0.0	0.	0.	0.	0.	0.							

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FUNCTION 4														
TCT.HOURS LWA							11.1	11.5	0.	0.	0.	0.	0.	0.
INCIDENTS							3	1	0	0	0	0	0	0
AVERAGE DOWN							3.7	11.5	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	0.1	0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	0.3	0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 7														
TCT.HOURS LWA	1.1	1.5	0.	0.	0.	0.	12.							
INCIDENTS	4	4	0	0	0	0	3							
AVERAGE DOWN	0.3	0.4	0.	0.	0.	0.	4.							
VARIANCE	0.1	0.1	-0.	-0.	-0.	-0.	3.							
STD.DEVIATION	0.2	0.2	-0.	-0.	-0.	-0.	2.							

FUNCTION 8														
TCT.HOURS LWA	63.7	0.	0.	0.	0.	0.	0.	464.7	61.2	0.	0.	0.	3.6	0.
INCIDENTS	10	0	0	0	0	0	0	44	10	0	0	0	2	0
AVERAGE DOWN	6.4	0.	0.	0.	0.	0.	0.	10.6	6.1	0.	0.	0.	1.8	0.
VARIANCE	18.6	-0.	-0.	-0.	-0.	-0.	-0.	50.9	35.2	-0.	-0.	-0.	1.6	-0.
STD.DEVIATION	9.4	-0.	-0.	-0.	-0.	-0.	-0.	7.1	5.9	-0.	-0.	-0.	1.3	-0.

FUNCTION 9														
TCT.HOURS LWA	22.4	40.7	2.5	4.8	0.	0.	0.							
INCIDENTS	14	25	1	4	0	0	0							
AVERAGE DOWN	0.9	1.7	2.5	1.2	0.	0.	0.							
VARIANCE	0.3	0.6	0.	0.5	-0.	-0.	-0.							
STD.DEVIATION	0.6	0.8	0.	0.7	-0.	-0.	-0.							

FUNCTION 7														
TCT.HOURS LWA	0.	0.	0.	0.	0.	0.	0.	0.	76.0	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	21	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	3.6	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	7.0	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	2.7	-0.	-0.	-0.	-0.	-0.

FUNCTION 9														
TCT.HOURS LWA	5.4	6.1	0.5	0.	0.	0.	0.							
INCIDENTS	17	13	1	0	0	0	0							
AVERAGE DOWN	0.4	0.5	0.5	0.	0.	0.	0.							
VARIANCE	0.1	0.3	0.	-0.	-0.	-0.	-0.							
STD.DEVIATION	0.3	0.5	0.	-0.	-0.	-0.	-0.							

FUNCTION 10														
TCT.HOURS LWA														

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AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.6	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	0.9	-0.	-0.	-0.	-0.
STD. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	1.0	-0.	-0.	-0.	-0.

FUNCTION 10														
TCT. FLURS DWN	0.1	0.3	4.3	0.	0.	0.	0.	0.	0.					
INCIDENTS	1	1	3	0	0	0	0	0	0					
AVERAGE DOWN	0.1	0.3	1.4	0.	0.	0.	0.	0.	0.					
VARIANCE	0.	0.	0.6	-0.	-0.	-0.	-0.	-0.	-0.					
STD. DEVIATION	0.	0.	0.8	-0.	-0.	-0.	-0.	-0.	-0.					

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FUNCTION 11														
TCT. FLURS DWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.4	21.7	11.0	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	0	1	10	1	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.4	2.2	11.0	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	0.	1.2	0.	-0.	-0.
STD. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	0.	1.1	0.	-0.	-0.

FUNCTION 11														
TCT. FLURS DWN	1.1	1.7	0.	0.	0.	0.	0.	0.	0.					
INCIDENTS	5	5	0	0	0	0	0	0	0					
AVERAGE DOWN	0.2	0.3	0.	0.	0.	0.	0.	0.	0.					
VARIANCE	0.0	0.1	-0.	-0.	-0.	-0.	-0.	-0.	-0.					
STD. DEVIATION	0.1	0.3	-0.	-0.	-0.	-0.	-0.	-0.	-0.					

FUNCTION 12														
TCT. FLURS DWN	8.0	0.	0.	0.	0.	0.	12.4	3.3	0.	0.	3.5	2.4	0.	0.
INCIDENTS	3	0	0	0	0	0	1	2	0	0	1	2	0	0
AVERAGE DOWN	2.7	0.	0.	0.	0.	0.	12.4	1.6	0.	0.	3.5	1.2	0.	0.
VARIANCE	0.9	-0.	-0.	-0.	-0.	-0.	0.	0.0	-0.	-0.	0.	0.1	-0.	-0.
STD. DEVIATION	1.0	-0.	-0.	-0.	-0.	-0.	0.	0.2	-0.	-0.	0.	0.3	-0.	-0.

FUNCTION 12														
TCT. FLURS DWN	1.	1.6	0.	0.	0.	0.	0.	0.	0.					
INCIDENTS	4	3	0	0	0	0	0	1	0					
AVERAGE DOWN	0.4	0.5	0.	0.	0.	0.	0.	0.	0.					
VARIANCE	0.2	0.4	-0.	-0.	-0.	-0.	-0.	-0.	-0.					
STD. DEVIATION	0.5	0.7	-0.	-0.	-0.	-0.	-0.	-0.	-0.					

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FUNCTION 12														
TCT. FLURS DWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.6	1.0	1.6	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	0	1	1	1	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.6	1.0	1.6	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	0.	0.	0.	-0.	-0.

FUNCTION 13  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 14  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 14  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 15  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 15  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 16  
TCT-FOCUS LWA  
INCIDENTS  
AVERAGE DCAW  
VARIANCE  
STD. DEVIATION

FUNCTION 16

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INCIDENTS	0.	0.	0.	0.	0.	0.	0.
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 17														
TCT.HOURS DWN	0.4	0.	0.	0.	3.0	1.5	0.	0.5	0.5	5.4	0.	0.	0.	0.
INCIDENTS	1	0	0	0	7	2	0	1	1	4	0	0	0	0
AVERAGE DOWN	0.4	0.	0.	0.	1.9	0.7	0.	0.5	0.5	1.3	0.	0.	0.	0.
VARIANCE	0.	-0.	-0.	-0.	1.6	0.1	-0.	0.	0.	0.4	-0.	-0.	-0.	-0.
STD.DEVIATION	0.	-0.	-0.	-0.	1.3	0.4	-0.	0.	0.	0.6	-0.	-0.	-0.	-0.

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FUNCTION 17							
TCT.HOURS DWN	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 18														
TCT.HOURS DWN	12.0	0.	0.	0.	4.2	3.2	0.	3.4	0.	0.8	0.	1.9	0.	0.
INCIDENTS	5	0	0	0	4	2	0	4	0	1	0	1	0	0
AVERAGE DOWN	2.7	0.	0.	0.	1.6	1.6	0.	0.8	0.	0.8	0.	1.9	0.	0.
VARIANCE	12.4	-0.	-0.	-0.	0.5	0.0	-0.	0.0	-0.	0.	-0.	0.	-0.	-0.
STD.DEVIATION	4.2	-0.	-0.	-0.	0.7	0.1	-0.	0.2	-0.	0.	-0.	0.	-0.	-0.

FUNCTION 18							
TCT.HOURS DWN	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 18														
TCT.HOURS DWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STD.DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 18							
TCT.HOURS DWN	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.

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STDEV. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
FUNCTION 20														
TCT.HOURS LBN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STDEV. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

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FUNCTION 20														
TCT.HOURS LBN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCIDENTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
STDEV. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.

FUNCTION 21														
TCT.HOURS LBN	25.5	0.	0.	0.	0.	22.0	0.	14.0	0.	0.	18.0	0.	0.	0.
INCIDENTS	8	1	0	0	5	0	3	0	0	6	0	0	0	0
AVERAGE DOWN	3.2	0.	0.	0.	4.4	0.	4.7	0.	0.	3.0	0.	0.	0.	0.
VARIANCE	3.1	-0.	-0.	-0.	6.6	-0.	11.6	-0.	-0.	1.1	-0.	-0.	-0.	-0.
STDEV. DEVIATION	1.8	-0.	-0.	-0.	2.6	-0.	3.4	-0.	-0.	1.0	-0.	-0.	-0.	-0.

FUNCTION 21														
TCT.HOURS LBN	2.8	4.7	1.5	0.	0.	0.	755.							
INCIDENTS	9	9	2	0	0	0	10							
AVERAGE DOWN	0.3	0.5	0.7	0.	0.	0.	76.							
VARIANCE	0.0	0.2	0.1	-0.	-0.	-0.	4246.							
STDEV. DEVIATION	0.0	0.5	0.4	-0.	-0.	-0.	65.							

FUNCTION 22														
TCT.HOURS LBN	7.2	0.	0.	0.	0.	0.	0.	2.6	0.	0.	0.	2.4	0.	0.
INCIDENTS	1	0	0	0	0	0	0	2	0	0	0	2	0	0
AVERAGE DOWN	7.2	0.	0.	0.	0.	0.	0.	1.8	0.	0.	0.	1.2	0.	0.
VARIANCE	0.	-0.	-0.	-0.	-0.	-0.	-0.	1.6	-0.	-0.	-0.	0.5	-0.	-0.
STDEV. DEVIATION	0.	-0.	-0.	-0.	-0.	-0.	-0.	1.3	-0.	-0.	-0.	0.7	-0.	-0.

FUNCTION 22														
TCT.HOURS LBN	0.	0.	0.	0.	0.	0.	0.							
INCIDENTS	0	0	0	0	0	0	0							
AVERAGE DOWN	0.	0.	0.	0.	0.	0.	0.							
VARIANCE	-0.	-0.	-0.	-0.	-0.	-0.	-0.							
STDEV. DEVIATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.							

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\*\*SUB TOTAL DELINEATION\*\*

FUNCTION 1		ASSOCIATED DELAY TOTALS		TOTAL TUBES
SUM#BASICS#SEC#EAPLS	229.1	SUM OF DELAYS	42.6	SUM 5271.
NUMBER OF INCIDENTS	31	INCIDENTS	31	CNT 31
AVERAGE TUBES DEL.	7.7	AVERAGE	1.4	AVG 176.
VARIANCE	110.1	VARIANCE	2.3	
STD. DEVIATION	10.5	STD. DEVIATION	1.5	

FUNCTION 2		ASSOCIATED DELAY TOTALS		TOTAL TUBES
SUM#BASICS#SEC#EAPLS	96.6	SUM OF DELAYS	11.2	SUM 726.
NUMBER OF INCIDENTS	25	INCIDENTS	25	CNT 25
AVERAGE TUBES DEL.	3.9	AVERAGE	0.4	AVG 29.
VARIANCE	23.3	VARIANCE	0.2	
STD. DEVIATION	4.8	STD. DEVIATION	0.5	

FUNCTION 3		ASSOCIATED DELAY TOTALS		TOTAL TUBES
SUM#BASICS#SEC#EAPLS	12.3	SUM OF DELAYS	0.8	SUM 11.
NUMBER OF INCIDENTS	7	INCIDENTS	7	CNT 7
AVERAGE TUBES DEL.	1.8	AVERAGE	0.1	AVG 1.
VARIANCE	0.2	VARIANCE	0.1	
STD. DEVIATION	0.2	STD. DEVIATION	0.2	

FUNCTION 4		ASSOCIATED DELAY TOTALS		TOTAL TUBES
SUM#BASICS#SEC#EAPLS	41.0	SUM OF DELAYS	11.2	SUM 3.
NUMBER OF INCIDENTS	6	INCIDENTS	6	CNT 6
AVERAGE TUBES DEL.	16.1	AVERAGE	1.3	AVG 1.
VARIANCE	100.1	VARIANCE	1.9	
STD. DEVIATION	17.6	STD. DEVIATION	1.4	

FUNCTION 5		ASSOCIATED DELAY TOTALS		TOTAL TUBES
SUM#BASICS#SEC#EAPLS	177.1	SUM OF DELAYS	11.2	SUM 40.
NUMBER OF INCIDENTS	31	INCIDENTS	31	CNT 31
AVERAGE TUBES DEL.	16.2	AVERAGE	0.4	AVG 4.
VARIANCE	100.1	VARIANCE	1.9	
STD. DEVIATION	17.6	STD. DEVIATION	1.4	

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FUNCTION 6  
 SUBBASIS OCCURRENCES 52.0  
 NUMBER OF INCIDENTS 18  
 AVERAGE HOURS PER I. 2.4  
 VARIANCE 7.7  
 STD. DEVIATION 2.8

ASSOCIATED DELAY TOTALS  
 SUM OF DELAYS 43.7  
 INCIDENTS 18  
 AVERAGE 2.4  
 VARIANCE 7.7  
 STD. DEVIATION 2.8

TOTAL TUBES  
 592  
 18  
 53.

FUNCTION 7  
 SUBBASIS OCCURRENCES 22.0  
 NUMBER OF INCIDENTS 4  
 AVERAGE HOURS PER I. 5.5  
 VARIANCE 17.8  
 STD. DEVIATION 4.2

ASSOCIATED DELAY TOTALS  
 SUM OF DELAYS 22.6  
 INCIDENTS 4  
 AVERAGE 5.6  
 VARIANCE 17.8  
 STD. DEVIATION 4.2

TOTAL TUBES  
 12  
 4  
 3.

FUNCTION 21  
 SUBBASIS OCCURRENCES 75.5  
 NUMBER OF INCIDENTS 11  
 AVERAGE HOURS PER I. 6.9  
 VARIANCE 25.5  
 STD. DEVIATION 5.1

ASSOCIATED DELAY TOTALS  
 SUM OF DELAYS 75.5  
 INCIDENTS 11  
 AVERAGE 6.9  
 VARIANCE 25.5  
 STD. DEVIATION 5.1

TOTAL TUBES  
 755  
 11  
 69.

REACTOR 5 OUTAGE FUNCTION EXPECTATION REPORT

APRIL 1961 TO MAY 15 1962

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THIS IS AN EXEMPLARY REPORT ILLUSTRATING  
AVERAGE TIME REQUIREMENTS AND EXPECTED  
VARIANCES FOR THE BASIC TASKS REQUIRED  
TO RE-ESTABLISH ON-LINE PRODUCTION STATUS.  
\*\*ALL DATA IN HOURS-EXCEPT SECONDARY FUNCTION#21-TUBE COUNT.

\*\* INCIDENT EXPERIENCE BY CAUSE FUNCTION \*\*

SECONDARY FUNCTION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FUNCTION TOTAL	34	18	5	7	17	15	4	44	33	5	16	4	6	1	39	38	11	17	0	0	36

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FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TOT. HOURS	505.1	63.0	7.3	47.6	148.4	179.0	23.5	945.3	151.8	8.7	46.5	14.4	14.8	3.2
INCRS. TS	34	18	5	7	17	16	4	44	33	5	16	4	6	1
AVERAGE	14.7	3.5	1.5	6.8	8.7	11.2	5.9	21.5	4.6	1.7	2.9	3.6	2.5	3.2
VARIANCE	391.0	7.1	0.9	35.8	31.1	197.8	19.0	1130.2	24.6	0.7	3.5	24.4	5.9	0.
STD. DEVIATION	19.5	2.7	1.0	6.0	5.6	14.1	4.4	33.6	5.0	0.9	1.9	4.9	2.4	0.
FUNCTION TOTAL	106.2	148.9	14.6	38.1	0.	0.	7083.							
TOT. HOURS	39	38	11	17	0	0	36							
INCRS. TS	2.0	3.9	1.3	2.2	0.	0.	197.							
AVERAGE	1.2	4.4	1.1	6.3	-0.	-0.	70739.							
VARIANCE	1.1	2.1	1.0	2.5	-0.	-0.	266.							

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	**TOTAL HOURS DOWN**							
	REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
CAUSE 1	0.	448.5	308.3	173.2	43.1	0.	431.8	643.1
CAUSE 2	516.4	978.0	584.2	742.7	373.3	642.8	334.0	243.3
CAUSE 3	805.1	192.1	538.8	794.8	699.4	1148.4	0.	0.
CAUSE 4	1681.8	526.7	1172.7	831.3	829.6	917.8	0.	33.4
CAUSE 5	4.1	10.2	50.6	173.8	133.3	127.7	663.6	334.1
CAUSE 6	31.1	72.4	146.4	35.3	1.8	4.7	0.	38.0
CAUSE 7	0.	56.0	5.4	0.	134.6	116.5	2.1	0.
CAUSE 8	0.	3.6	0.	0.	6.3	0.	0.	0.
CAUSE 9	72.6	0.5	121.5	274.1	41.8	0.	0.6	92.7
CAUSE 10	0.	0.	0.	0.	0.	0.	0.	1.1
CAUSE 11	0.1	0.	0.	0.	0.	0.	117.5	0.
CAUSE 12	0.	200.6	0.	0.	0.	0.	0.	0.
CAUSE 13	102.8	43.4	0.	0.	188.9	0.	0.	0.
CAUSE 14	52.9	0.	0.5	89.2	27.1	0.5	0.	0.
CAUSE 15	37.7	0.	0.	0.	0.	0.	0.	0.
CAUSE 16	7.5	11.1	0.	3.1	0.	2.5	0.	0.

- Cause 1 = Scheduled Charge-Discharge
- 2 = Rupture
- 3 = Tube Replacement
- 4 = Water Leaks
- 5 = Control Trips (Panellit, Beckman, etc.)
- 6 = Front Face Leaks
- 7 = Rear Face Leaks
- 8 = Production Test
- 9 = Electrical Power Failure
- 10 = Oriface Failure
- 11 = Control Rod Failure
- 12 = Scheduled Overbore
- 13 = Water Supply Failure
- 14 = Ball Drop - Loss of Reactivity
- 15 = Plugged Rear Nozzles
- 16 = Faulty Thermocouples

APPENDIX

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	**TOTAL DOWN INCIDENTS**							
	REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
CAUSE 1	0	4	3	2	1	0	6	9
CAUSE 2	9	14	13	18	9	21	8	6
CAUSE 3	2	1	2	2	4	6	0	0
CAUSE 4	29	11	22	14	15	25	0	1
CAUSE 5	4	16	10	12	5	24	21	19
CAUSE 6	1	2	4	1	1	3	0	1
CAUSE 7	0	3	2	0	4	4	2	0
CAUSE 8	0	1	0	0	1	0	0	0
CAUSE 9	2	1	5	2	1	0	1	1
CAUSE10	0	0	0	0	0	0	0	1
CAUSE11	1	0	0	0	0	0	2	0
CAUSE12	0	2	0	0	0	0	0	0
CAUSE13	2	1	0	0	3	0	0	0
CAUSE14	2	0	1	2	2	2	0	0
CAUSE15	2	0	0	0	0	0	0	0
CAUSE16	2	2	0	2	0	2	0	0

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	REACTOR1		REACTOR2		REACTOR3		REACTOR4		REACTOR5		REACTOR6		REACTOR7		REACTOR8	
	**DOWN INCIDENT AVERAGE AND STANDARD DEVIATION**															
CAUSE 1	0.	0.	112.1	38.3	102.8	18.4	86.6	68.5	43.1	0.	0.	0.	72.0	9.7	71.5	9.6
CAUSE 2	57.4	28.4	69.9	73.0	44.9	21.2	41.3	5.1	41.5	21.7	30.6	13.8	41.8	35.6	40.6	27.4
CAUSE 3	402.5	27.6	192.1	0.	269.4	168.8	397.4	75.6	174.8	142.4	191.4	148.6	0.	0.	0.	0.
CAUSE 4	58.0	36.5	47.9	30.3	53.3	16.2	59.4	24.9	55.3	17.0	36.7	25.4	0.	0.	33.4	0.
CAUSE 5	1.0	1.2	0.6	0.5	5.1	12.6	14.5	20.9	26.7	26.5	5.3	10.5	31.6	25.9	17.6	16.6
CAUSE 6	31.1	0.	36.2	0.5	36.6	29.3	35.3	0.	1.8	0.	1.6	0.6	0.	0.	38.0	0.
CAUSE 7	0.	0.	18.7	30.7	2.7	3.1	0.	0.	33.6	37.3	29.1	57.7	1.1	0.1	0.	0.
CAUSE 8	0.	0.	3.6	0.	0.	0.	0.	0.	6.3	0.	0.	0.	0.	0.	0.	0.
CAUSE 9	36.3	8.5	0.5	0.	24.3	22.4	137.0	142.5	41.8	0.	0.	0.	0.6	0.	92.7	0.
CAUSE 10	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.1	0.
CAUSE 11	0.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	58.7	3.2	0.	0.
CAUSE 12	0.	0.	100.3	84.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CAUSE 13	51.4	70.4	43.4	0.	0.	0.	0.	0.	63.0	25.4	0.	0.	0.	0.	0.	0.
CAUSE 14	26.5	36.1	0.	0.	0.5	0.	44.6	23.9	13.5	5.5	0.2	0.0	0.	0.	0.	0.
CAUSE 15	18.8	25.9	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CAUSE 16	3.8	3.1	5.6	7.6	0.	0.	1.5	1.6	0.	0.	1.3	0.6	0.	0.	0.	0.

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\*\*DOWN INCIDENT SUMMARY- TOTAL HOURS, PERCENTAGE OF TOTAL DEPARTMENT HOURS AND TIME OPERATING EFFICIENCY\*\*

	REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
TOTAL	3312.2	2543.2	2928.4	3117.4	2479.1	2961.0	1549.8	1385.7
PERCENT	16.335	12.542	14.442	15.374	12.226	14.603	7.643	6.834
EFFENCY	0.664	0.742	0.703	0.684	0.749	0.700	0.843	0.860

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	TOTAL HOURS	DEPARTMENT DIALS DOWN**	AVERAGE	STANDARD DEVIATION
CAUSE 1	2048.0	25.0	81.9	28.2
CAUSE 2	4414.8	98.0	45.0	34.7
CAUSE 3	4178.7	17.0	245.8	146.4
CAUSE 4	5993.4	117.0	51.2	27.5
CAUSE 5	1477.4	111.0	13.5	19.9
CAUSE 6	329.8	13.0	25.4	22.1
CAUSE 7	314.6	15.0	21.0	36.3
CAUSE 8	9.8	2.0	4.9	1.9
CAUSE 9	603.7	13.0	46.4	63.1
CAUSE 10	1.1	1.0	1.1	0.
CAUSE 11	117.6	3.0	39.2	33.9
CAUSE 12	200.6	2.0	100.3	84.1
CAUSE 13	335.1	6.0	55.8	36.3
CAUSE 14	170.2	9.0	18.9	23.5
CAUSE 15	37.7	2.0	18.8	25.9
CAUSE 16	24.3	8.0	3.0	3.7

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**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***  
**CAUSE 1**

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
	1040.3	749.9	486.6			977.6	857.7
	1147.4	6021.5				1069.4	747.8
	2299.6					760.5	1055.8
						826.8	1591.4
						1552.7	473.2
							412.3
							642.9
							917.2

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BM-57258 E

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
334.6	170.0	444.1	502.2	189.2	418.9	1.8	2864.7
138.2	834.2	2898.2	1965.7	136.1	2.4	186.8	594.2
3.3	34.7	36.2	395.5	1528.8	1274.2	538.6	2881.2
1067.0	2970.2	253.5	142.1	207.0	1165.6	395.0	16.1
4788.8	251.7	545.9	203.7	62.9	519.5	5722.4	1138.6
1136.8	1007.9	1085.8	41.3	2.0	26.6	1439.6	
193.3	360.6	978.1	93.7	900.2	74.9	96.4	
1491.5	224.7	494.8	74.2	12.7	660.8		
	375.9	395.8	28.1		1625.4		
	1415.7	1309.1	38.0		198.3		
	212.1	6.6	1120.8		129.8		
	402.9	105.0	270.4		45.6		
	27.9		1720.8		127.2		
			916.8		12.2		
			105.4		183.4		
			88.2		79.0		
			116.9		64.1		
					1083.4		
					337.1		
					901.9		

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**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
1794.7		1515.0	1445.1	1934.1	1050.3		
				3004.4	2841.2		
				1419.6	1117.1		
					1675.2		
					1112.3		

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BR-57168 F

\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\*  
CAUSE 4

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
81.4	2.7	1402.1	61.3	6.6	2.9		
1472.5	666.8	506.1	425.8	2107.1	538.4		
430.9	69.0	335.7	103.0	16.2	453.2		
49.7	99.5	326.7	522.0	105.8	192.0		
111.1	184.4	174.3	162.5	577.0	580.9		
229.2	3507.2	776.9	529.8	399.6	203.4		
255.5	1255.8	31.2	69.1	278.4	584.7		
89.1	76.1	81.8	3096.1	1461.8	356.5		
12.0	1360.7	519.0	281.9	6.7	314.1		
99.5	300.8	195.8	1082.6	105.0	182.5		
109.2		132.5	458.2	352.5	92.5		
124.4		139.8	506.7	326.2	73.4		
156.2		43.1	1035.5	139.8	92.3		
2.3		385.6		959.0	448.3		
148.4		266.2			160.7		
49.4		119.0			70.7		
121.0		76.2			140.6		
75.6		145.6			113.6		
62.5		197.4			304.5		
347.6		270.0			136.8		
137.6		1989.8			1457.5		
903.5					69.2		
36.2					781.4		
152.3					365.5		
365.8							
150.1							
249.0							
161.1							

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\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\*  
CAUSE 5

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
631.1	1203.3	1393.1	2782.2	73.3	305.1	353.6	15.6
1645.3	3.3	2963.8	293.5	4878.6	308.2	323.1	574.4
2217.9	2368.3	529.6	622.6	210.8	205.6	628.3	322.8
	968.9	786.1	286.9	1453.6	357.5	1252.5	712.5
	36.1	358.8	326.6		1094.9	148.0	41.6
	136.6	1045.7	117.7		1.1	585.2	2462.0
	1183.7	0.1	69.6		1044.4	308.2	1008.4
	63.1	492.5	925.7		0.3	130.9	714.7
	1050.3	66.3	1139.2		1.4	558.4	51.5
	987.1		1881.9		0.6	226.4	350.9
	411.6		332.0		1407.1	792.9	0.2
	840.6				11.7	208.3	1.1
	1.3				3.3	357.8	0.7
	0.5				15.5	646.0	70.2
	0.4				5.3	483.7	457.1
					65.6	4.1	179.2
					110.9	1586.2	447.9
					0.9	1.4	928.0
					1063.7	19.1	
					742.6	317.3	
					702.6		
					0.6		
					975.2		

A-10

BM-57168

DECLASSIFIED

\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\*  
CAUSE 6

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
	604.2	1214.6			657.6		
		3074.2			660.1		
		1649.0					

DECLASSIFIED

TI-11

HW-57168

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
	4389.9	3551.9		529.7	704.3	1079.1	
	4147.9			753.4	1000.8		
				6536.2	2965.5		

DECLASSIFIED

A-12

BM-57168 F

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***  
**CAUSE 8**

REACTOR1

REACTOR2

REACTOR3

REACTOR4

REACTOR5

REACTOR6

REACTOR7

REACTOR8

A-13

BA-57168 F

DECLASSIFIED

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***  
**CAUSE 9**

**REACTOR1**  
5588.9

**REACTOR2**

**REACTOR3**  
1373.5  
17.8  
3146.1  
1833.2

**REACTOR4**  
6220.0

**REACTOR5**

**REACTOR6**

**REACTOR7**

**REACTOR8**

**DECLASSIFIED**

A-11

BM-57168 E

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***  
**CAUSE10**

REACTOR1

REACTOR2

REACTOR3

REACTOR4

REACTOR5

REACTOR6

REACTOR7

REACTOR8

A-15

BF-57168 E

DECLASSIFIED

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***  
**CAUSE11**

REACTOR1

REACTOR2

REACTOR3

REACTOR4

REACTOR5

REACTOR6

REACTOR7  
540.7

REACTOR8

A-16

BM-57168 E

DECLASSIFIED

**\*\*INTERVAL BETWEEN LIKE OUTAGES BY CAUSE\*\***

REACTOR1

REACTOR2  
3112.7

REACTOR3

REACTOR4

CAUSE12

REACTOR5

REACTOR6

REACTOR7

REACTOR8

DECLASSIFIED

A-17

HW-57168

••INTERVAL BETWEEN LIKE OUTAGES BY CAUSE••  
CAUSE13

REACTOR1  
272.6

REACTOR2

REACTOR3

REACTOR4

REACTOR5  
517.8  
28.6

REACTOR6

REACTOR7

REACTOR8

DECLASSIFIED

A-18

BM-57168 E

INTERVAL BETWEEN LIKE OUTAGES BY CAUSE

REACTOR1	REACTOR2	REACTOR3	REACTOR4	REACTOR5	REACTOR6	REACTOR7	REACTOR8
312.5			115.3	10.1	1.1		

DECLASSIFIED

A-19

BM-57168

INTERVAL BETWEEN LINE OUTAGES BY CAUSE\*\*  
CAUSE 15

REACTOR1  
5512.3

REACTOR2

REACTOR3

REACTOR4

REACTOR5

REACTOR6

REACTOR7

REACTOR8



A-20

BM-57168 F

DECLASSIFIED

••INTERVAL BETWEEN LIKE OUTAGES BY CAUSE••  
CAUSE16

REACTOR1  
3936.5

REACTOR2  
3340.8

REACTOR3

REACTOR4  
8137.4

REACTOR5

REACTOR6  
0.7

REACTOR7

REACTOR8

DECLASSIFIED

A-01

BM-57168 R

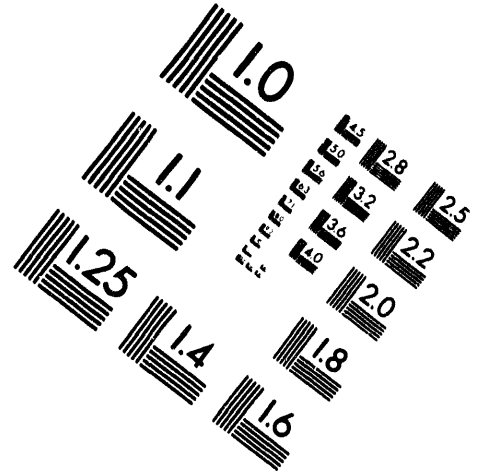
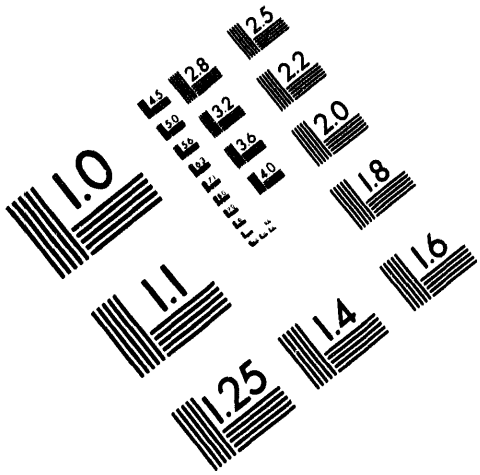




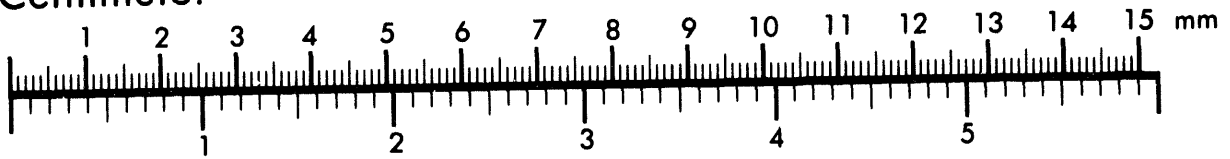
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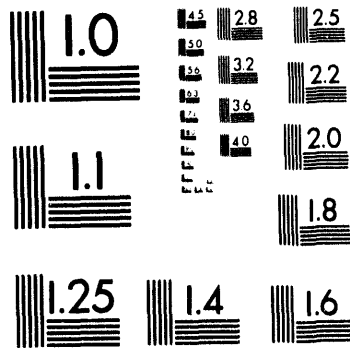
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Silver Spring, Maryland 20910  
301/587-8202



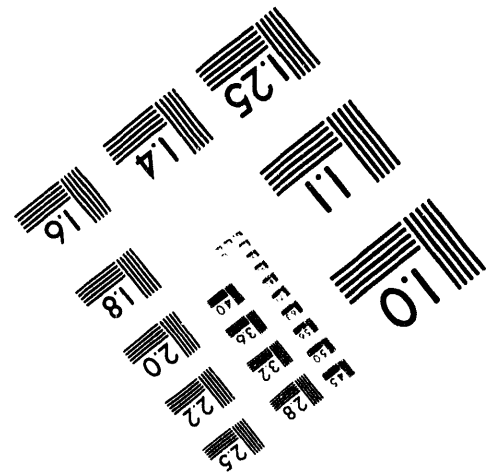
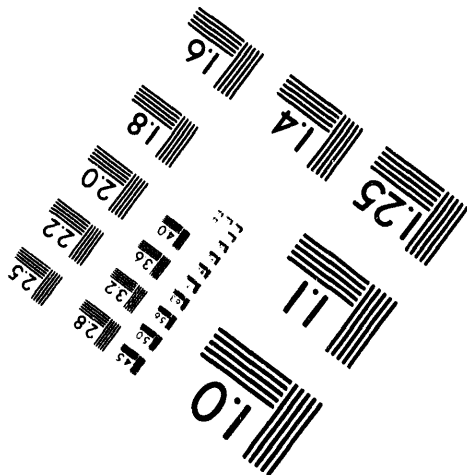
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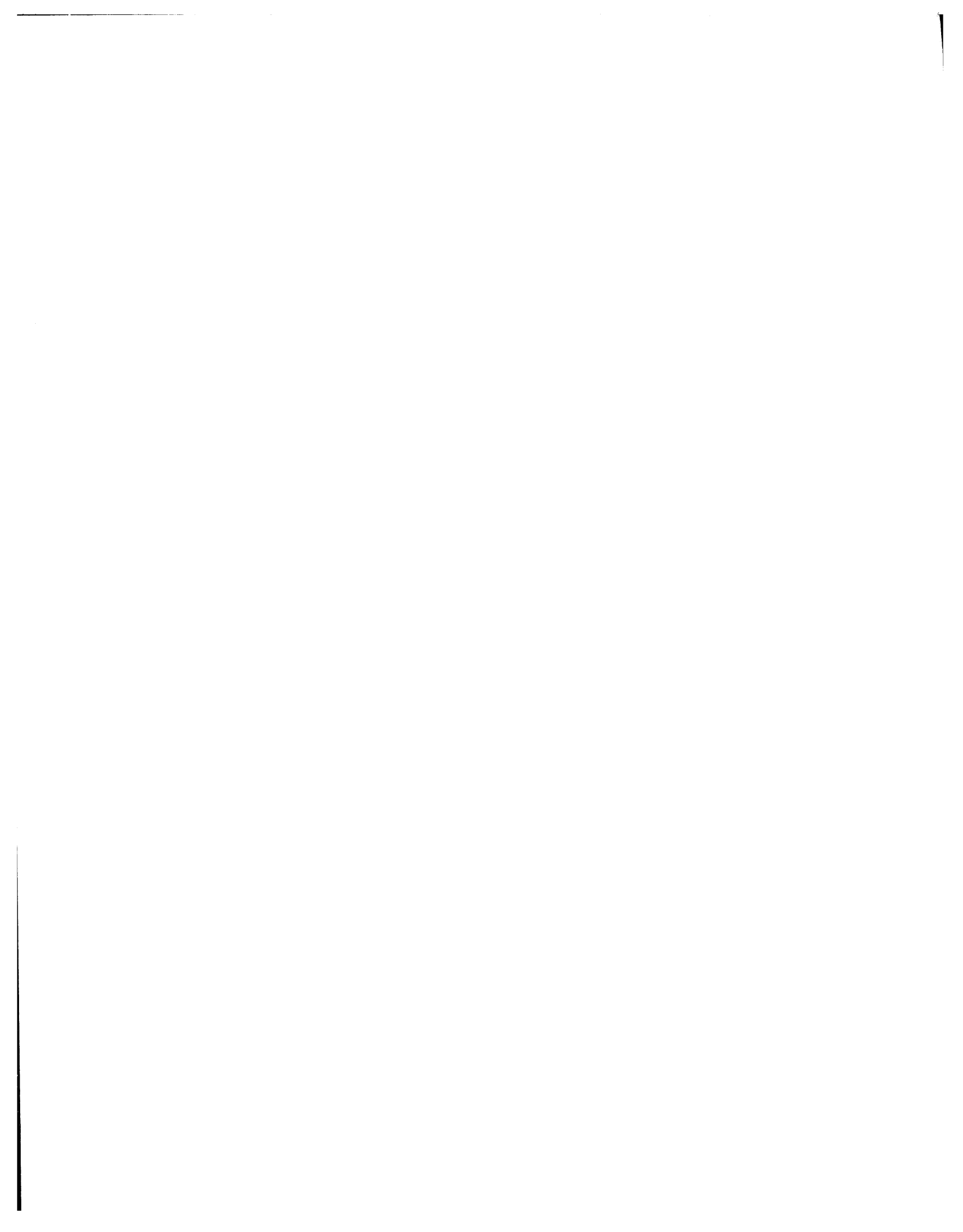


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