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SAVANNAH RIVER LABORATORY DATA BANKS FOR RISK ASSESSMENT
OF FUEL REPROCESSING PLANTS

by

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MASTER

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Position and Area of Responsibility

William S. Durant is a Research Associate in the Actinide Technology Division of the Savannah River Laboratory. He is primarily responsible for the development of probabilistic risk assessment methodologies for the fuel reprocessing facilities at the Savannah River Plant.

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Abstract

The Savannah River Laboratory maintains a series of computerized data banks primarily as an aid in probabilistic risk assessment studies in the fuel reprocessing facilities. These include component failure rates, generic incidents, and reports of specific deviations from normal operating conditions. In addition to providing data for probability studies, these banks, have served as a valuable aid in trend analysis, equipment histories, process hazards analysis, consequence assessments, incident audit, process problem solving, and training.

Data Banks

The data are derived from many sources both on-site and off-site. The component failure rate data bank was abstracted primarily from information in the open literature and is increasingly supplemented by analysis of Savannah River Plant experience. This

bank contains the failure rate, error bounds where available, and the source of the information. Currently, about 1200 entries are catalogued.

The generic incidents data bank is a listing of those incidents that can affect each of the unit operations associated with fuel reprocessing. Included with each of the generic incidents are the causes; consequences; and safety features to prevent, detect, or mitigate the incident. These incidents were derived from safety analyses of existing or planned fuel reprocessing plants, analyses by commercial engineering firms, and from Savannah River Plant experience. Currently, about 800 incidents are catalogued.

Specific deviations from normal operating conditions are stored in a computer as the Fault Tree Data Bank. This bank is primarily from experience at the Savannah River Plant but does include a small amount of data from the Idaho facilities and from the Nuclear Fuel Services plant in New York. Internal sources include daily and monthly reports, incident reports, operating logs, and a linkage with the computerized maintenance records. This data bank currently contains about 70,000 entries.

Methods of data retrieval are a function of the volume of material in the bank and the nature of the retrieval mission. The failure rate library is the simplest. One exercises the "find" option available for our computer system. For example if thermo-couple failure rates are desired, one merely accesses the data

bank and types "find thermocouple" as the input command. Data are displayed at the terminal.

Generic incidents are stored as individual members (named records) for each unit operation. These are recalled by directly accessing the desired member for terminal display or hard copy.

Incidents in the fault tree data bank are coded by four sets of specifications: the plant area, facility, unit operation, and key words. Data may be recalled by using one to four of these specifications in any combination. Data may also be recalled by month, year, or source of information. Either terminal display or hard copy options are available.

Data banks for the reprocessing facilities are under the control of the Safety Technology Group of the Savannah River Laboratory. This is the organization responsible for data collection, coding, editing, storing, sorting, and analysis. With a single responsible organization, source documents are funneled to a coordinator on a timely basis such that an even work load can be achieved. Internally published documents are accumulated for one month, then abstracted and coded so that the data may be read into the computer banks. Maximum lag time between a documented occurrence and its availability in the data bank is about 2 months. Data from operating logs lag from about six months to 1 1/2 years because a single log book may take from one month to one year to complete. This imposes a minimum of interference with plant operations if only completed books are abstracted. The computerized maintenance records are accessed on an annual basis.

Data banks are recorded on disk packs with magnetic tape backup in case of destruction of the disks. In addition, the fault tree data bank has a punch card file that is stored in a building remote from the computer operation center.

Access to the data is restricted to the Safety Technology Group to protect against accidental erasure, alteration, or unauthorized use of the data. The component failure rate bank and the generic incidents bank can be made available through the Savannah River Operations Office; however, the fault tree data bank is restricted. Raw data are of little legitimate use to those outside of the Savannah River Plant because of cryptic notation, jargon, a lack of knowledge of when process changes were initiated, and not knowing when certain data abstracting began. In addition, because the Savannah River Plant is a weapons material production facility, national interests could be comprised.

One of the agonies of putting together data banks is making them all things to all people. Information that is one person's trash is the next person's treasure. Even this varies for an individual depending on the problem under consideration at the moment. Unfortunately, one finds those who become irritated if the data sorts do not contain exactly the information being sought.

With a number of people abstracting data, setting a uniform guide on what to include is difficult. In general, we tend to

over-abstract. One can always discard irrelevant data later, but data cannot be retrieved from log books that have a limited retention requirement and are eventually destroyed.

Uniform coding of entries is also difficult. Even with a standard list of code designations, different people apply different interpretations to an event. Over-coding and sorting on multiple word combinations tends to compensate for this situation.

Although it has not been a problem at Savannah River, data bank compilers tend to forget that the mission of a production facility is to produce a product, not to collect statistical data. If one works within existing reporting systems, the quality of the data can be quite satisfactory. If a complex reporting system is imposed, data from the low-consequence end of the spectrum will become suspect.

Data banks are expensive. Savannah River has invested nearly three million dollars over the past seven years in the ones just discussed. Despite the cost, we have found these banks to be valuable assets.

We have recently developed statistical analysis programs that can calculate a number of parameters directly from the fault tree data bank. These include mean, median, and error bound values. The codes also determine the best standard distributions (such as exponential, log normal, etc.) and plot trend curves as a function of time. With this capability, we are expanding our failure rate

data bank. In addition, we are developing the capability to automatically recall failure rate data from a library directly into fault tree analysis computer codes.

VIEWGRAPH SLIDES

SAVANNAH RIVER LABORATORY DATA BANKS FOR
RISK ASSESSMENT OF FUEL REPROCESSING PLANTS

- COMPONENT FAILURE RATE DATA BANK
- GENERIC INCIDENT DATA BANK
- FAULT TREE DATA BANK

COMPONENT FAILURE RATE DATA BANK

- FAILURE RATES
- ERROR BOUNDS
- REFERENCES

GENERIC INCIDENT DATA BANK

- INCIDENT
- CAUSES
- CONSEQUENCES
- SAFETY FEATURES
 - PREVENT
 - DETECT
 - MITIGATE

FAULT TREE DATA BANK

- SPECIFIC DEVIATIONS FROM NORMAL OPERATION
 - DATE OF OCCURRENCE
 - SOURCE OF INFORMATION
 - ABSTRACT OF OCCURRENCE
 - CODE SPECIFICATIONS