CONF-930243--1

WSRC-MS-92-440

RISK ASSESSMENT DATA BANK DESIGN AT THE SAVANNAH RIVER SITE (U)

by

WSRC-MS--92-440

DE93 004296

C. S. Townsend, K. B. Johnson
Westinghouse Savannah River Company
Savannah River Site
Aiken, S. C. 29802

A paper proposed for presentation at
Data Banks for Risk Assessment Workshop
Augusta, GA
February, 1993

and for publication in the proceedings

DISCLAIMER

RISK ASSESSMENT DATA BANK DESIGN AT THE SAVANNAH RIVER SITE (U)

ABSTRACT

The Savannah River Site has designed and implemented a database system containing a series of compilations of incidents used primarily for risk assessment. Four databases have been designed and implemented using advanced database management system computer software. These databases exist for reprocessing, fuel fabrication, waste management, and the Savannah River Technology Center. They are combined into one system called the Risk Assessment Methodology (RAM) Fault Tree Data Banks.

This paper will discuss the logical design of the data, the menus, and the operating platform. Built-in updating features, such as batch and on-line data entry; data validation methods; automatic update features; and expert system programs, will also be discussed. User functions, such as on-line search/view/report and statistical functions, will be presented. Security features and backup and recovery methods will also be covered.

DISCUSSION

Data Design

The RAM System is a database system consisting of four relational databases. A relational database is one in which the design of the data is perceived by the users as a collection of tables.

The four databases in the RAM System are identical in design. The information contained in each of the databases is the only difference.

There are two tables defined for a given RAM database. These are the Incident and Consequence Tables. These tables contain single pieces of data describing each incident that has occurred on the Site. The single pieces of data are known as fields (Slide 1).

The Incident Table contains information about where the incident occurred, when it occurred, the source documents from which it was taken, the type of incident, when it was recorded and last updated in

the database and by whom, the repair time (if applicable), and unique identifying numbers that are system generated.

Consequences (e.g. spills, contamination, etc.) are recorded in a separate table because the number of consequences per incident is not fixed. An unlimited number of consequences can be recorded for a single incident by storing the consequences in a separate table and linking each one to its parent incident in the Incident Table. Consequences are linked to the parent incident by the unique identifying number generated by the system in the Incident Table (Slide 2).

Menus

Users across the Site can access and traverse the RAM System through a series of menus. These menus offer the user many choices of activities within the system. Activities include choosing a database, searching for incidents, updating a database (restricted), choosing a printer, changing passwords, generating hard copy reports, and performing statistical calculations on sets of data (Slide 3).

Software and Operating Platform

The RAM System was designed using a database software package known as BASIS-Plus and is maintained on a VAX 6610 256 Mb computer.

Data Entry/Update

The RAM System provides state-of-the-art methods for updating, validating, searching, reporting, and statistically analyzing the data stored in the four databases.

An average of one hundred to three hundred new entries are processed and entered in the databases each day by data entry clerks. There are two methods for adding new entries and updating the databases.

For large batches of data, personal computers (PC) and a word processing software package are used to compile the new information or to record the change information. A FORTRAN program written for the PC is invoked to place the data into a format

that the BASIS-Plus database software can read and interpret (Slide 4). The reformatted data is then transferred to the VAX computer from the PC using a high-speed file-transfer utility. The transferred data can be loaded into the database using a high volume update utility provided in the BASIS-Plus software. The file transfer and the updating utilities are invoked from within the RAM System (Slide 5).

When small sets of data need to be added or updated, the on-line update utility is used. This feature allows the data to be entered directly into the system without having to go through the file-transfer and high-volume updating utilities. On-line update is not routinely used for large batches of data since computer time must be shared on the VAX and is charged to individual organizations. Also, the word processing software on the PCs is much easier to use for large amounts of data.

Data Validation

Data validation is essential in the RAM System. The BASIS-Plus software has validation features that ensure correctness of the data. One such feature, called the "word list", is used by the RAM System. A word list is a list of values that are allowed for a field. Data not found in the word list cannot be entered into that field. Usually word lists are used to validate field values that are not often changed and for small lists of allowed values. In the RAM System, word lists are used for fields that contain information such as units of measure.

Another valuable validation feature used by the RAM System is called the thesaurus database. A thesaurus database is a separate database that contains several thesauri and is linked to a RAM database. Thesaurus databases are used for large amounts of validation criteria and can be easily updated. In the RAM System, there are thesauri to record allowed codes and their meanings for the source, facility, operation, and equipment (keyword) code fields of the RAM databases (e.g. Equipment code 007 identifies PLUGGAGE). There are nearly 1000 codes recorded in the thesaurus databases. Codes not found in the thesaurus databases cannot be entered into the RAM databases (Slide 6).

Automatic Features

The RAM System takes advantage of automatic updating features provided by the BASIS-Plus software. There are several fields that are automatically updated by the system. The unique number fields and the entry and update date fields are system generated when a new entry is added. Some fields are assigned values based on the value of another field.
The source and facility code field values are input by data entry clerks and validated by the thesaurus. The name identified by the code is automatically supplied by the system (e.g. Facility code A is input by the data entry clerk, and CANYON is automatically input by the system).

Some fields are mathematically calculated based on the values of other fields (e.g. the repair time in hours is calculated from the recorded repair time). Other fields, such as beta-gamma contamination in mrad/mR/hr at 30 cm or air contamination conversion from RCG to micro-Ci/cc of air Pu, are also system calculated (Slide 7).

An expert system program that uses the features of the thesaurus database was written to automatically supply values for the operation and equipment code fields.

Operation and equipment codes are assigned to identify the type of incident and the unit of operation in which it occurred (e.g. a pluggage incident that resulted in overflow and contamination in the tanks). In the past, these codes were manually assigned by a technical person who read the abstract of the entry and looked up codes in a book. Thesauri for operation and equipment codes were built that contain the code and words and phrases that help identify the code. Words and phrases were gathered by studying the data already in the database in which codes were manually assigned (Slide 8).

The expert system program runs nightly on new entries that have not been coded. Upon finding new entries, the program performs searches for each code in the text of the entry. By searching for the code, all of the words and phrases identified for that code are also automatically searched for in the text. Upon finding new entries that have the correct words and phrases that identify the code, the system assigns the code to the entry, and the entry is marked "coded

not checked". All entries coded by the system are manually checked for accuracy and then marked "coded checked".

The program is showing about a 60% - 70% success rate. The thesauri are updated as new words and phrases are found for codes. The success rate has steadily increased since implementation in July, 1992. A final success rate of 80% - 85% is expected.

Inquiry

The RAM System has on-line search and view capabilities. The menu system offers easy traversal through the system, and fill-in-the-blank screens make searching for sets of data simple. Users supply only those criteria applicable to the search, and the system retrieves the data that fit those criteria for on-screen viewing (Slide 9). Any number of searches can be performed in a user session. Users can view any entry from any search performed at any time during the session on the screen .

Users can also search the thesaurus database for codes. Searching by codes is the best way to ensure that all applicable entries are retrieved. If users are unsure about what code to use in a search, the thesaurus database can be browsed as an aid (Slide 10).

Reporting

Hard copy reports can be generated for any or all of the searches performed in a user session. The report can be printed to any printer in the list of printers provided by the system. The report contains the date of incident; area, facility, source, operation, and equipment codes; and the text for the entry. Entries are automatically sorted by date of incident (Slide 11).

A report that can be read by the statistical software package STATPAC can also be generated. This report consists of the date of incident and the text of the entry (Slide 12). The capability to call the STATPAC program, which performs trend and frequency analysis, is in place although the STATPAC software is only available on the IBM-VM computer and is not yet available on the VAX computer.

Statistical Analysis

Statistical analysis such as maximum, minimum, average, and standard deviation for a given set of data can be calculated in the RAM System. Reports for all consequence numerical fields and the repair time field can be generated (Slide 13).

Security

The data in the RAM System is protected by the password security features available with the BASIS-Plus software. All users have user identification numbers as well as passwords that can be changed periodically. A log report is generated monthly to track use of the system (Slide 14).

Backup and Recovery

To ensure recoverability of the data, the system is backed up on disk daily by the systems personnel. The custodian of the data also receives a weekly tape backup that is stored away from the disk backups.

CONCLUSION

In conclusion, the RAM System provides state-of-the-art storage and retrieval of data used for risk assessment. Enhancements will be made as needed to further increase the utilization of the system and to reduce cost where possible.

REFERENCES

1. W. S. Durant, D. F. Baughman, C. S. Townsend, P. Hang. "200-Area Fault Tree Data Bank 1992 Status Report (U)" WSRC-TR-92-118. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC 29808-0001, March 16, 1992.

2. W. S. Durant, D. F. Baughman, C. S. Townsend, P. Hang. "Data Banks for Risk Assessment at the Savannah River Site (U)" WSRC-MS-92-169. Westinghouse Savannah River Company, Savannah River Site, Aiken, SC 29808-0001, August, 1992.

ACKNOWLEDGEMENT

The information contained in this article was developed during the course of work done undercontract No. DE-AC09-88SR18035 with the U. S. Department of Energy.

INCIDENT TABLE

ACCESSION NUMBER	INCIDENT DATE	AREA (4)	FACILITY (10)	SOURCE (15)	OPERATION (10)	EQUIPMENT (30)	REPAIR TIME	REPAIR TIME (HOURS)	INCIDENT TEXT
6357	1/1/55	F	A	07	49,04	125,003			SP.G. ERRORS CAUSED PROBLEMS IN FEED ADJUST.
33341	6/25/79	H	A,M	32	86	524,523, 128,231	1 SHIFT	8	SAMPLE TRUCK HAS A BURST HOSE. 8-4 SHIFT.
344855	2/18/92	F	A	82	72	153,048			REMOVAL OF HSA FLOOR DRAIN HEADER. UNEXPECTED CONTAM.

CONSEQUENCE TABLE

ACCESSION NUMBER	SYSTEM KEY	SINGLE VALUE CONSEQUENCE	SURFACE CONTAMINATION	AIR CONTAMINATION	BETA/GAMMA CONSEQUENCE
250	1	5 gal.			
344855	1051			120.5 DAC	
344855	1052		300,000 d/m ALPHA		
355502	1586				1000/100 mrad/mR/hr

INCIDENT TABLE

ACCESSION NUMBER	INCIDENT DATE	AREA (4)	FACILITY (10)	SOURCE (15)	OPERATION (10)	EQUIPMENT (30)	REPAIR TIME	REPAIR TIME (HOURS)	INCIDENT TEXT
6357	1/1/55	F	A	07	49,04	125,003			SP.G. ERRORS CAUSED PROBLEMS IN FEED ADJUST.
33341	6/25/79	H	A,M	32	86	524,523, 128,231	1 SHIFT	8	SAMPLE TRUCK HAS A BURST HOSE. 8-4 SHIFT.
344855	2/18/92	F	A	82	72	153,048			REMOVAL OF HSA FLOOR DRAIN HEADER. UNEXPECTED CONTAM.

CONSEQUENCE TABLE

ACCESSION NUMBER	SYSTEM KEY	SINGLE VALUE CONSEQUENCE	SURFACE CONTAMINATION	AIR CONTAMINATION	BETA/GAMMA CONSEQUENCE
250	1	5 gal.			
344855	1051			120.5 DAC	
344855	1052		300,000 d/m ALPHA		
355502	1586				1000/100 mrad/mR/hr

USER MENUS

13:36 9-OCT-1992

WELCOME TO THE 200-AREA FAULT TREE DATABANK - SEPR

A Menus, screens and reports
B Use FQM command language
C Batch data entry (restricted)
D Access the thesaurus
E Select a printer **Apple Laser**
F Change your database password

R Exit to Databank listing panel

***Note: Option A (Menus, screens and reports) is the preferred method for sorting.

Select option by entering the letter shown
Type **LO** to logout of the system.
===>

PERSONAL COMPUTER BATCH DATA

```
H
B
B4
231
6B
01-29-92
TROUBLESHOOT AND REPAIR TORQUE
COUPLING.  8-4 SHIFT.
$$
H
B
B4
102015
6B
01-29-92
REPAIR HOT LIGHT ON FURNACE.  8-4
SHIFT.
$$
```

REFORMATTED BASIS-PLUS DATA

```
            AREA: H
 FACILITY CODE: B
   SOURCE CODE: 6B
 OPERATION CDE: B4
   EQUIP. CODE: 231
 INCIDENT DATE: 920129
TEXT: TROUBLESHOOT AND REPAIR TORQUE
COUPLING.  8-4 SHIFT.
            AREA: H
 FACILITY CODE: B
   SOURCE CODE: 6B
 OPERATION CDE: B4
   EQUIP. CODE: 102   015
 INCIDENT DATE: 920129
TEXT: REPAIR HOT LIGHT ON FURNACE.  8-4
SHIFT.
```

BATCH DATA ENTRY/UPDATE

16:32 9-OCT-1992

200-AREA FAULT TREE DATABANK - SEPR BATCH UPDATE OPTION

A Add record function
B Update record function
C Delete record function
D Edit reject files
E View the batch load log file
F Monitor the batch queue
G Print update summary log files

R Return to application panel

Select function by entering the letter shown
Type **LO** to logout of the system.
===>

WORD LISTS

REPAIR TIME UNITS

day, days, hr, hrs, min, mins, month, months, shift, shifts, week, weeks

CONSEQUENCE UNITS

Ci, R, R/hr, cc, g, gal, gpm, l, lb, lbs, lbs/hr, mCi, mR/hr, mg, micro-Ci, micro-Ci/l, micro-g/1.5l, micro-g/l, ml, mrad/hr, psi, rad, rad/hr, rem, dollar, dollars, mrad/mR/hr, rad/R/hr, cm, ft, in, m, mi, yd, DAC, RCG, micro-Ci/cc of air FP, micro-Ci/cc of air Pu, C/M ALPHA, C/M BG, D/M ALPHA, D/M BG

THESAURUS EXAMPLES

001		
	USE	TRANSFER ERROR
002		
	USE	OVERFLOW
003		
	USE	CHEMICAL ADDITION ERROR
004		
	USE	UNCONTROLLED REACTION
005		
	USE	CRITICALITY POTENTIAL
006		
	USE	SIPHONING
007		
	USE	PLUGGAGE

AUTOMATIC FIELD UPDATE

******* 200 Area Fault Tree Data Bank ******* **Page 1 of 2**

INCIDENT INFORMATION

Accession Number: 355349 Date: 920109
Entry into Basis: 920819 Last Updated: 920916

Area: F
Facility: A Name: CANYON

Source: 32 Name: SENIORS LOG BOOK, CANYON

Operation: 05 Name: FIRST CYCLE SOLVENT EXTRACTION

Equipment: 015 Name: INSTRUMENT MALFUNCTION

Repair Time: 20.00 (In hours: 0.33)
Status: CC

Action > (Add,Delete,Exit,Find,Help,Match,Print,Replace,Show,>,<,?)
Member# 1 of 263 for Set 1 (For Delete, Replace and Show)

CODING THESAURUS EXAMPLE

CODE = 007

AIR PURGING
BACK BLEW
BACK BLOW
BACKFLUSH
BACKFLUSHED
BLEW DOWN
BLEW MAKEUP
BLOCKAGE
BLOCKED
BLOCKS
BLOW DOWN
BLOWN DOWN
CLEANED STRAINER
CLOG
CLOGGED
CLOGS
DRAINAGE
DRAINED
DRAINING
FLUSHED
FLUSHES
FOULED
NOODLE
NOODLED
PLUG
PLUGGAGE
PLUGGED
PLUGS
PURGED
REPLACED FILTER
RODDED
STEAM BLEW
STEAM BLOW
STOPPED UP
UNCLOG
UNCLOGGED
UNPLUG
UNPLUGGED

ON-SCREEN VIEWING

******* 200 Area Fault Tree Data Bank ******* **Page 1 of 2**

INCIDENT INFORMATION

Accession Number: 355349 Date: 920109
Entry into Basis: 920819 Last Updated: 920916

Area: F
Facility: A Name: CANYON

Source: 32 Name: SENIORS LOG BOOK, CANYON

Operation: 05 Name: FIRST CYCLE SOLVENT EXTRACTION

Equipment: 015 Name: INSTRUMENT MALFUNCTION

Repair Time: 20.00 (In hours: 0.33)
Status: CC

Action > (Add,Delete,Exit,Find,Help,Match,Print,Replace,Show,>,<,?)
Member# 1 of 263 for Set 1 (For Delete, Replace and Show)

BROWSING THE DATABASE THESAURUS

Help Go_Home Cancel Ok

Browse Thesaurus KW **for**

Thesaurus Term> PLUG*

Using Format: All **With Intent:** Read

Help Ok

All the relations for the given term are shown below.

THESAURUS: Thesaurus for keywords

PLUGGAGE

UF 007

PF2=Help|KP0=Ok|KP.=Cancel|KP1=Direction|KP2=Granularity|KP3=Window ...

HARD COPY REPORT

200-AREA FAULT TREE DATA STORAGE AND RETRIEVAL SYSTEM

SEPR DATABASE

OCT 07, 1992

FIRES IN F AREA FROM 1980 - 1987

ACC #	SOURCE	DOI	AREA	FAC	OPER	EQUIPC
78571	28 02 49	02/04/80	F	I	A6 44	076 066

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	F	M	86 44	227 241 129 076 257 227 129

TRAILER FIRE - MOVING NO. 3 DEIONIZER TRAILER, SRO 2927 FROM 105-I 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 36	04/16/80	F	B	44	608 589 412 464 076 030 216 153

PIPE WELDING OPERATION INSIDE PLASTIC CONTAINMENT HUT IN JB-LINE CAUSED IGNITION OF PLASTIC TAPE AND CONSUMPTION OF 1.5 SQ. FT. OF HUT PLASTIC. TAPE HAS 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.

102485	28	05/28/80	F	M	86 44	468 524 024 206 076

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	F	C	44	076 453 458

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	F	B	34 37 44	414 464 070 076 646 441

STATPAC REPORT

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

10/07/92

NO.	SOURCE	DATE	OCCURRENCE
111111	; ; ; ;07	12-31-79	DUMMY
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.
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.
999999	27;04; ; ;	01-01-81	DUMMY

STATISTICAL ANALYSIS

Repair time in hours	
0.17	
0.08	
0.17	
0.17	
0.33	
0.50	
0.37	
0.25	
0.20	
0.08	Min
0.50	Max
0.25	Mean
0.14	Standard deviation

RAM DATABANKS ACCOUNTING LOG

User name	Date	Time	DB name
W5609	1-SEP-1992	07:13	WASTE MANAGEMENT
O9668	1-SEP-1992	07:21	200-AREA
T9796	1-SEP-1992	08:32	WASTE MANAGEMENT
T9796	1-SEP-1992	08:47	WASTE MANAGEMENT
W7418	1-SEP-1992	09:00	200-AREA

END

DATE
FILMED
4/12/93