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WINCO DATABASE PROGRAM

Introduction

Six years ago, WINCO began a program aimed at developing a site-specific database containing equipment and instrument failure rates, human error probabilities, and specific event probabilities. The development of this database was fundamental in performing the probabilistic risk assessments (PRAs) on the facilities at the Idaho Chemical Processing Plant (ICPP).

At one point, it became apparent that developing such a database would take more resources than were available. As a result, WINCO approached Idaho State University and Montana State University for assistance. These universities were chosen because Idaho State University had the benefit of offering courses in probability and risk assessments while Montana State University offers curricula in human factors. As a result of this solicitation, Montana State University has supplied four graduate students and two professors for three of the last six years while Idaho State University has supplied seven graduate students and a professor during the last six years. Five of the seven ISU graduate masters theses resulted from work being performed at the ICPP. Topics of these theses include the following:

- Common Cause Analysis of Instruments at the ICPP
- Maximum Likelihood Estimators for Use in Updating Failure Rates
- Plant Specific Sampling Errors
- Competing Failure Modes of Instruments at the ICPP
- Bootstrapping of Instrument Failure Data to Reduce Uncertainties Due to Small Sample Sizes.

As a result of this program, WINCO has hired two of the seven ISU students and one of the three MSU students on a full time basis. Of the remaining five ISU students, two work in PRA and safety related professions, one works as a project engineer, and the remaining two are currently fulfilling the graduate positions at WINCO working with the database program. In short, this program continues to give WINCO the opportunity to observe graduate students in a working environment and consider them for full time employment. Additionally, the program allows the graduate students an opportunity to obtain marketable experience.

Through this cooperative effort, the WINCO ICPP Failure Rate Database report was issued in October, 1991. The aim of this database was to combine into one referenceable report the data necessary for performing PRAs at the ICPP. This database includes the following:

- Site-Specific Failure Rate Database
- Site-Specific/Generic Event Frequencies and Probabilities
- Generic Failure Rate Database

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Site-Specific Failure Rate Database

The site-specific failure rates consist of equipment and instrument failure rates. For the equipment items, the failure rates are categorized first by component type and then, if the data is sufficient, by environment and failure mode. For example, this categorization yields a failure rate for a pump that leaks and is exposed to an acid environment.

For instrument items, the failure rates are categorized first by instrument type and then by failure mode. For each instrument, a failure rate is developed for both the instrument drifting out-of-tolerance (OOT) and for the instrument failing. If an instrument drifts OOT, it can generally be corrected with a calibration. If an instrument is identified as failed, the instrument, or some part of it, generally needs replacing.

Included in both the equipment and instrument failure rates is a 90% Error Factor. Multiplying the failure rates by the error factor yields the 95% and 5% limits for that failure rate.

Site-Specific/Generic Event Probabilities and Frequencies

In addition to the equipment and instrument failure rates, the database report also presents a number of event probabilities and frequencies. This section consists of both site-specific and generic event probabilities and frequencies such as:

- Inadvertent Transfer Frequencies
- Human Error Probabilities
- Plugging frequencies for various instruments and equipment
- Total power loss frequency for a given facility

If the events being reported are frequencies, a scale is reported to indicate whether the frequency is based on an hourly frequency or a yearly frequency. Also, a 90% Error Factor is provided for some of the site-specific data.

Generic Failure Rate Database

In the development of most site-specific databases, because of small data samples or limited number of failures, the site-specific failure data will not yield all desired failure rates and failure probabilities. It becomes a necessity to seek out and examine the generic databases for any failure rates not included in the site-specific database. A report by EG&G Idaho was selected to furnish the generic data. This report examined data from light water and liquid sodium reactor PRAs and several popular generic databases including IEEE-500 and WASH-1400. The EG&G report then extracted "recommended" failure rates from the generic databases. Only the applicable data was extracted from the EG&G report and included in the WINCO report.

Program Problems

In addition to the program successes, there are a number of problems WINCO has faced in developing the database. One of the problems exists in obtaining consistently reliable equipment failure data with enough information to accurately calculate equipment failure rates. Equipment failure data at the ICPP is obtained primarily from work orders. These work orders are tracked by computer using the Maintenance, Inventory, and Procurement System (MIPS). In the beginning of this program, the information included on the work orders was insufficient, making it difficult to accurately identify failure data. In recent years, personnel filling out the work orders have been including sufficient enough information to determine if an equipment failure occurred and what piece of equipment was affected. Failure codes are also being filled out on the work order form to identify whether the equipment failed as a result of wear, improper use, and so on.

Another problem often faced by WINCO is in obtaining data for such studies as human error analyses. Human errors are a fundamental part of any analyses performed on a man-machine system. Unfortunately, the data necessary for such an analyses is often scarce or non-existent. The lack of data is usually attributable to the reluctance of personnel to record human errors or to be monitored.

Future of the Program

The primary purpose of the program at the ICPP is to maintain the database as a valuable source of information. In order for this to happen, the needs of the users are periodically reexamined. As a result of the review, efforts are being made to develop more human error probabilities, develop better approaches to determining the availability of instruments, and determine trends in equipment and instrument failures. Additionally, the existing data is being reanalyzed to develop more detailed equipment failure rates.

In addition to developing site-specific data, WINCO is also concentrating on obtaining data from other sources including other DOE sites, chemical processing plants, and generic databases including NUCLARR, INPO, and IEEE to name a few. One of the programs available through which WINCO is working is the Westinghouse Savings Through Sharing program. This corporate program is aimed at reducing costs through sharing information between the Westinghouse Management Organizations (M&O). This program helps reduce the amount of duplication of efforts between the various Westinghouse sites.

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