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DATA BANKS FOR RISK ASSESSMENT AT THE SAVANNAH RIVER SITE (U)

by

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William S. Durant, C. Ray Lux, and Donna F. Baughman

ABSTRACT

The Savannah River Site maintains a compilation of operating problems and equipment failures that have occurred in the fuel reprocessing and other areas in the form of computerized data banks.

INTRODUCTION

One of the lessons learned from the explosion scenarios discussed in reference 1 is that mistakes of the past are soon forgotten if no method is available to retrieve and review these events. Savannah River Site has for many years maintained a system for recording, retrieving, and reviewing its incident history. The system is based on a series of data banks developed primarily for risk assessment. Six such banks exist for reprocessing, fuel fabrication, tritium, reactor, laboratory, and naval fuels facilities (Slide 1).

DISCUSSION

The original data bank was developed in 1973 for the SRS nuclear fuel reprocessing plants (including waste management facilities). Dates of entries range back to plant startup in 1953 and include equipment failures, process upsets, operating errors, facility contamination, personnel injuries, environmental insults, etc. Basically, if the event was of sufficient concern to record someplace, it was considered sufficiently important to abstract into the data bank. As of 1990, this data bank contains approximately one quarter million entries (Slide 2).

About 90 internal sources of data are routinely searched for information. These sources are either published; that is, any report that is typed, or unpublished; such as shift turnover log books that are hand written. Examples of published reports are operating incident reports, special hazards investigations, plant technical monthly reports, fire department reports, and criticality audits (Slide 3). Because the data bank contains abstracts rather than full

text, applicable sections of the source document are highlighted and coded to enable the data bank clerks to determine the information to be processed (Slide 4).

Examples of unpublished logs include senior supervisor log books, health protection log books, burial ground log books, and decontamination and maintenance log books (Slide 5). Approximately 25,000 pages are scanned annually for items of interest. Despite an occasional legibility problem, the logs are the most valuable source of the less significant events (Slide 6).

Each entry is coded to record the source of the data, the date of occurrence, and four sets of specifications to reflect which of the two reprocessing plants is applicable, the specific facility within that plant, the unit operation within the facility, and key words to reflect the specific occurrence (Slide 7). An almost unlimited number of plants, facilities, unit operations, and key words can be applied to a single entry (Slide 8). The repair time (the time between detection of a fault and restoration of the system) and the consequence where it can be expressed numerically are recorded in fields separate from the general text of the entry. Data may be sorted by any combination of the specifications using either "or", "and", or "not" logic. In addition, embedded words or phrases in the text may be specified.

Although the data bank was originally intended as a source of information for the probabilistic risk assessments performed at the Savannah River Laboratory, many other uses have been discovered. These include failure rate data, equipment breakdown histories, generic incident histories, trend analyses, training, audits, and incident investigations (Slide 9).

All incident investigations are required to be accompanied by a search of the data bank for similar events. This provides immediate evidence even to less experienced personnel whether a recurring problem exists. It also provides additional information for root cause analysis.

Where quantitative statistical information is required, such as for safety analysis reports, the data bank and its accompanying statistical analysis packages provide an invaluable resource (slide 10). Data for a given scenario is sorted to a named record in the computer library. A computer code named STATPAC-2 is evoked to react to the dates of the sorted information. STATPAC-2 determines the best fit distribution of the times-between-occurrences from normal, lognormal, Weibull, exponential, and log uniform equations. From the distribution, mean, median, and standard deviation values are calculated for the frequency of the event. In addition, plots of the data fit (Slide 11)

and trend as a function of time (Slide 12) are provided. Repair times and consequences (Slide 13) are calculated directly from the data bank based on the data recorded in specific fields.

The location of particularly vulnerable operations to any given event may also be determined directly from the data bank. For example, the overall frequency of a transfer error may be determined by sorting and analyzing the error itself; however, the most vulnerable location is immediately evident (Slide 14).

The data bank provides information necessary for reliability studies of process equipment by use of a Weibull analysis. The Weibull analysis was developed to predict the characteristic life of equipment in which some of the units had failed while others have not. For example, based on data contained in the bank for process agitators, the characteristic life is calculated to be 6040 days (Slide 15).

The cost of maintaining a data bank has through the years been of concern to a number of managers at other DOE sites. The initial 8000 entries were abstracted by five technical people over a four month interval. Because of significant enhancements to the system of data bank management, about 2/3 of one technical person is required for marking entries to be abstracted, editing, coding, and computer support. In addition, a data bank specialist and three clerks manage and support information flow and data processing (Slide 16). Some of the enhancements that have significantly reduced costs include abstracting onto a personal computer rather than manually, entering the data by electronic transfer rather than by punch cards, more reliance on clerical personnel rather than technical personnel, and interactive sorting rather than batch sorting (Slide 17).

A detailed history and description of the data bank is contained in an IEEE publication, Reference 2 (Slide 18). In addition, data on a number of types of process equipment have been published in DOE research and development reports including evaporators, manipulators, cranes, agitators, pumps, and centrifuges, References 3-8 (Slide 19). Data that are not already published can be obtained by contacting the authors; however, release of the data is subject to review and approval of the US Department of Energy. Unpublished data do not represent official records of specific events nor are they intended to include information of a personal and confidential nature; eg, personnel radiation and medical records.

Some typical examples of information contained in the data bank include data on robots (Slide 20), fires (Slide 21),

instrument pluggage (Slide 22), criticality potential (Slide 23), and computers (Slide 24).

The validity of the data bank depends heavily on the coding of the entries. Improperly coded data can provide erroneous results. It is important that the data be consistently coded. At present, each facility has an individual responsible for the coding of the data from that facility. Therefore, a thorough understanding of the coding techniques and the meaning of the various codes is limited to a few individuals. To maintain the integrity of the data bank, it is imperative that this knowledge be captured for future use. The use of artificial intelligence is being considered. We anticipate that an expert system can be developed to emcompass the present knowledge about coding of the data and provide helpful assistance to individuals attempting to use the data.

The introduction of personal computers to the data extraction process has greatly simplified the task. It now appears that another giant step is on the threshold. IBM has developed voice recognition software for the personal computer. The software allows direct conversion of speech to text. The computer is first educated with a vocabulary using the operator's voice. Once the computer is trained, the operator is able to produce data entries by merely speaking them. The software is being evaluated to determine if it meets all of our requirements. (Slide 25).

In conclusion, the data banks have been invaluable resources to the safety analysis and risk management effort at Savannah River. We anticipate that the banks will continue to grow and future developments will be forthcoming to further reduce the cost and increase the utilization.

REFERENCES

1. W.S. Durant, L.W. Gray, R.M. Wallace, and W.W.F. Yau. Explosions and Other Uncontrolled Chemical Reactions at Non-Reactor Nuclear Facilities of the Savannah River Plant. DP-MS-88-15. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC 29808-0001, September 1988.

2. W.S. Durant, C.R. Lux, and W.D. Galloway. "Data Bank for Probabilistic Risk Assessment of Nuclear-Fuel Reprocessing Plants". IEEE Transactions on Reliability, Vol. 37, No. 2, pp. 138-143. June 1988.

3. W.S. Durant and W.D. Galloway. Evaporator Operating Problems and Equipment Failures - H-Canyon Reprocessing Facility at the Savannah River Plant. DP-1681. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC 29808-0001, June 1984.

4. W.S. Durant and W.D. Galloway. Manipulator Operating Problems and Equipment Failures - Fuel Reprocessing Facilities - Savannah River Plant. DP-1696. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC 29808-0001, January 1985.

5. W.S. Durant and W.D. Galloway. Hot Canyon Crane Operating Problems and Equipment Failures - F-Canyon Reprocessing Facility - Savannah River Plant. DP-1713. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC 29808-0001, February 1986.

6. W.S. Durant, J.B. Starks, and W.D. Galloway. Process Pump Operating Problems and Equipment Failures - F-Canyon Reprocessing Facility - Savannah River Plant. DP-1731. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC 29808-0001, February 1987.

7. W.S. Durant, J.B. Starks, J.M. Low, and W.D. Galloway. Process Agitator Operating Problems and Equipment Failures - F-Canyon Reprocessing Facility - Savannah River Plant. DP-1775. E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken SC 29808-0001, September 1988.

8. W.S. Durant, M.L. Cowen, and D.F. Baughman. Process Centrifuge Operating Problems and Equipment Failures in Canyon Reprocessing Facilities. WSRC-RP-89- . Westinghouse Savannah River Company, Savannah River Site, Aiken SC 29802-0001, December, 1989.

ACKNOWLEDGMENT

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SLIDE #1

DATA BANKS FOR RISK ASSESSMENT AT SRS

W. S. DURANT

BANK	NUMBER OF ENTRIES
200 AREA	200,000
300 AREA	19,000
TRITIUM	10,000
100 AREA	5,000
SRL	3,000
NAVAL FUELS	300

SLIDE #2

200 AREA FAULT TREE DATA BANK

- MAINTAINED SINCE 1973 WITH DATA RANGING BACK TO 1953
- CONTAINS > 200,000 ENTRIES
- ENTRIES INCLUDE EQUIPMENT FAILURE, PERSONNEL ERROR, PROCESS UPSETS, ETC.
- ABOUT 70 INTERNAL SOURCES OF DATA ARE ROUTINELY ABSTRACTED

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SLIDE #3

SELECTED PUBLISHED SOURCES OF DATA

- ❑ OPERATING INCIDENT REPORTS
- ❑ SPECIAL HAZARDS INVESTIGATIONS
- ❑ PLANT TECHNICAL MONTHLY REPORTS
- ❑ DAILY TELETYPES
- ❑ FIRE DEPARTMENT REPORTS
- ❑ WORKS ENGINEERING MONTHLY REPORTS
- ❑ WASTE MANAGEMENT MONTHLY REPORTS
- ❑ CRITICALITY AUDITS
- ❑ POWER DEPARTMENT INCIDENT REPORTS

SLIDE # 4

MARCH 5, 1985

TO: T. A. MOORE, 703-A

FROM: I. K. SULLIVAN, 703-H
R. J. VERO, 703-F

H-AREA SWE-ES DAILY REPORT

PERSONNEL

S. R. GRUNDY - Attended the final new employee orientation today. Health Protection and Security were the topics of discussion.

BUSINESS
221-H

QUICKSET PAN/TILT - D. C. DEL VECCHIO - E & I is continuing to wire the new connectors and install them in the third Quickset Pan/Tilt. Probable completion and installation on the Hot Crane is by 3/8/85.

10 TON HOIST FLEXIBLE COUPLING - J. W. WONG - SWE-ES and Maintenance will install flexible coupling on 8-4 shift, 3/6/85.

CRANE LUBRICATION - J. W. WONG - Necessary lubricants for maintenance of 221-F&H Hot and Warm Cranes have been ordered per scope of work found in SWE-ES Crane Lubrication Evaluation memo.

HOT CRANE - D. C. DEL VECCHIO/J.W. WONG - E & I repaired the south monorail drifting problem. The brake gear was slipping and the problem was resolved by installing a new keyway.

WARM CRANE - D. C. DEL VECCHIO/J. W. WONG - Operation Routine.

IMPROVED SPECIFICATIONS DISSOLVER LID GASKET - B. A. SHINN - Contacted Purchasing to determine current vendor and specifications for 6.4 dissolver lid gasket. Purchasing does not have records of current vendor, and material specifications would not be located. Investigation will continue to determine this information. Use of an

SLIDE # 5

SELECTED UNPUBLISHED SOURCES OF DATA

- SENIOR SUPERVISOR LOG BOOKS
- HEALTH PROTECTION DEPT. LOG BOOKS
- BURIAL GROUND LOG BOOKS
- WASTE MANAGEMENT LOG BOOKS
- SALVAGE YARD RECEIPT RECORDS
- CANYON CRANE LOG BOOKS
- DECONTAMINATION AND MAINTENANCE LOG BOOKS

SLIDE 6

LOG BOOK ENTRIES

✓ * "attempted to DOP test filter on ~~[illegible]~~ warm Crane. test was unsuccessful." VTO.

✓ * "SWC repaired contact on AC unit of Warm Crane. ~~*~~ Fan not running"

* Sparged pot in HDC & SP.

* OT personnel worked in WDC cleaning centrifuge.

✓ * "blew down 7.7E traps."

* Performed rounds all ok.

* Worked on "C" shift tanks.

* Performed HK in assigned area.

* Worked on 14.2 → 18.4 setup. loop → loop [illegible] in sect. 16. Need to reground [illegible] and install and leak check.

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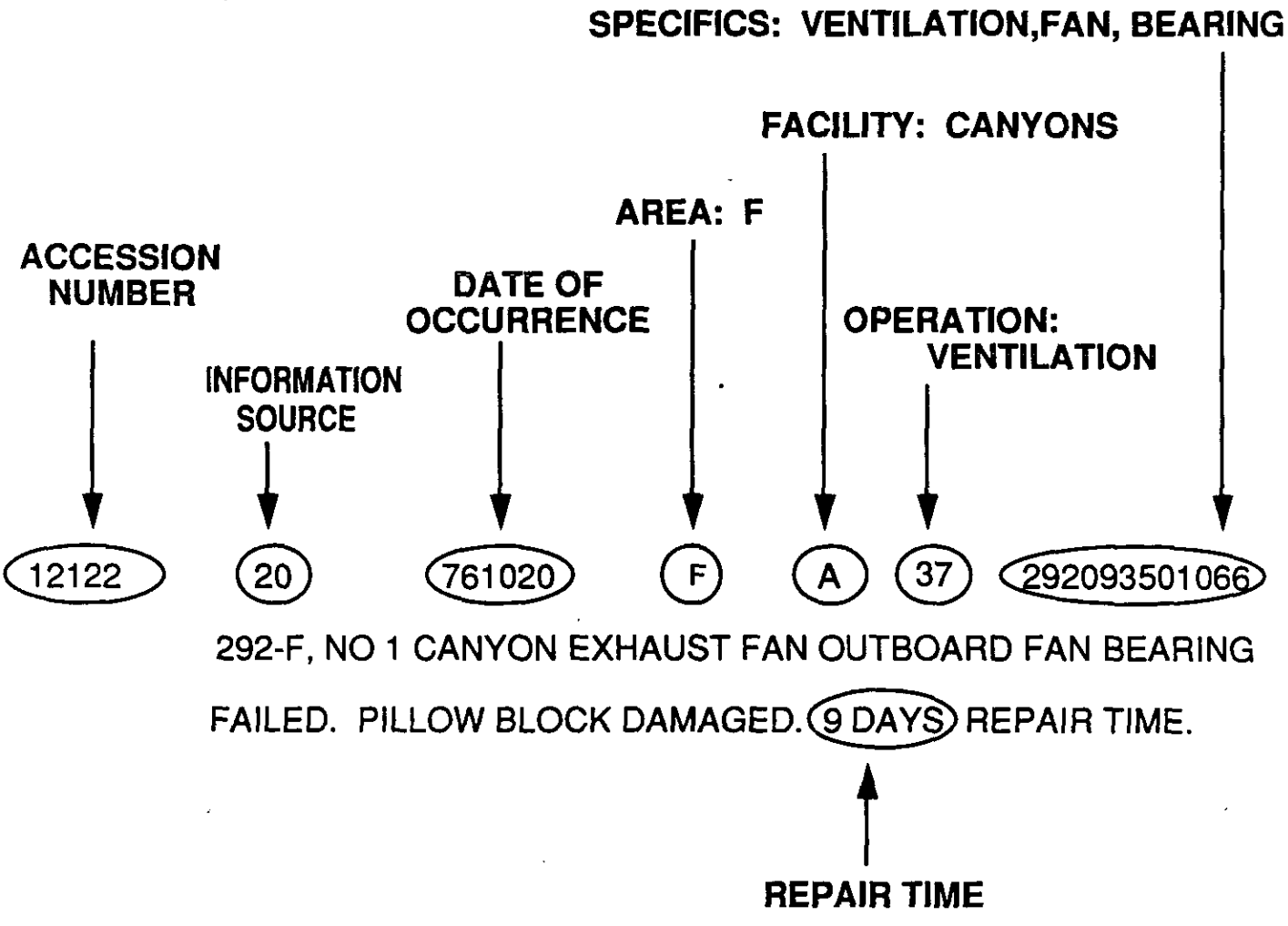
SLIDE # 7

SORT OPTIONS

- PLANT AREA
- FACILITY
- UNIT OPERATION
- KEY WORD
- SOURCE OF INFORMATION
- "AND" OR "NOT" LOGIC
- DATE OR RANGE OF DATES
- EMBEDDED WORDS OR PHRASES IN TEXT

SLIDE 8

ANATOMY OF A DATA ENTRY



SLIDE # 9

APPLICATIONS OF FAULT TREE DATA BANKS

- ❑ FAILURE RATE DATA
- ❑ EQUIPMENT BREAKDOWN HISTORIES
- ❑ GENERIC INCIDENT HISTORIES
- ❑ DATA FOR SYSTEMS ANALYSES AND SAFETY ANALYSIS REPORTS
- ❑ DATES OF SPECIFIC INCIDENTS
- ❑ DATA FOR DESIGN STUDIES
- ❑ DATA FOR QUALITY ASSURANCE STUDIES
- ❑ TREND ANALYSES
- ❑ DATA FOR PROJECT JUSTIFICATION

SLIDE #10

QUANTITATIVE STATISTICAL INFORMATION GENERATED FROM DATA BANK

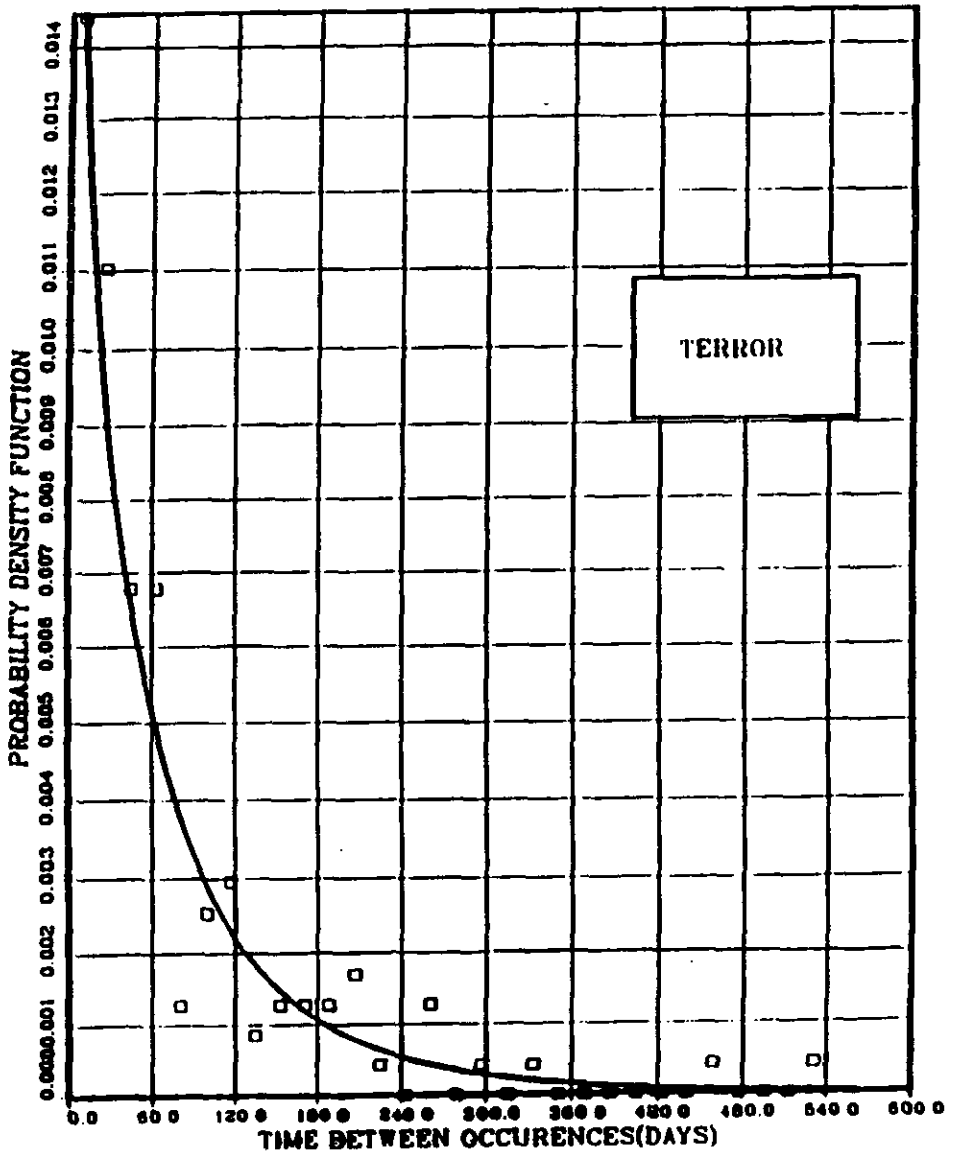
- O FREQUENCY OF EVENTS
  - FITTED TO STANDARD DISTRIBUTION (LOGNORMAL, WEIBULL, ETC.)
  - CALCULATES MEAN, MEDIAN, STD. DEVIATION VALUES
  - PROVIDES TREND PLOT
- O REPAIR TIMES FOR EQUIPMENT
  - CALCULATED DIRECTLY FROM DATA BANK
- O CONSEQUENCES OF ACCIDENTS
  - CALCULATED DIRECTLY FROM DATA BANK

SLIDE 11

FREQUENCY OF TIME BETWEEN OCCURRENCES

OBSERVED DATA FITTED BY WEIBULL DISTRIBUTION CURVE

F CANYON TRANSFER ERRORS



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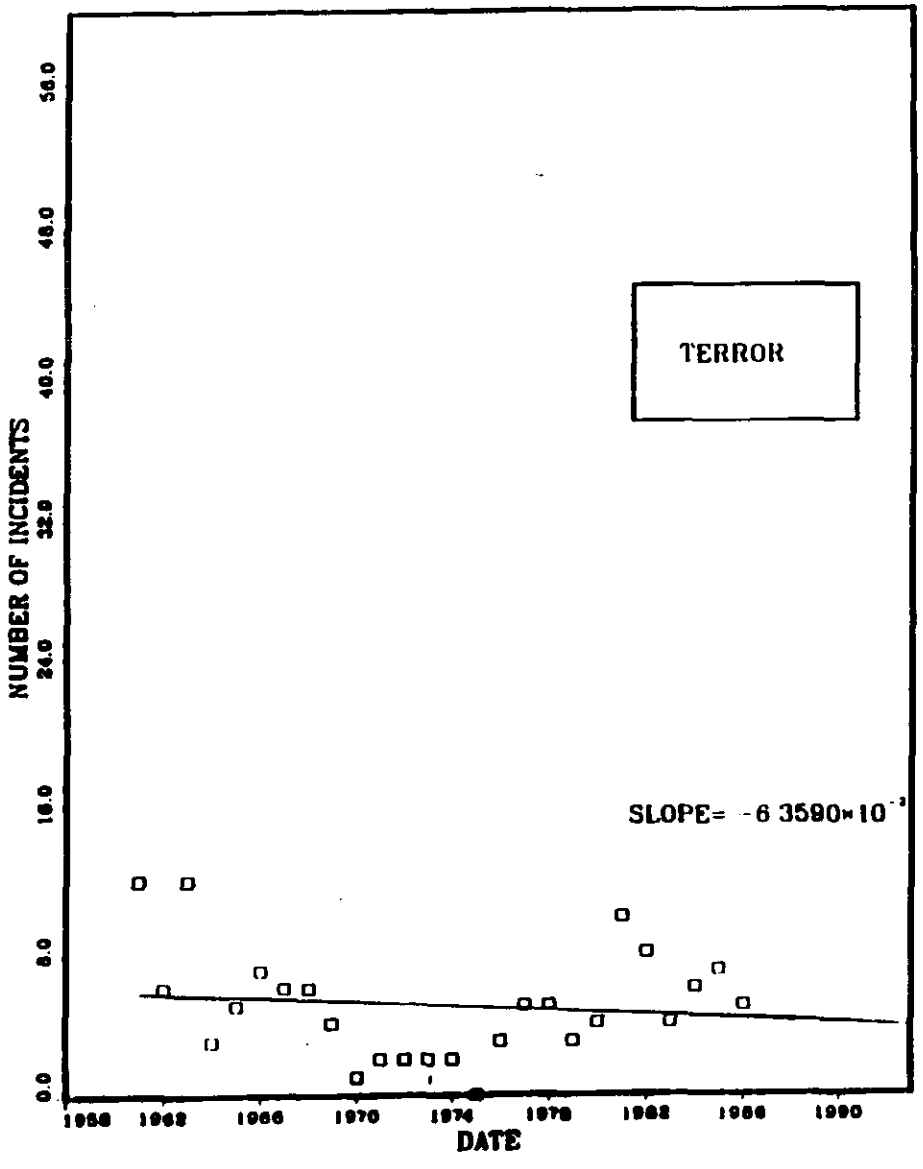
SLIDE 12

NO. OF OCCURRENCES OVER OBSERVATION PERIOD

F CANYON TRANSFER ERRORS



SLIDE # 13

MASSES OF MATERIALS INVOLVED IN TRANSFER ERRORS*

SYSTEM	MEAN, LB	MEDIAN, LB	90% ERROR BOUNDS, LB
Canyon Process material	3,170	2,460	434 - 9,000
Chemicals	14,620	2,865	133 - 72,250
Water	36,290	2,920	252 - 290,000
Ion exchange material	280	94	16 - 2,720

SLIDE # 14

TRANSFER ERRORS -- CANYON SYSTEM IN WHICH ERROR WAS INITIATED

SYSTEM	NUMBER OF RECORDED OCCURRENCES 1961-1986	FREQUENCY, OCCURRENCES/HR
Cold Chemicals	45	2 x 10-4
Dissolving	14	6 x 10-5
Ion Exchange	14	6 x 10-5
Solvent Extraction	13	6 x 10-5
Evaporation	12	5 x 10-5
FB-Line	10	4 x 10-5
Solvent Recovery	5	2 x 10-5
Sumps	4	2 x 10-5
Waste Disposal	4	2 x 10-5
211-F	2	9 x 10-6
Head End	1	4 x 10-6
Drain Header	1	4 x 10-5
Bucket Storage	1	4 x 10-6
Not Identified	2	9 x 10-4
TOTAL	128	6 X 10-4

NUCLEAR PROCESSES SAFETY RESEARCH
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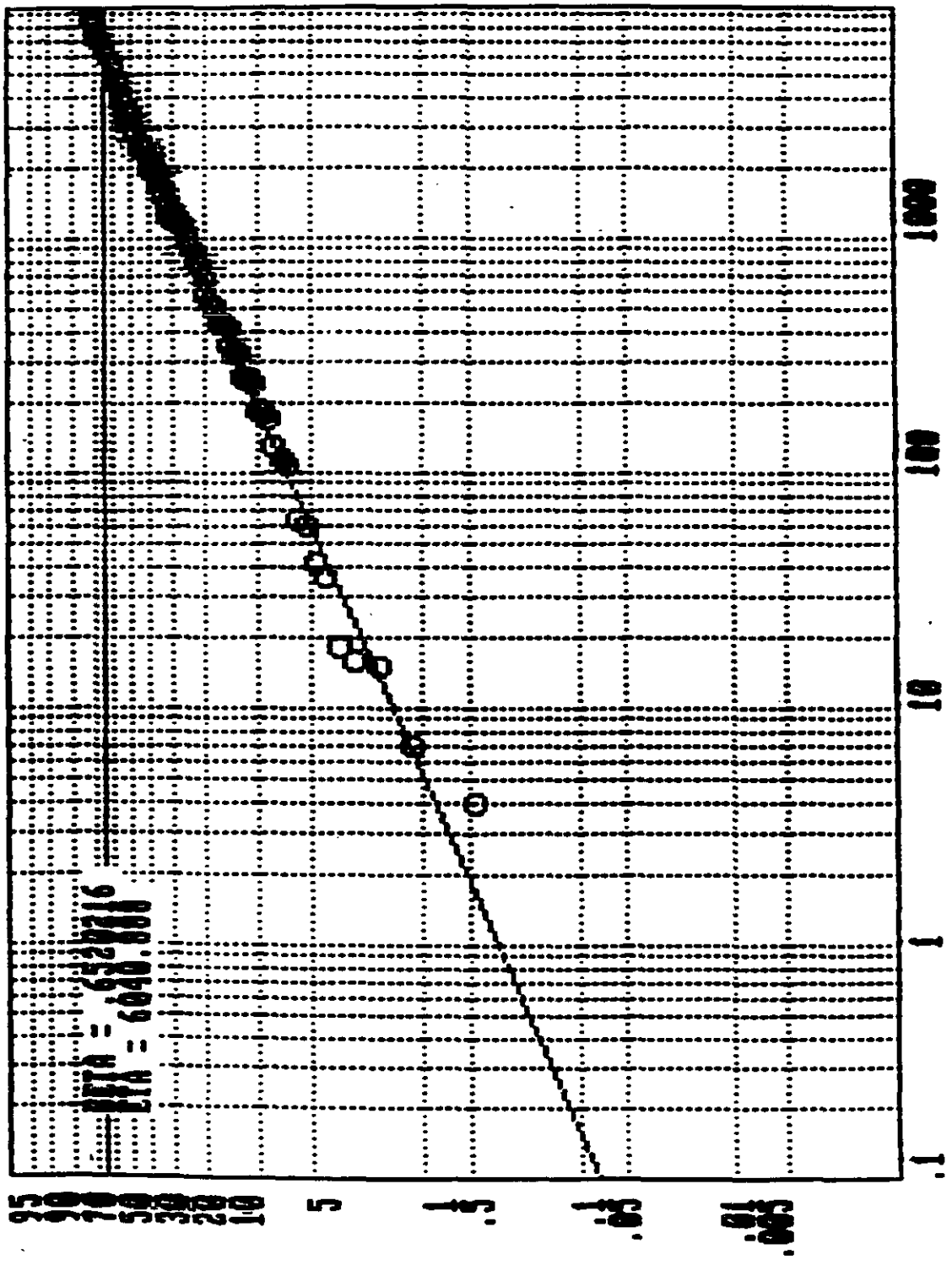
SLIDE 15

FIGURE 4. Weibull Failure Analysis of F-Canyon Agitators



SLIDE # 16

PERSON POWER

- 2/3 OF ONE TECHNICAL PERSON
  - MARKING ENTRIES TO BE ABSTRACTED
  - EDITING
  - CODING
  - COMPUTER SUPPORT
- 1 DATA BANK SPECIALIST
- 3 DATA BANK CLERKS

SLIDE # 17

COMPARISON OF 1974 AND 1987 DATA MANAGEMENT PRACTICES

1974	1987
DATA BANK CAPACITY 99,999	DATA BANK CAPACITY 999,999
DATA ABSTRACTED BY HAND	DATA ABSTRACTED BY IBM PC
DATA ENTERED TO MAIN-FRAME VIA PUNCHED CARDS	DATA ENTERED TO MAIN-FRAME VIA ELECTRONIC TRANSFER
PUNCHED CARD BACKUP FILE	MULTIPLE MAGNETIC TAPE BACKUP FILES
MANUAL DATA COMPRESSION	COMPUTER DATA COMPRESSION
DATA PROCESSED BY EXEMPT TECHNICAL PERSONNEL	DATA PROCESSED BY NON-EXEMPT CLERICAL PERSONNEL
MANUAL STATISTICAL ANALYSIS	COMPUTER STATISTICAL ANALYSIS
BATCH SORTING	INTERACTIVE SORTING

SLIDE # 18

HISTORY AND DESCRIPTION OF DATA BANK

W. S. Durant, C. R. Lux, and W. D. Galloway. "Data Bank For Probabilities Risk Assessment of Nuclear-Fuel Reprocessing Plants." IEEE Transactions On Reliability, VOL. 37, No. 2, pp. 138-143. June 1988.

SLIDE # 19

PUBLICATIONS CONTAINING DATA

- W. S. Durant and W. D. Galloway. "Evaporator Operating Problems and Equipment Failures H-Canyon Reprocessing Facility at the Savannah River Plant." DP-1681 (June 1984).
- W. S. Durant and W. D. Galloway. "Manipulator Operating Problems and Equipment Failures - Fuel Reprocessing Facilities - Savannah River Plant." DP-1696 (January 1985).
- W. S. Durant and W. D. Galloway. "Hot Canyon Crane Operating Problems and Equipment Failures - F-Canyon Reprocessing Facility - Savannah River Plant." DP-1713 (February 1986).
- W. S. Durant, J. B. Starks, and W. D. Galloway, "Process Pump Operating Problems and Equipment Failures - F-Canyon Reprocessing Facility - Savannah River Plant. " DP-1731 (February 1987).**
- W. S. Durant, J. B. Starks, J. M. Low, and W. D. Galloway. "Process Agitator Operating Problems and Equipment Failures F-Canyon Reprocessing Facility." DP-1775 (September 1988).**
- W. S. Durant, M. L. Cowen, D. F. Baughman, "Process Centrifuge Operating Problems and Equipment Failures in Canyon Reprocessing Facilities." WSRC-RP-89-( )(1989).**

** Includes failure rate analysis

****
200 AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM
****

11/17/89

SPECIFICS : ROBOT

RANGE OF DATES : 01/1980 TO 03/1980

NO.	SOURCE	DATE	OCCURRENCE
79108	40, , , ,	01-03-80	ROBOT "BIG GEORGE" HITTING THE STOP PEG WHEN IT COMES DOWN CAUSING METAL TO SCRAPE OFF THE BACK PLATE OF THE ROBOT. 4-12
79109	40, , , ,	01-03-80	ONE OF THE DIE CARTS WONT POSITION UNDER THE ROBOT CORRECTLY BECAUSE THE STOP HAS BECOME BENT BACK. 4-12
79113	40, , , ,	01-05-80	"GEORGE" BECOMING SLOWER AND SLOWER. ALMOST WONT GO AT ALL. 4-12
79154	40, , , ,	02-05-80	THE ROBOT (GEORGE) VERY SLOW WHEN STARTING EACH CYCLE. 4-12
79159	40, , , ,	02-06-80	THE ROBOT ROTATED CLOCKWISE ABOUT 5-10 DEGREES WHEN THE BOTTOM OF DIE STRUCK THE TOP CORNER OF NEW DIE LOADER PAD. THE TOP ANCHOR NUT WAS LOOSENED, AND THE ROBOT WAS REPOSITIONED. WHEN THE TOP ANCHOR NUT WAS BEING TIGHTENED. IT CAME OFF. 4-12. 2 SHIFTS.
79172	40, , , ,	02-11-80	ASKED MAINT. TO REPLACE MAGNETIC STOP AT ROBOT. 8-4
79177	40, , , ,	02-13-80	MAINT REPLACED MAGNETIC STOP AT ROBOT. 8-4
79178	40, , , ,	02-13-80	POWDER SPILLED WHEN THE ROBOT MISSED THE TROLLY WITH THE DIE. 4-12
79179	40, , , ,	02-15-80	EXPERIENCED SOME TROUBLE WITH ROBOT, WOULD NOT RETRACT ARMS. 4-12
79181	40, , , ,	02-15-80	NEED TO HAVE MAGNETIC STOP AT ROBOT REPAIRED OR REPLACED. 4-12
79200	40, , , ,	02-24-80	THE ROBOT MOVES VERY SLOW AT TIMES, TAKES ALMOST 2 MIN. TO GO THROUGH THE CYCLES, AT TIMES. 8-4.
79201	40, , , ,	02-24-80	THE ROBOT SLIPPED ABOUT 10 DEGREES CLOCK WISE, TWICE. 8-4
79203	40, , , ,	02-24-80	STILL HAVING MUCH TROUBLE WITH EQUIPMENT. TIGHTENED BOLTS ON THE ROBOT AND AIR MOTOR ON DIE-LOADER. THE BOLTS ON LOADER KEEP WORKING LOOSE. THE SHAFT DRIVE ON LOADER NOT ROTATING CORRECTLY. 4-12
79210	40, , , ,	02-26-80	ROBOT SLIPPED SEVERAL TIMES AND WAS REPOSITIONED. 4-12
79235	40, , , ,	03-12-80	PRESSURE REGULATOR TO DIE LOADER STARTED LEAKING. LEAK WAS SO BAD THAT PRESSURE WAS LOST, AND DIE LOADER NOR ROBOT WOULD OPERATE. 4-12
79239	40, , , ,	03-16-80	AIR LINE TO THE ROBOT CAME OFF AT 10:45 PM. 4-12. 3 SHIFTS.
79243	40, , , ,	03-18-80	10:25 PM, WHEN A AIR LINE ON ROBOT BROKE. 4-12

SLIDE 20

NUCLEAR PROCESSES SAFETY RESEARCH
SAVANNAH RIVER LABORATORY

****
200 AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM
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11/17/89

AREA : F

OPERATION : FIRES

SPECIFICS : FIRE

RANGE OF DATES : 01/1980 TO 12/1987

NO.	SOURCE	DATE	OCCURRENCE
78571	28,02,49, ,	02-04-80	PEF MAINT RM - AT APPROX. 10:05 AM, FIRE ALARM BOX NO. 32 SOUNDED. ELECTRIC MOTOR ON ARGON PURIFICATION UNIT UNDER CAB. NO. 7 BURNED INTERNALLY ACTIVATING HALON FIRE SUPPRESSION SYSTEM. 8-4
102477	25, , , ,	03-10-80	TRAILER FIRE - MOVING NO. 3 DEIONIZER TRAILER, SRO 2927 FROM 105-P TO 105-K, PATROLMAN NOTICED SMOKE COMING FROM THE LEFT REAR WHEELS OF THE TRAILER. SOME FLAMES IN THE SAME AREA AND IN THE RIGHT REAR WHEEL AREA. HEAT IN THE BRAKE AREA OF THE REAR WHEELS MELTED THE OIL SEAL AND PERMITTED THE LUBRICAION OIL TO GET ON THE HEATED BRAKE SURFACES WHERE THE OIL IGNITED.
44182	27,01,10,07,28	04-16-80	PIPE WELDING OPERATION INSIDE PLASTIC CONTAINMENT HUT IN COUPLING MAINTENANCE ROOM NO. 2 ON 5TH LEVEL OF JB-LINE CAUSED IGNITION OF PLASTIC TAPE AND CONSUMPTION OF 1.5 SQ. FT. OF HUT PLASTIC. TAPE WAS NOT FIRE RETARDANT IN VIOLATION OF DPSOL. POTENTIAL FOR CONTAMINATION AND BURNS TO WELDER. SI-80-4-46. OI-221-F-JB-80-4. 1046X10-12MICROCI PU/CC. ALSO SOURCE 36.
102485	28, , , ,	05-28-80	SANITARY LANDFILL - BUILDING 740-G - THE FIRE APPARENTLY WAS CAUSED BY FAILURE OF A GASKET AT THE FUEL FILTER WHICH RESULTED IN FUEL SPRAYING ON A HOT EXHAUST MANIFOLD.
65713	08, , , ,	06-10-80	A FIRE OCCURRED IN A CLEAN DUMPSTER LOCATED NEAR 222-F. THE FIRE IS BELIEVED TO HAVE STARTED AS A RESULT OF A CHEMICAL REACTION FROM DISCARDED MATERIAL.
47614	27,28,08,36,	07-21-80	PLASTIC VACUUM CLEANER IN THE MECHANICAL-LINE PRESSURE CHAMBER WAS LEFT RUNNING BY OPERATOR AND HE LEFT ROOM. IT CAUGHT ON FIRE (PROBABLY FROM OVERHEATING) AND FIRE BURNED OFF ONE GLOVE AT SPHINCTER. HP INSPECTOR FOUND FIRE AND DISCHARGED HALON CYLINDER THROUGH OPEN GLOVE PORT TO EXTINGUISH FIRE. THE FIRE SUPPRESSION SYSTEM HAD NOT ACTIVATED BECAUSE NEAREST DETECTOR (HEAT DETECTOR) WAS ABOUT 6 FT AWAY. BUTTONS (CONT 47615)
47615	27,28,08,36,	07-21-80	(CONT FROM 47614) MAY BE CONTAMINATED WITH CARBON FROM SOOT. 2125 RCG AIRBORNE IN MLO 1. SI-80-7-91.

SLIDE 21

NUCLEAR PROCESSES SAFETY RESEARCH
SAVANNAH RIVER LABORATORY

****
200 AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM
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11/17/89

AREA : H

SPECIFICS : INSTRUMENT MALFUNCTION
PLUGGAGE

RANGE OF DATES : 01/1985 TO 02/1985

NO.	SOURCE	DATE	OCCURRENCE
220393	48, , , ,	01-00-85	EVAPORATOR 2H HAD A SPACE GAIN OF 140,000 GALLONS. TOTAL DOWNTIME WAS 286 HOURS (16 HOURS FOR DESALT/DESCALE, 156 HOURS FOR INSTRUMENT REPAIRS, 36 HOURS FOR WELL WATER LEAK, 8 HOURS FOR TANK 41 FAN REPAIR, 22 HOURS FOR TUBE BUNDLE HYDROTEST AND 48 HOURS FOR TANK 41 JET REPLACEMENT).
139286	69, , , ,	01-01-85	STEAM BLEW 7.7E SP. GR. DIP TUBES TO REMOVE PLUGGAGE.
139288	69,32, , ,	01-01-85	STEAM BLEW 7.6E SP. GR. DIP TUBES TO REMOVE PLUGGAGE.
173213	28, , , ,	01-01-85	H.M. RECORDER #21 IS OUT OF ORDER. MONITOR THE 2ND LEVEL. 4-12.
139293	69,04,32, ,	01-02-85	STARTUP OF THE CYCLE WAS DELAYED APPROXIMATELY 10 HRS. DUE TO PLUGGED 12.3 TO 13.1M 1AF FEED JET.
139294	69,32, , ,	01-02-85	SECOND URANIUM CYCLE. 1.5 HRS. DOWNTIME RESULTED FROM PLUGGED 14D 1DS-FS FEED TANK FILTERS.
167774	32, , , ,	01-02-85	E & I REPAIRED 14.2 COLORIMETER. 4-12
184539	45, , , ,	01-02-85	E&I REPAIRED CAM MACHINE IN CONTROL ROOM.
139303	69,28,32, ,	01-03-85	REPAIRING CAM IN HOT CRANE CAB.
173219	28, , , ,	01-03-85	SANDFILTER - SEP. ENTERED SANDFILTER AND RESET MERCURY SWITCH ON TOP OF SAND IN LATERAL #6.
156906	41, , , ,	01-04-85	LDB-7 TK 43 (BROKEN WIRE). 12-8.
173223	28, , , ,	01-05-85	HCSA - SEP. BLEW DOWN 8.1 SAMPLER WITH BODY DOSE RATES OF 1,000 MRADS/240 MR/HR. 12-8.
155112	58, , , ,	01-06-85	FLUSHED 281-6 AND 4 ALPHA SWIRL CELLS. 8-4.
167798	32, , , ,	01-06-85	17.2E DOWN, PLUGGED WT FTR AND DELTA P. 4-12
167799	32, , , ,	01-06-85	2ND U - COLORIMETOR NEEDS REPAIRS - WILL NOT RESPOND. 12-8

SLIDE 22

NUCLEAR PROCESSES SAFETY RESEARCH
SAVANNAH RIVER LABORATORY

****
200 AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM
****

11/17/89

AREA : H

FACILITY : CANYON

OPERATION : CRITICALITY

RANGE OF DATES : 01/1986 TO 01/1987

NO.	SOURCE	DATE	OCCURRENCE
165849	27,69,01, ,	01-03-86	SI-86-1-7 - THE LIQUID LEVEL IN TANK 8.5, A STATIC STORAGE TANK CONTAINING PU SOLUTION, WAS AT THE NUCLEAR SAFETY CONTROL LEVEL LIMIT FOR A PERIOD OF FIVE DAYS. THE LIQUID LEVEL DECREASED BELOW THE MINIMUM OPERATING LIMIT DURING THE WEEK OF SEPTEMBER 20. THE LIQUID LEVEL READINGS WERE RECORDED EVERY SHIFT, BUT NO ACTION WAS TAKEN. THE 8.5 LIQUID LEVEL DECREASED TO THE NUCLEAR SAFETY CONTROL LIMIT DUE TO (CONT. 165850)
165850	27,69,01, ,	01-03-86	(CONT. FROM 165849) OPERATOR INATTENTION. THIS INCIDENT HAD POTENTIAL FOR SERIOUS CONSEQUENCES AND DID INCREASE THE CHANCE OF A CRITICALITY. OI-221-H-86-1-4.
161945	27,01, , ,	01-09-86	SI-86-1-6 - FIRST CYCLE WAS OPERATED FOR 30 MINUTES WITH THE 1CX FLOW RATE BELOW THE NUCLEAR SAFETY CONTROL LIMIT. THROUGH LACK OF ATTENTION BY THE OPERATOR THE 1CX FLOW RATE DROPPED TO 14.4 LB/MIN. THE MINIMUM OPERATING LIMIT IS 21.3 LBS/MIN AND THE NUCLEAR SAFETY CONTROL LIMIT IS 20.9 LBS/MIN. THIS INCIDENT DID NOT HAVE SERIOUS CONSEQUENCES BUT IT DID INCREASE THE POTENTIAL FOR CRITICALITY. OI-221-H-86-1-5.
165617	27,69,04,01,	01-20-86	SI-86-2-14 FIRST CYCLE WAS OPERATED FOR 25 MINUTES WITH THE 1CX FLOW RATE BELOW THE NUCLEAR SAFETY CONTROL LIMIT. THE OPERATING PROCEDURE ALLOWS 15 MINUTES FOR THIS PROBLEM TO BE CORRECTED AND THE TECHNICAL STANDARDS ALLOW UP TO 2 HOURS AND 20 MINUTES LACK OF ATTENTION BY THE OPERATION. EQUIP FAILURE (1CX LOW FLOW ALARM). INADEQUATE DESIGN OF EQUIP. LACK OF ATTENTION BY THE OPERATOR. OI 221-H-86-1-6.
165662	27,69,01,16,04	01-21-86	SI-86-2-15 - SECOND URANIUM CYCLE WAS OPERATED WITH AN IMPROPER 1DF FEED RATE DUE TO A TRANSCRIPTION ERROR MADE ON DPSOL 221-H-4412. IN THIS INCIDENT, THE OPERATOR RECORDED THE TANK 16.8 235U G/L INSTEAD OF THE TOTAL U G/L. THIS ERROR CARRIED THROUGH SEVERAL CALCULATIONS. THIS INCIDENT DID NOT HAVE SERIOUS CONSEQUENCES BUT IT DID INCREASE THE POTENTIAL FOR CRITICALITY. OI-221-H-86-1-7. ALSO SOURCE 32.

SLIDE 23

NUCLEAR PROCESSES SAFETY RESEARCH
SAVANNAH RIVER LABORATORY

****
200 AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM
****

11/17/89

SPECIFICS : COMPUTER

RANGE OF DATES : 01/1987 TO 04/1987

NO.	SOURCE	DATE	OCCURRENCE
198434	52, , , ,	01-00-87	211-F COMPUTER PROBLEMS.
200633	34,04, , ,	01-04-87	SEP. TECH. REPRESENTATIVE TROUBLESHOOTING PROBLEMS WITH THE P190 COMPUTER.
217098	71, , , ,	01-04-87	ONLY TWO ALPHA COUNTERS AVAILABLE THIS SHIFT. HIGH BACKGROUNDS CONTINUE TO PLAGUE. 8-4.
229860	75, , , ,	01-04-87	6-8 - VALVES NO. 1 AND NO. 2, ANN PUMP, AND OD-2 AGITATOR DO NOT OPERATE THROUGH THE SEQUENCES. 12-8.
229869	75,04, , ,	01-05-87	6-8 - COMPUTER GROUP WORKED ON P-190. 8-4.
209855	32, , , ,	01-06-87	SECOND PU CYCLE - THE 12.5 SAMPLER UNIT ON PROVOX IS NOT OPERATING PROPERLY. 4-12.
219371	58, , , ,	01-08-87	211-F: COMPUTER WENT DOWN AT 4:30 AM; REBOOTED; COMPUTER QUIT SCANNING AND AGITATORS STOPPED. 12-8.
191825	04, , , ,	01-09-87	THE SECOND PU CYCLE WENT DOWN AT 11:30 P.M. DUE TO COMPUTER PROBLEMS.
209882	32, , , ,	01-09-87	SECOND U CYCLE - E&I CHANGED OUT PANEL BOARD IN BACK UP, TO CORRECT THE IDS FLOW. 12-8.
209883	32,52, , ,	01-09-87	SECOND PU CYCLE - CYCLE DOWN ALL SHIFT, DUE TO PROVOX PROBLEMS. ALL PRODUCT TANK LL ARE READING INCORRECTLY. 12-8.
217127	71, , , ,	01-11-87	ALPHA SCANNER SHUT DOWN. PRINTER WON'T PRINT AFTER SCANNING. STOPPED AGAIN AT 7:20 A.M. 12-8.
217128	71, , , ,	01-11-87	ALPHA SCANNERS BACK IN SERVICE AT APPROX. 9:15 A.M. 8-4.
202580	76, , , ,	01-13-87	NCR NUMBER 1684, REPAIR OF HB-LINE PHASE I CONTROL ROOM I/O ON MODICON SYSTEM. AFTER DETERMINING FAILURE WAS AN I/O CIRCUIT BOARD, MECHANIC SUBSTITUTED AN ADJACENT BOARD OUT OF AN UNUSED PART OF THE PROCESS CONTROL. HE THEN PUT THE FAILED BOARD IN THE UNUSED SLOT WHICH CAUSED THE COMPUTER TO IMPROPERLY FUNCTION. THE FAILED BOARD SHOULD NOT HAVE BEEN INSTALLED BUT RATHER TAGGED OUT AND SEGREGATED. ESTIMATED (CONT. 202581)
202581	76, , , ,	01-13-87	(CONT. FROM 202580) COST OF NONCONFORMANCE IS $400.

SLIDE 24

NUCLEAR PROCESSES SAFETY RESEARCH
SAVANNAH RIVER LABORATORY

SLIDE # 25

FUTURE SYSTEM IMPROVEMENTS

* DEVELOP LEXICON FOR FAULT TREE FAILURE RATE, CONSEQUENCE, AND REPAIR TIME DATA WITH AUTO-INPUT FROM DATA BANKS.
* USE OF ARTIFICIAL INTELLIGENCE FOR CODING ENTRIES.
* VOICE ACTIVATED SYSTEM FOR DATA ENTRY.
* DIRECT ACCESS OF DATA TO OTHER DOE SITES.