Attachment 1

1988 NPRDS EVALUATION REPORT

Summary and Future Direction

The NRC staff continued to find the NPRDS a usable data base. The data base is being enhanced as planned improvements are completed and warrants increased usage by industry.

From July 1987 through 1988, INPO continued to make important improvements in NPRDS through making data more accessible, enhancing data quality assurance, upgrading data, providing better technical guidance, and soliciting industry support. Industry continued its support such that failure and engineering data grew at rates similar to past experience. There are now about 84,000 failure records and 505,000 engineering records in the database. While no improvements were noted in timeliness and completeness of failure reporting, upgrades were made to portions of the engineering record database. INPO and the industry have actions underway to make further improvements (e.g., release of NPRDS Plus Release 3 to improve data entry quality, increased user support to improve plant operations, and further upgrades of engineering records).

In 1988, the NRC staff, in addition to continued use of NPRDS in traditional areas such as events analysis, nuclear plant aging research (NPAR) and component performance studies, expanded its use into maintenance evaluation and other areas. NPRDS proved particularly useful in the maintenance evaluation programs. Based on its usage, staff provided feedback through the NPRDS Users Group (NUG) on proposed changes in scope and identified areas needing further attention (e.g., timeliness and data quality). AEOD upper management also wrote to INPO in early 1988 highlighting the need to upgrade portions of the engineering data base.

In the future, the staff will continue to expand its usage of NPRDS. Staff will monitor NPRDS progress through the following activities:

1. Reviews of industry maintenance initiatives through use of the NPRDS data for maintenance assessment programs and maintenance effectiveness indicators, including associated site visits.

2. Events assessment, component performance studies, NPAR, reviews of frequencies of Technical Specification surveillances, and limited, probabilistic risk assessments efforts.

3. Review of reporting patterns at selected operating plants, including visits to discuss NPRDS implementation.

Staff efforts will be evaluated in terms of accessibility and useability of the information, the results of data verifications performed, and the ability of the data to meet staff needs. Staff will continue to provide feedback to INPO through participation in NUG and interactions at the staff and management levels, when appropriate.

In view of the long time periods for completion of planned actions by INPO and the industry, annual reporting continues to be appropriate. Accordingly, unless something of particular importance occurs, staff's next NPRDS evaluation report will be made in early 1990.

Background

In 1981, INPO announced that it had decided to assume responsibility for the management of the Nuclear Plant Reliability Data Syster (NPRDS). At that time the Commission had under consideration a rule for reporting operational data. Following INPO's decision, the Commission agreed to drop the requirement of component failure reporting from the proposed rule. However, the Commission directed the staff to monitor the progress of INPO's management of the NPRDS and to report to the Commission semi-annually on the database status and its ability to meet NRC needs.

In January 1988, the staff provided to the Commission its 11th semi-annual report on the effectiveness of INPO's management of NPRDS and on the responsiveness of NPRDS to NRC needs [SECY-88-1, Nuclear Plant Reliability Data System (NPRDS)]. Staff at that time reported an overview of progress since INPO assumed management responsibility in 1982. Staff indicated that INPO had made major improvements to the NPRDS in soliciting industry support, providing technical guidance, enhancing data quality assurance, and making data accessible. The volume of reporting (both engineering records and failure reports) increased significantly during the period. Staff estimated that about 65% of the reportable failures occurring throughout the industry were being routinely submitted and the median time of failure reporting had been significantly reduced to about 90 days. Staff also indicated that the overall level of failure reporting had reached an apparent plateau. Staff indicated that while the gains and improvements over time were impressive, further improvements in data quality and timeliness were desirable, particularly the accuracy of portions of the engineering data base. Staff anticipated such improvements would result from two industry actions already underway - (1) a large number of licensee commitments to provide complete and timely NPRDS reporting in response to Generic Letter 83-28, and (2) expanded utility use of NPRDS following INPO's efforts to make system operations more "user friendly."

The staff also indicated that the NRC evaluation program then in use would not be effective in causing further improvements in quality and timeliness of failure reporting and would not contribute to improvements in accuracy of engineering data. Thus, a new direction for the 1988 evaluation effort was proposed. First, the staff would continue to monitor NPRDS reporting for selected plants. Second, the staff would also conduct site visits to selected plants. Also, as part of the Maintenance Assessment Programs, the plant participation in and use of the NPRDS would be evaluated as part of the evaluation of industry maintenance initiatives. Lastly, through more direct use of the system, the staff would assess the quality, completeness, and timeliness of the data and would communicate to INPO any notable findings along with a description of the NRC needs and use of NPRDS data. Internal NRC staff coordination between AEOD, NRR, and RES would remain an element of this assessment and feedback program.

In SECY-88-1, staff also indicated that in view of the status of NPRDS then and the time period for actions (about two years), annual reports to the Commission would be more appropriate. Thus, this report, the twelfth in the series, is the first such evaluation. This report, however, addresses activities that occurred during the last half of 1987 and 1988 to bring reporting to a calendar year basis. It also includes information on future plans and goals.

Description of the NPRDS

The Nuclear Plant Reliability Data System is an industry system, managed by the Institute of Nuclear Power Operations (INPO), that collects data on component failures in specified safety and balance-of-plant systems in commercial nuclear power plants. NPRDS data are provided voluntarily (i.e., reporting is not required by NRC regulations). For each component within the NPRDS scope, utilities are to submit two types of records: 1) component engineering reports and 2) component failure reports. The former provide descriptive material on the component manufacturer, model number, system application and design specifications (e.g., electrical or fluid flow ratings, temperature, pressure, etc.); the latter document when covered components "fail" (i.e., cannot fulfill the design function). Failure reports can be matched to corresponding engineering reports and provide information on the date and time of failure, the length of time to restore the component function, the failure mode and mechanism, and corrective actions. Text and coded information are supplied.

INPO enters, on a quarterly basis, each unit's operating hours for the quarter; these hours are obtained from NRC's Monthly Operating Report. The hours can be used in conjunction with the engineering and failure reports to generate failure statistics for operating systems and components.

In addition, engineering and failure information can be combined in various ways. A search of the failure records can identify problems experienced with components in other plants and the corrective actions taken. Although the data base was originally designed to support calculation of most of the statistics used in simplified reliability models, such as those used in WASH-1400, the data are now used by utility and plant staffs, design groups, and operating experience reviewers for a variety of purposes.

NPRDS data are available to users primarily through direct on-line access of the data base from a personal computer.

INPO Program Management Activities

During the past year, there were organizational changes at INPO within the NPRDS department to provide increased attention to user support and usage enhancements while maintaining a focus on complete, timely, and quality reporting. The NPRDS department now includes 16 professionals working full time on NPRDS, as well as support contracts for 3 full time failure report auditors and up to 5 additional staff working on data and system upgrades.

During the period, INPO continued to improve the automated data processing (ADP) capability of NPRDS. In December 1987, INPO introduced the IBM NPRDS Plus! system, a menu-driven system developed to enhance data processing and make the system more user-friendly. A tutorial program was included, plus some training provided. NPRDS Plus!, Release 2, was made available in June 1988 to provide users with canned output programs, as well as additional capabilities for performing statistical analyses of the data and highlighting performance trends using various reports and graphs. The new capabilities were documented in the Release 2 update to the NPRDS Plus! Information Retrieval Guide, dated May 1988. In November 1988, INPO released an upgrade to their telecommunications software, SIM/PC. The new release was to eliminate many of the communication interface problems that users have experienced with modems, downloading data to disk and printers, and noisy telephone lines.

Release 3 of NPRDS Plus!, which is presently scheduled for early 1989, is to be the final transition from the Prime to the IBM computer. This release is to transfer all NPRDS data reporting to the IBM system using a full-screen data entry approach. Training classes to demonstrate the new reporting enhancements to utility data reporters are scheduled for the spring of 1989. Release 3 will also incorporate several features to improve data quality, such as edits for consistency between fields, improved data edit checks, and an automated link of the failure and engineering reports.

INPO also has on-going programs to improve the quality of the NPRDS data. They conduct on-site reviews of NPRDS reporting at selected utilities. They routinely monitor NPRDS engineering records for out-of-service reports, data deletions, and changes in system and component assignments. They also monitor NPRDS failure reporting completeness, accuracy, and timeliness. In 1988, five regional work meetings lasting 2-3 days were held with the NPRDS reporters. Each included training for new reporters, resolution of multi-reporter variances in interpretation of the reporting guidance, and reporter feedback sessions. In addition, INPO has essentially completed the coding of all missing application codes in the engineering records for key electrical and mechanical components and has continued to assign standard model numbers for approximately 305,000 common components (i.e., those most often queried). With the assistance of the utilities, approximately 75% of the model identification numbers have already been standardized. The latter will greatly improve the capability to retrieve data on a specific component.

INPO has been reviewing the timeliness of failure reporting to NPRDS. The current guidance requires failure reports to be submitted within 30 days of the end of the month in which the failure was discovered. If required, reporting may be delayed to obtain information for a complete and accurate failure report. If the delay is expected to be lengthy, the current guidance requires partial failure reports to be submitted and then revised later. Some industry uses of NPRDS require timely reporting of failures such as the Component Failure Analysis Report (CFAR) feature of NPRDS Plus!.

As a result, INPO is considering a new failure reporting guideline, as follows:

- Ninety-five percent of failure reports are to be submitted within 30 days of repair of the failure.

- If more than 60 days will be required to repair a failure after the failure is discovered, a failure report should be provided with an incomplete end date and corrective action.

To obtain feedback and advice from the users and to support task group studies on selected issues, INPO uses the NPRDS Users Group (NUG), which consists of rotating assignees from utilities, as well as representatives from DOE, NRC, EPRI, NSSS vendors, and AEs. The NRC, as one of the NUG members, provides input to INPO regarding the NRC's data needs. NRC proposals and suggestions are considered by INPO in the same manner as those proposed by other NUG members.

At the request of users, NUG has begun to consider the expansion of the NPRDS scope to include additional balance-of-plant equipment, as well as the possible reduction of the scope in other areas. They are also considering adding failure mode codes to all failure reports dated after January 1, 1984 and providing data flags to distinguish between complete and interim failure reports.

In addition to the routine processing and auditing of utility submitted data, INPO's objectives for NPRDS for 1989 include:

- Achieve an industry-wide ramp increase in usage.

- Complete the development, implementation, documentation, and coding of component failure modes for all component failure records dated after January 1, 1984.

- Identify systems and components, if any, to be added to or deleted from the reportable scope of NPRDS. The criteria to be used for increasing the scope to include new systems or components includes their effect on plant availability, as well as their importance to plant safety.

- Enhance usability of NPRDS instrumentation data by developing and inserting into instrumentation records appropriate application codes. Develop and issue revised guidance to NPRDS scoping documents addressing instrumentation.

- Complete the implementation of model identification assignments on the remaining 25% of the NPRDS engineering records based on utility responses.

Industry Participation

Typically, each utility has an NPRDS coordinator, at least one reporter, and

data entry staff involved in NPRDS activities. One to two man-years of effort per station is routinely devoted to these activities. Occasionally, additional resources are devoted for periodic efforts such as the engineering data upgrade.

During the 18 month period, the database volume grew about as expected. The engineering records grew from roughly 455,000 to about 505,000 and the failure records increased from about 60,000 records to 84,000 failure records at the end of 1988. This includes the addition of ten new plants to the reporting base. The rate of failure reporting has apparently leveled off at about 160 reports per plant per year, considering over 17,000 failure records were submitted by the plants in 1988. This value is unchanged from the previous evaluation (i.e., 159 reports per plant per year). Also similar to past experience, the plant specific reporting rate is still very uneven and ranged from less than 20 to over 450 failure reports per year. This variability in reporting exists for a number of reasons such as differences in the type of plant reporting [e.g., BWR Class 3, 4, 5 and 6; PWRs designed by 3 different nuclear steam system suppliers; small and large capacity (MWe) units]; in actual failure rates; in resources devoted to NPRDS; and in interpretation of reporting guidance.

Historically, there has been a moderate time lag based on the industry median value between the date a failure occurred and the date the failure report appears on the data base. During the evaluation period, the timeliness and completeness of NPRDS failure reporting continued at about the same level as previously reported. The NRC staff estimates that approximately 65% of the reportable failures occurring throughout the industry were being routinely submitted, and that half of the reports were in the data base within three to four months after the event occurred. Routinely quarter to quarter variations in the failure reporting timeliness and completeness occur for various reasons such as availability of resources, outage findings, and priority assignments. In this regard, some decrease in timeliness and rate of failure reporting was noted near the end of 1988 due in part to decreased resource availability throughout the holiday period and some diversion of NPRDS resources to upgrading the engineering records.

In early 1988, staff selected a set of plants for further review regarding NPRDS participation based on the number, completeness, and timeliness of failure reporting and/or a poor SALP maintenance rating trend. For these plants, LER component failures were identified and the NPRDS data base searched to find the corresponding NPRDS failure reports, as had been done for all plants in previous evaluations. As these reviews have been in progress for only a little over a year, there are too few data points to identify significant trends. Staff plans to continue to collect and assess such data and to make site visits to discuss and review NPRDS participation at selected plants to better understand the specific factors influencing reporting.

The NRC staff's plant site visits and inspections in the Maintenance Assessment Program in 1988 also indicated that while the plants visited are participating in NPRDS, the extent of their participation varies greatly in the amount of failure reporting and usage. These reviews found that only a small number of these plants are making full use of the data available from NPRDS.

NRC Usage, Site Visits, and Feedback to INPO

During 1988, NRC staff use of NPRDS expanded into the maintenance assessment and maintenance performance indicator areas. Other additional usage continued in areas where component failure data are valuable, such as events analysis, aging studies, identification of component generic concerns, and probabilistic risk studies. In addition, in early 1988, INPO provided direct access capability to a total of 29 NRC employees and 4 national laboratory employees (NRC contractors). At that time, INPO also provided training to some staff on NPRDS Plus!, including representatives from NRR, AEOD and Regions I, II, III and V. Additional training is planned in 1989. Any remaining problems with communications interface equipment (i.e., modems) are being addressed on a case-by-case basis. During 1988, the total NRC accession time was over 850 hours. Actual usage within specific programs varies monthly with the needs for data and data processing (e.g., creation of tables, charts, reports).

As previously mentioned, increased staff usage of NPRDS included the work on developing a proposed rule regarding the maintenance programs at commercial nuclear power plants. One aspect addresses monitoring the effectiveness of maintenance programs through the application of quantitative performance indicators (PIs). For such indicators, a well structured and defined component-oriented system to capture and track equipment historical data industry-wide is desirable. For the trial maintenance PI program, NPRDS was the primary source for the available data to develop maintenance effectiveness indicators. Based on extensive correlation studies between NPRDS data and other information, the trial program concluded that the NPRDS provided the best information since it is standardized, industry-wide, and component failure oriented. It also already contains a significant amount of data, including engineering records, at the system and component level.

As a part of this trial program, AEOD visited 13 sites and reviewed data for 23 associated units. The findings were as expected. All plants visited were participating in NPRDS to varying degrees in reporting data; few were making extensive use of the data for maintenance effectiveness or other component/system performance trending. The AEOD report (AEOD/S804A) on the trial program states that, if maintenance effectiveness indicators are implemented, NPRDS is the best available data collection and processing system, but further development will be required.

As part of another activity, the Maintenance Assessment Program, NRR staff conducted reviews of the degree of participation and implementation of the system in selected plants and the use of the system by plants as a tool for improving plant operations. The data from the NPRDS was reviewed both before the plant visits and on-site. The pre-visit review of NPRDS was used to identify systems and components having frequent failures and suspected areas of weakness. The review at the plant was to further identify equipment failures and operating problems and to assess licensee root cause analysis and corrective actions in response to events.

The findings from five such assessments of NPRDS participation were similar to those from AEOD visits in that they ranged from one plant that was strongly involved in INPO and industry initiatives and routinely used NPRDS for equipment evaluations to a plant with a history of problems that input hardware failures to the NPRDS system but showed no evidence that the data were ever used for trending failures. In between was one plant which assigned a full-time individual to provide on-site NPRDS coordination and was rated strong on its support and commitment to industry organizations but was rated weak on the integration of the NPRDS data into plant operations. The NPRDS met the staff's needs for this program.

NRC staff continued its statistical and engineering analysis of selected NPRDS key components to identify trends and causes of component failures. AEOD studies of NPRDS data on MSIVs and reactor trip breakers undertaken in 1988 experienced some of the problems identified in earlier studies, such that considerable efforts (about a third of the study effort) were expended in problem resolution. For example, data on applicable key components were not submitted; inaccurate data were submitted routinely by some plants, often due to ambiguity in the data field description; and engineering data were often not revised when components were replaced by those of another manufacturer. Problem resolution involved contacting the individual plants to correct data. Data from these studies were tabulated and provided to the NPRDS Users Group in April and December 1988. Staff anticipates that INPO's efforts to upgrade the engineering data will lessen such problems in the future.

Staff use of the failure data in NPRDS has expanded in the statistical area (e.g., the development of the maintenance performance indicators). But, for the most part, usage continued to be qualitative rather than quantitative. AEOD case studies include a review of NPRDS, as well as LERs, to identify relevant events and to attempt to identify root causes. RES continues to use NPRDS in the NPAR program to identify components and systems that are most subject to aging in connection with plant life extension. In this regard, staff found the existing data useful and, along with others involved in aging studies (e.g., EPRI, DOE), provided feedback to INPO's NUG on usage and proposed enhancements for consideration to aid aging studies. The staff has continued to use the engineering data file in much the same way as utilities to locate similar equipment across the industry. In this regard, the NPRDS is often adequate to distinguish between an isolated problem (i.e., one involving few uses of a particular component) and a widespread problem. RES continued to make qualitative use of NPRDS in the risk method integration and evaluation program (RMIEP) and the risk rebaselining for NUREG-1150. Additional use of the NPRDS as a source of statistical failure data to perform quick ad hoc probabilistic assessments was made in connection with screening and prioritizing generic issues. This work is expected to expand.

In NRR's review of the feasibility of reducing Technical Specification surveillance requirements, operational data from NPRDS along with Licensee

Event Reports, NPAR (which also included NPRDS data), and other sources served as the basis to assess the impact of such requirements on plant operation. And, on a case by case basis, NPRDS data may be considered by staff when technical bases are developed for proposed changes in surveillance testing frequencies.

In 1988, staff provided user feedback to INPO on specific problems and generic concerns on data accuracy and completeness as a result of findings from studies of selected components. Such feedback included correspondence and input at NUG meetings. Staff, in particular, provided considerable input to the NUG on proposals for changes in scope. In addition, in May 1988, the Director of AEOD wrote to the Director of INPO's Engineering Division indicating the staff's concerns about the accuracy and completeness of the engineering data for key components and expressing a strong opinion that priority attention be given to upgrading this data. In June, INPO responded that there were on-going efforts to correct such deficiencies identified by users. INPO provided the status and plans for actions related to upgrading the completeness and accuracy of key components and standard model number codes for common components, as well as for enhancements to data entry software and guidelines to assure future entries are of good quality. (Such actions were discussed in detail in earlier sections of this evaluation.)

Evaluation

The industry and INPO in 1988 completed a number of important steps in making NPRDS a more serviceable source of nuclear power plant component failure information. These steps were milestones in the long term plans to complete the IBM conversion, upgrade data reporting and the data base (particularly the engineering data), and promote increased usage of the system. Examples of such steps are (1) the two releases of NPRDS Plus! and (2) completion of planned electrical and mechanical key component/application code efforts, as well as 75% of the planned work on assigning standard model numbers for common components.

Data quality, i.e., portions of the engineering data, improved in 1988. Failure reporting transactions in 1988 remained sizeable. Wide variations in reporting continue to exist among some similar plants and components. Timeliness and completeness remained similar to past evaluations. INPO has identified methods to further improve timeliness of failure reporting and is taking actions to improve data entry quality (e.g., better computer edits and reporter training on new ADP features). INPO efforts also continued to promote increased usage of the NPRDS data by utilities. Industry's capability to access NPRDS increased during the year, as did the NRC staff's.

Staff found that NPRDS remained a usable source for component failure data.

All of the above activities provided further incremental improvements to NPRDS and moved the system closer to full implementation of planned long-term enhancements.

Staff uses for NPRDS data expanded into the maintenance assessment and maintenance effectiveness indicator areas where the data base has proven useful in providing component failure histories and indications of maintenance effectiveness. Traditional uses (events analysis, NPAR, component performance studies) continued and benefitted from the incremental upgrading of data. However, staff continues to have some concern with the variation in reporting among similar plants and components, the timeliness of failure reporting, and the low quality of some data. For example, for maintenance assessment and maintenance effectiveness indicators, consistent, timely, high quality (accurate) reporting provides the maximum benefit for across plant and component reviews.

Staff anticipates that, with the recent steps taken by INPO to improve the ADP features of NPRDS (i.e., release of NPRDS Plus!) and with the completion of planned actions, increased use by utilities will occur, which will in turn increase user feedback to INPO and further induce improvements, particularly in data quality. Also, with the increased use of NPRDS by the utilities, there may be an additional awareness of the importance of timely, consistent, complete failure reporting. With such recognition, the cost/benefit advantages should also be better recognized and additional resources supplied to upgrade the reporting, timeliness, and data quality.