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Nuclear Power Safety Reporting System

Final Evaluation Results

Prepared by F. C. Finlayson, R. D. Newton

The Aerospace Corporation

Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

This document presents the results of a study conducted by the U.S. Nuclear Regulatory Commission of an unobtrusive, voluntary, anonymous third-party managed, nonpunitive human factors data gathering system (the Nuclear Power Safety Reporting System -- NPSRS) for the nuclear electric power production industry. The data to be gathered by the NPSRS are intended for use in identifying and quantifying the factors that contribute to the occurrence of significant safety incidents involving humans in nuclear power plants. The NPSRS has been designed to encourage participation in the System through guarantees of reporter anonymity provided by a third-party organization that would be responsible for NPSRS management. As additional motivation to reporters for contributing data to the NPSRS, conditional waivers of NRC disciplinary action would be provided to individuals. These conditional waivers of immunity would apply to potential violations of NRC regulations that might be disclosed through reports submitted to the System about inadvertent, noncriminal incidents in nuclear plants.

This document summarizes the overall results of the study of the NPSRS concept. In it, a functional description of the NPSRS is presented together with a review and assessment of potential problem areas that might be met if the System were implemented. Conclusions and recommendations resulting from the study are also presented. A companion volume (NUREG/CR-4133, "Nuclear Power Safety Reporting System: Implementation and Operational Specifications") presents in detail the elements, requirements, forms, and procedures for implementing and operating the System.

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The authors also want to express their gratitude for the assistance they received from the NRC and members of the nuclear power community in identifying and evaluating potential problem areas that might be associated with the NPSRS. Technical staff members of the NRC were especially helpful in participating in interviews about the system. Eighteen NRC staff members courteously shared their opinions with us. They represented various offices including the EDO, ELD, I&E, NRR, AEOD, NMSS, and RES. Members of the nuclear power community were equally accommodating. Eleven individuals from Duke Power, Carolina Power and Light, Toledo Edison, and the Northeast Utilities Service Co. provided us with their frank and candid views on NPSRS feasibility.

We are particularly fortunate to have received the support of the Quadrex Corporation in Tulsa, Oklahoma in the performance of the Operability Demonstration on the NPSRS. Eight of the Quadrex technical staff members performed the roles of prototypal reporters, NPSRS staff analysts, program managers, and clerk/editors. In the course of their efforts in connection with the Operability Demonstration, the Quadrex support team not only worked with the draft NPSRS forms and procedures, but also critiqued them. They also participated frankly and candidly in a final debriefing in which they provided their opinions about the feasibility of the system from the points of view of nuclear plant operational staff members.

The authors also are particularly grateful to the support which they received from staff members of the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA), and the Aviation Safety Reporting System (ASRS) in connection with the performance of the study of the NPSRS. Draft NPSRS study documents were reviewed, interviews granted, and briefings provided to the NRC by various members of the organizations. Particular thanks are due to Mr. Tom Kossiaris, the FAA's program manager for the ASRS; to Mr. William Reynard, the NASA project manager for the ASRS; to Mr. Edgar Cheaney, the ASRS program manager, and ASRS staff analysts Mr. Rex Hardy and Mr. Lorin Rosenthal. The authors are especially grateful for the support received from Mr. Harry W. Orlady, Senior Research Scientist for the ASRS who served as an observer and proctor for the Operability Demonstration of the NPSRS and gave, without reservations, his time, opinions, advice, and counsel to support the constructive development of the NPSRS program.

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GLOSSARY

ITEM	DEFINITION
AEOD	NRC Office for the Analysis and Evaluation of Operational Data
ASEP	Accident Sequence Evaluation Program
ASRS	Aviation Safety Reporting System
EEI	Edison Electric Institute
EDO	NRC Office of the Executive Director for Operations
ELD	NRC Office of the Executive Legal Director
EPRI	Electric Power Research Institute
FAA	Federal Aviation Administration
GAO	U.S. General Accounting Office
HRDB	Human Reliability Data Bank
I&E	NRC Office of Inspection and Enforcement
IBEW	International Brotherhood of Electrical Workers
INPO	Institute for Nuclear Power Operations
IREP	Interim Reliability Evaluation Program
LER	Licensee Event Report
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NMSS	NRC Office of Nuclear Material Safety and Safeguards
NPRDS	Nuclear Plant Reliability Data System
NPSRS	Nuclear Power Safety Reporting System
NRC	U.S. Nuclear Regulatory Commission
NREP	Nuclear Reliability Evaluation Program
NRR	NRC Office of Nuclear Reactor Regulation
NSAC	Nuclear Safety Analysis Center
OIA	NRC Office of Inspector and Auditor
PRA	Probabilistic Risk Assessment
RES	NRC Office of Nuclear Regulatory Research
SALP	Systematic Assessment of Licensee Performance
SASA	Severe Accident Sequence Analysis Program
TVA	Tennessee Valley Authority
TWA	Trans World Airlines

1.0 INTRODUCTION

This document describes the results of the study conducted by the U.S. Nuclear Regulatory Commission (NRC) of an unobtrusive, voluntary, anonymous, nonpunitive, third-party managed human factors data gathering system (the Nuclear Power Safety Reporting System -- NPSRS) for the nuclear electric power production industry. The NPSRS has been designed to encourage the participation of nuclear industry and NRC personnel in the System through guarantees of reporter anonymity provided by a third-party organization that would be responsible for management of the System. Additional motivation for contributing data to the NPSRS would also be provided to individuals through conditional waivers of NRC disciplinary action. These waivers of immunity would apply to potential violations of NRC regulations that might be disclosed through reports submitted to the System about inadvertent, noncriminal incidents in nuclear power plants.

The study of the NPSRS was conducted along the following lines. (1) An analysis was performed of the Aviation Safety Reporting System (ASRS). This is a human error data gathering system of the Federal Aviation Administration (FAA) that is managed by the National Aeronautics and Space Administration (NASA) as an independent third-party. The ASRS assessment was performed to determine if it would be feasible to apply part (or all) of the ASRS concepts for collecting data on human factor-related incidents to a system with similar objectives for the nuclear power producing industry. (2) The basic elements and requirements of an NPSRS were identified and defined. (3) Structured personal interviews were conducted with nuclear industry representatives from the ranks of management and operational personnel, with NRC staff members, and others to ascertain and assess potential problems that might be associated with the NPSRS. (4) An NPSRS Operability Demonstration was performed in order to investigate the effectiveness of the functional elements, forms, and procedures developed for the System. (5) Implementational procedures and System specifications were prepared to aid in the overall assessment of the NPSRS and to provide the basic materials needed for System implementation if the NRC should decide to take that step.

This document summarizes the overall results of the study of the NPSRS. In it, an outline and functional description of the NPSRS are presented. An assessment is presented of potential problem areas that might affect System implementation which have been identified during the feasibility evaluation. Finally the results of the study are summarized and the conclusions and recommendations that evolved from the study are presented. Detailed System descriptions, forms, procedures and specifications that have been developed for the NPSRS are presented in NUREG/CR-4133, "Nuclear Power Safety Reporting System: Implementation and Operational Specifications" (Ref. 1). Results of earlier efforts to define the elements of the NPSRS and assess its feasibility are presented in NUREG/CR-3119, Volumes 1 and 2 (Refs. 2 and 3).

1.1 Background

The importance of human error as a significant contributor to nuclear power plant risks has been recognized for over a decade (Refs. 4 and 5). However, little has been done in that period to develop a better data base for understanding the actual causes of human error. Improved methods are needed for collecting relevant information on human performance in nuclear power plants. Current Licensee Event Report (LER), 766 System File, Licensed Operating Reactors Status Summary Reporting System, and Systematic Assessment of Licensee Performance (SALP) event descriptions are either too abbreviated or are not intended to ascertain in-depth causal factors associated with human error.

As a consequence, the NRC instituted the research described in this document to determine the feasibility and advisability of developing and implementing a human performance data gathering system that was designed along the same lines as the ASRS. As designed (Ref. 1), the NPSRS would focus on causal factors of both positive and erroneous human actions committed in the performance of operation and maintenance tasks during nuclear power station operation under normal, transient, or emergency conditions. The NPSRS has been investigated as part of a larger Human Reliability Research Program within the NRC to support the Human Risk Analysis segment of the NRC's Probabilistic Risk Assessment (PRA) programs, and other nuclear plant and system reliability evaluation programs (e.g., IREP, SASA, ASEP).

The research on the NPSRS has been conducted by several different mechanisms. As previously noted, the ASRS concept (sponsored by the FAA) was reviewed in detail to determine whether the technology associated with an unobtrusive, voluntary, anonymous, nonpunitive, third-party managed, human performance data gathering system could be appropriately transferred into the environment of the nuclear power industry. As the NPSRS elements were developed, attempts were made to work closely with the industry and NRC to assure that the positive features and objectives of the ASRS were being appropriately tailored to nuclear industry needs. Meetings and interviews were conducted with industry personnel, labor representatives, the NRC, FAA, NASA, and ASRS personnel (e.g., Ref. 2) as the work progressed. The regulatory intricacies of the nuclear industry, and its relationships with the NRC and the public have made development of a universally acceptable System a challenge. However, significant suggestions and comments that were provided by those who have participated in the meetings and interviews related to the study have been assimilated in the current System design and specifications (cf, NUREG/CR-4133, Ref. 1). Strenuous efforts have been made to assure that the NPSRS conformed with the needs and requirements of the nuclear community.

1.2 Purpose

In accordance with NPSRS objectives, data developed by the System would be used: (1) to support the evaluation and modeling of the human reliability elements of probabilistic risk assessments (PRAs); (2) to evaluate the influence of various nuclear power plant systems on both human error-proneness and outstanding positive actions occurring within the system; and (3) to aid in the development of design criteria for human-machine interfaces with systems in nuclear plants. NPSRS feasibility depends upon a number of aspects such as: (a) its practicality (e.g., the simplicity and workability of system features, costs, etc.); (b) the usefulness of data developed by such a system (e.g., its relevance, biases, and applicability to NRC and nuclear community needs); and (c) its acceptability to government, industry, and operational personnel.

1.3 Summary of System Feasibility Evaluation Results

Over the course of the study of the NPSRS, a number of issues were identified that are associated with system feasibility. Brief descriptions and summary assessments of these issues are presented below. More detailed discussions and evaluations of the issues are presented in Section 4 of this document.

1.3.1 PRACTICALITY - What are the characteristics of an implementable System?

System Management

1. How important would it be to have a third-party manager for the NPSRS? What kinds of organizations would make good candidates for the third-party manager?

A third-party manager would be essential for the NPSRS in order to maintain the independence of the System, assure reporter anonymity, and preserve the integrity of the NPSRS data base. Non-government organizations have features which make them potentially desirable candidates for the NPSRS manager.

Reporters

2. What types of personnel from the nuclear industry, NRC, or elsewhere should be encouraged to submit reports to the NPSRS?

No restrictions should be placed on the types of personnel who might submit reports to the NPSRS.

Reports

3. What restrictions, if any, should be imposed upon the kinds of reports submitted to the NPSRS? Are reports on positive actions, procedures, etc. (as well as reports on human errors) appropriate for solicitation by a NPSRS?

No restrictions should be placed on categories of written material submitted to the NPSRS. Reports on all aspects of human performance including outstanding positive personnel actions, and plant practices and procedures should be solicited by the NPSRS. Some reports will probably deal with subjective material. Staff analysts for the System will need to have sufficient experience and professional insight to evaluate the significance and relevance of reports submitted to the System.

Motivational Incentives to System Support

4. How important would the prospect of anonymity be to potential reporters?

Maintaining the anonymity of reporters is one of the most critical requirements for motivating reporter support of the NPSRS. Publication of individual incident reports could jeopardize reporter anonymity. In an attempt to preserve anonymity, special procedures have been developed for dealing with those infrequent incident reports that must be published as "Alert Reports" and distributed to the NRC and nuclear utilities.

5. How effective would the prospect of receiving a grant of limited immunity from NRC regulatory enforcement actions be to reporters?

A warranty of limited immunity for individuals who report incidents that may involve potential violations of NRC regulations would be an important motivational mechanism for persuading people to submit reports to the System.

6. Would a policy of mitigation of punitive NRC actions against a nuclear electric utility be needed in order to provide the utility with sufficient motivation to support the NPSRS and to ensure that they would not penalize their employees for filing incident reports?

Extending the concept of limited individual immunity to include a policy of mitigation of NRC penalties to utilities/plants for incidents for which reports were filed with the NPSRS could enhance utility support of the System. A precedent for such a policy exists in the current mitigation factors that are outlined in 10 CFR 2, Appendix C (Ref. 10) dealing with potential utility penalties for violations of NRC regulations.

System Oversight and Evaluation

7. How important would it be to have a top-level independent advisory committee to provide oversight and evaluation of NPSRS activities? What should the characteristics of its membership be?

An independent advisory committee that would oversee and evaluate NPSRS activities would be an important element in the implementation and continued operation of the NPSRS. The committee membership should be selected from opinion leaders from the nuclear power community, with representation from professional organizations, operational personnel, nuclear utilities, the NRC, etc.

NRC Liaison Organization

8. Which organization within the NRC should have the liaison responsibility for the NPSRS (e.g., provide funding, manage NRC interests, serve on the advisory committee, and act as point of contact for NPSRS data and studies)?

NRC staff members have a variety of interests and objectives for using human factors data. It appears that a program office within the Office of the Analysis and Evaluation of Operational Data (AEOD) or the Office of Nuclear Regulatory Research (RES) could be an appropriate location for a liaison office given these considerations.

System Implementation Mechanisms

9. How should the responsibility for implementing the NPSRS be transferred from the NRC to a third-party operational agency?

To implement the NPSRS, a memorandum of agreement (MOA) (or statement-of-work for a non-government organization) would need to be prepared between the NRC and the selected third-party management organization, after which work could begin almost immediately. NRC mandated annual NPSRS training programs should be implemented in the nuclear plants in order to provide plant operational personnel with incident report forms and to help them understand and support the program.

System Forms and Procedures

10. Are the specifications, forms, and procedures that have been developed for the NPSRS adequate for implementation by someone other than the system developer?

The specifications, forms, and procedures prescribed in NUREG/CR-4133 (Ref. 1) were determined to be adequate for System implementation by participants in the NPSRS Operability Demonstration.

System Personnel Requirements

11. What skills, personality characteristics, and training would be required for NPSRS personnel?

Broad and extensive backgrounds in nuclear power plant operations would evidently be the most significant skill requirements for NPSRS staff members. Human factors skills are also needed, but most knowledgable interviewees felt that adequate human factor skills could be developed by on-the-job training of NPSRS staff analysts.

System Facility Requirements

12. What office facilities, space, equipment, reference materials, and other resources would be needed to implement and operate a NPSRS?

The requirements for facilities, space, equipment, reference material and the other resources needed for implementing the NPSRS are presented in detail in NUREG/CR-4133 (Ref. 1, Sections 2.9 and 2.10) and summarized in Section 4 of this document. Facility requirements for the System are nominal and are projected to be a relatively small part of the costs of System implementation (less than 1/3 of the total System costs -- cf, Section 4.2.13).

System Cost Estimates

13. How much will it cost to implement the NPSRS?

Costs of implementing and operating the NPSRS have been compared with operational costs of the ASRS. Based upon estimated NPSRS staff requirements of 10-15 people, and input rates of reports of 5000-7000 per year, System operational costs are estimated at $1.5 to $2 million per year.

1.3.2 USEFULNESS - Will the data developed by a NPSRS be beneficial to the nuclear community?

Reliability of Task Frequency Estimates

14. Will NPSRS reporters be able to make reliable estimates of how frequently they perform the tasks that led to the incidents being reported? Could these estimates be used to support PRA projections of human reliability for such tasks?

Results of the Operability Demonstration show that reporters appear to be able to make reliable task frequency estimates for nuclear plant operations involved in reported incidents. With trend data from the NPSRS files to give some semi-quantitative input for numerator data for human reliability estimates, and associated task frequency estimates to give information about denominator values, NPSRS reports appear to be a potentially useful source of information for model development for PRA estimates of human reliability.

Reliability of Incident Analyses

15. If several NPSRS analysts were asked to process the same incident report using NPSRS forms and procedures, how much similarity would exist between their independently produced data summaries?

A reasonable degree of reliability was shown by prototypal NPSRS staff analysts when they were processing and analyzing the example incidents of the Operability Demonstration. Editorial improvements have been made in the final NPSRS forms and procedures (NUREG/CR-4133, Ref. 1) that reflect the lessons learned fron the Operability Demonstration. These, along with standardized training procedures for staff analysts, would further improve the reliability of data reduction for the System.

Value of Deidentified Reports

16. Would NPSRS reports that were being prepared for publication still contain useful information if identifying data were deleted to protect the anonymity of reporters?

Assessment of the deidentification process for a number of example NPSRS input reports indicates that it would be difficult to maintain the anonymity of reporters and to publish synopses of individual reports if they were not extensively edited. Fortunately, it is the consensus of opinion that the need to publish information from NPSRS incident reports should be infrequent, since most events of major safety significance are reported to the NRC through conventional communication channels. Specific procedures have been developed for preparation, publication and distribution of Alert Reports from the NPSRS that have been designed to minimize the probability of loss of reporter anonymity for the relatively small number of incidents for which Alert Reports may be required (cf, Section 3.4.2).

Interfaces with Other Users

17. Would the data produced by the NPSRS be useful to the development of human reliability estimates and the models of PRA analysts and methodology developers? To the Human Reliability Data Bank?

In accordance with the specifications of NUREG/CR-4133 (Ref 1.), trend analyses of the NPSRS data would be published by the System at regular intervals. These analyses should have substantial benefits for System users such as the Human Reliability Data Bank and PRA analysts and methodology developers as well as reactor vendors, facility designers, and plant operational personnel.

1.3.3 ACCEPTABILITY - Would the data from the NPSRS be needed? Would the System be embraced or shunned by the nuclear community?

Need for Human Performance Data

18. How important are human performance data to nuclear power industry personnel? To NRC personnel? How adequate are the currently available sources of data on human performance?

There was almost complete agreement among both industry and NRC interviewees that more (and more reliable) data on human performance are needed. In interviews conducted with nuclear plant operational personnel, broad agreement existed that a substantial number of significant near-miss incidents occur in nuclear plants that are not reported to plant managers or the NRC through any of the existing reporting channels for safety-related incidents.

NPSRS Implementation: An Asset or an Intrusion?

19. Considering the data needs and potential problems with existing human performance data collection mechanisms, would implementation of the NPSRS be accepted as an asset by the nuclear power industry? The NRC? Reporters?

Whether potential participants considered the possibility of implementation of the NPSRS to be an asset or an intrusion depended heavily upon their perceptions of the objectives and functions of the System and their relationship to the internal structure of the nuclear industry. With certain caveats, plant operational personnel groups were strong supporters of the concept. Aside from their obvious concerns over being penalized by the NRC and/or utilities for filing reports, the main concern of reporters was that the data extracted from their reports should result in useful applications within the industry. Utility management representatives had mixed responses to the question but often considered the NPSRS to be redundant with existing data gathering systems. While some managers were opposed to the NPSRS, others felt that it should be implemented and given an opportunity to demonstrate whether it would be useful. NRC interviewees were most often supportive of the NPSRS concept (with some reservations). If the System were implemented in accordance with the conceptual design and specifications which have now been developed (NUREG/CR-1433, Ref. 1), many of the reservations of the interviewees concerning the implementation of the NPSRS in its earlier draft form might be overcome. It would probably be necessary to implement and operate the NPSRS in full before the reservations of others could be overcome.

Based upon the assessment of all the comments received on the System and its potential capabilities and problems, it appears that on balance the NPSRS could provide an important new source of human performance data without undesirable impacts on the industry. Implementation of the NPSRS could have both near-term and long-range benefits for both industry and the NRC that would apparently outweigh the potential problems that some people may have seen for the System.

1.3.4 Unaddressable Issues

In addition to the issues discussed briefly above, there were a number of issues that were beyond the scope of this study to address. Resolution of these issues would require field implementation of the system or an extensive trial period. These issues are described in more detail in Section 4.1 and include the following topics:

1. The adaptability and flexibility of the system;
2. The effectiveness of System safeguards for detecting and rejecting specious reports;
3. The effectiveness of NPSRS safeguards for preventing misuse of material from the System data base;
4. The quantities and types of plant specific and generic information that might be received most frequently by the NPSRS;
5. The validity of data collected by the NPSRS;
6. The reliability of NPSRS data;
7. The completeness of information reported to the NPSRS.

1.4 Report Organization

Section 2 of this report contains a description of the relationship between the ASRS and the NPSRS, and an outline of the functional relationships of the NPSRS. A brief description is also presented of the research conducted to develop the elements of the NPSRS and to assess its feasibility. Section 3 contains a concise description of the System and its elements. In Section 4, the approaches are described that were taken to assess the NPSRS concept, an issue-by-issue review of the study results is presented, and a summary overview is given of the results of interactions with personnel from the FAA, NASA, and the ASRS over the course of the study. Section 5 contains a summary of the study results, and conclusions and recommendations relative to the NPSRS.

2.0 BACKGROUND AND OVERVIEW

2.1 NPSRS Development Procedures

The NPSRS concept was developed in a three-step series of actions: feasibility analysis, prototypal System development, and NPSRS prototype evaluation. At the outset of the investigation, retrospective analyses were made of the FAA's Aviation Safety Reporting System to see whether the ASRS concept contained technological features that could be applied to the nuclear industry. It was evident that the ASRS has been very successful in accumulating pertinent human performance data for the aviation industry and the FAA through an unobtrusive, voluntary, anonymous, nonpunitive, third-party managed system. A working model of a similarly based system for the NPSRS was developed around the unique characteristics of the nuclear power generation industry (Ref. 6). The principal issues associated with such a nuclear power industry oriented system were assessed initially though a concept review meeting in which industry management, labor, the NRC, the FAA, the ASRS, and several research organizations participated (Refs. 2 and 3). The System feasibility issues were evaluated in detail by conducting a series of structured individual and group interviews with key representatives of the nuclear utility industry, operational personnel, the NRC, and the ASRS. (Samples of the protocols used for the structured interviews are contained in Appendix A.) Finally, the draft implementation and operational specifications for the NPSRS (Ref. 6) were evaluated by means of an Operability Demonstration (Refs. 7 and 8). The results of the research conducted on the NPSRS are described in this document with particular emphasis upon the assessments made from the structured interviews that were conducted for the study and the performances of the protypic NPSRS staff members in the Operability Demonstration.

2.2 Summary of Aviation Safety Reporting System Features

In December 1974, Trans World Airlines (TWA) Flight 514 crashed into a Virginia mountain side. The tragedy was subjected to the full glare of media publicity and contributed to forces that induced the FAA to implement a human performance data gathering system called the Aviation Safety Reporting System. The effects of the TWA 514 crash on the FAA are quite analogous to those of the Three Mile Island incident on the NRC. Specifically, both incidents resulted in a heightened concern with respect to human safety related incidents in each of the respective government organizations (Ref. 2).

In 1976, following a thorough review of the events of the TWA Flight 514 crash and some false starts in implementing unsuccessful, non-third-party managed human performance reporting systems, the FAA instituted the Aviation Safety Reporting System. The ASRS was designed to encourage flight crew members, air traffic controllers and others in the national aviation system to voluntarily report any incident, situation, or occurrence (contributing either positively or negatively to its outcome) which the reporter felt was related to air safety. Two provisions were included in the system that have proved to be very effective in motivating voluntary reporting. First, a neutral and independent third-party organization (NASA) was asked to manage and operate the program in order to isolate the report (and the reporter) from the FAA, and thereby provide anonymity for the reporter. After its previous false starts, third-party management of the system was recognized by the FAA to be essential to the successful outcome of its efforts. (Consequently, the FAA has no explicit managerial connection with the ASRS, but is its primary financial supporter providing about $1.5 million per year to fund the system.) Second, the FAA extended an offer of limited immunity from regulatory disciplinary action to those individuals who submitted reports of safety-related incidents where Federal Air Regulations may have been violated. The offer of immunity is currently extended to an individual for a single, appropriately reported incident once in a five-year period, as long as the reported incident does not involve criminal offenses or actual aircraft accidents.

A steady influx of reports has been received over the nearly nine-year period since the ASRS was established. Reports have been received at a rate of about 400 per month and over 40,000 have been received since the system was initiated. ASRS analysts routinely search the information in the data base for trends that may identify existing or potential problems within the U.S. aviation system. Several special technical reports describing findings and system results are issued each year by the ASRS staff. When critical problem areas are identified by a reporter, hazard notification reports are issued promptly to those with a specific need for the information. The ASRS program also publishes a monthly newsletter/safety bulletin (the "Callback") that provides a regular, relatively informal forum in which safety issues of general interest are highlighted.

In the performance evaluation for the ASRS conducted in 1982, the official and unqualified conclusion of the NASA sponsored ASRS Advisory Committee was that the System was practical, useful, and widely accepted within the aviation community (Ref. 9). In September 1983, the administrators of the FAA and NASA once again implicitly acknowledged the value of the ASRS by approving its continuance through September 1987. The successful performance of the ASRS provides substantial support for a determination that a human performance data gathering system built around the concept of an unobtrusive, voluntary, anonymous, nonpunitive, third-party managed operation could be successfully implemented and would provide substantial benefits within the nuclear community.

2.3 NPSRS Concept Summary

The basic elements of the NPSRS are shown in Figure 1. As it is designed (cf, Ref. 1) the NPSRS, like the ASRS, would provide a simplified method for submitting reports of safety incidents to the System. The ASRS experience has shown that guarantees of anonymity are an essential feature to the System's success in assuring reporters they will not incriminate themselves by sending information on safety incidents to the data collecting system. Therefore, the NPSRS has been designed, as shown in Figure 1, as though it was isolated from its surroundings by a one-way permeable boundary. This quasibarrier permits incident reports to flow into the system and specific deidentified output reports to flow out of it, but prevents direct, external access to the individual incident reports.

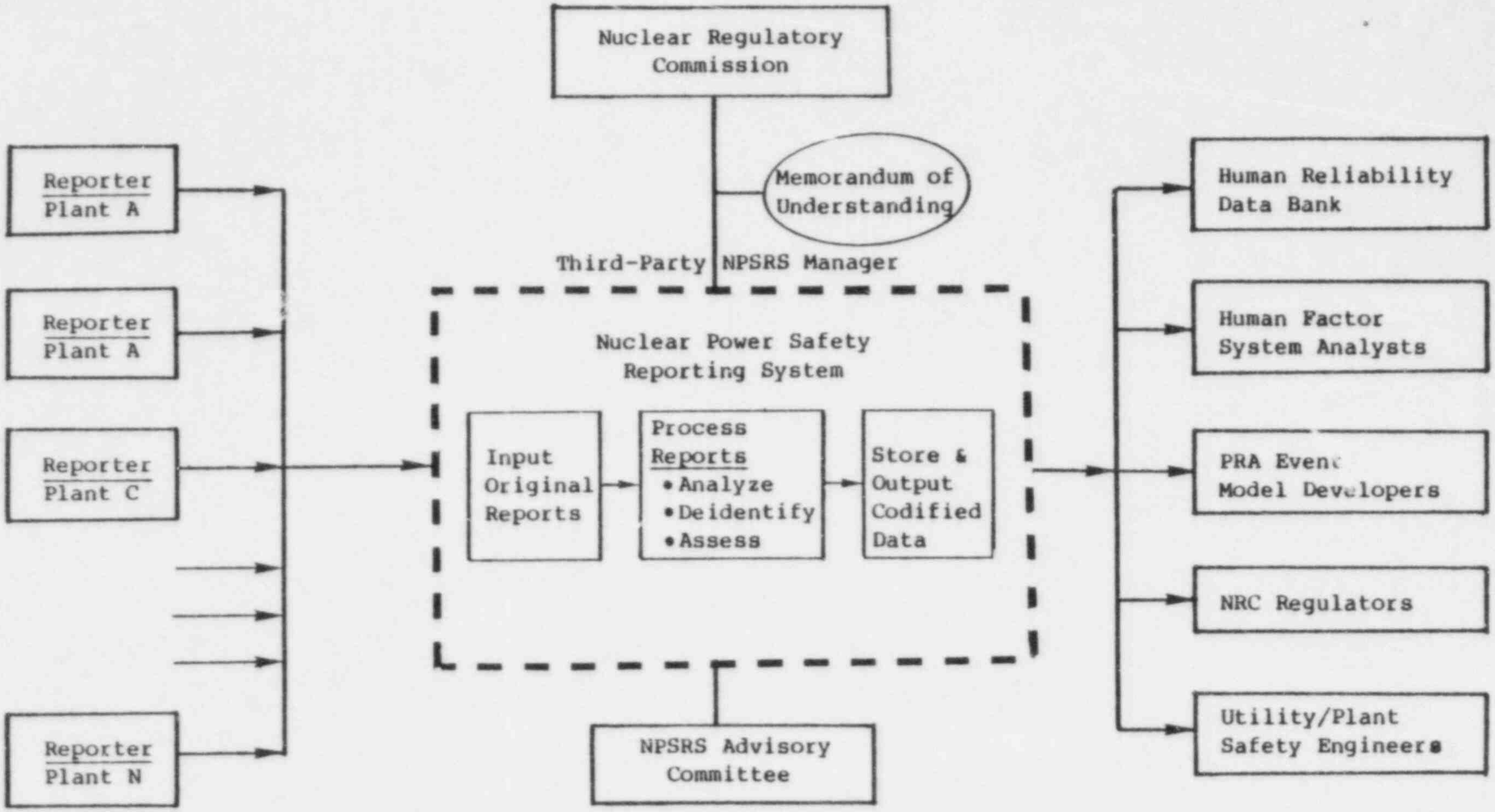

Figure 1. Functional Diagram of Operational Relationships and Processes of a Nuclear Power Safety Reporting System

A number of factors may motivate individuals to report safety-related incidents to the System: (1) professionalism, (2) concern for personal and public safety, (3) concern for the economic well-being of the organization for which they work, (4) concern for their personal self-esteem with respect to their jobs in light of the public's emotional response to safety-related incidents in nuclear plants, or (5) concern over possible job-related disciplinary action such as loss of operating licenses (or jobs) as a result of human errors that may have contributed to the incidents.

Similar factors motivate members of the aviation industry (pilots, air traffic controllers, etc.) to report incidents to the ASRS. However, a significant difference exists between the U.S. aviation system and the nuclear power industry with respect to the motivational effect of disciplinary actions taken against individuals. In the aviation system, disciplinary actions for violations of FAA regulations are normally taken against individual pilots, air traffic controllers, etc. However, in the nuclear power industry, utilities rather than individuals have, in the past, usually been the recipients of discipline for violations of NRC regulations.

In the U.S. aviation system, individual reporters are rather strongly motivated to support the ASRS by the FAA's warranty of a limited waiver of disciplinary action for any unintentional regulatory misdeeds short of accidents and clearly illegal activities. As previously noted, the FAA extends immunity to ASRS reporters for one incident per five-year period. In order to provide basic motivation for reporting to the NPSRS, similar limited warranties of immunity would need to be provided by the NRC to nuclear power plant personnel. However, the NRC's current regulatory policies might not make an individual warranty of immunity such an attractive "carrot" to nuclear power plant operational personnel. They might feel less incentive to report because they would not necessarily have such immediate concern (on an individual basis) about the possibility of being subject to NRC disciplinary actions.

To increase the plant operational personnel's motivational level to report safety-related incidents, incentives should also be provided to utilities (as well as individuals) to motivate the utilities to encourage employee participation in the NPSRS. The reports summarizing NPSRS findings that would be provided to utilities would represent one such incentive. The availability of the NPSRS data base for industry research would be another incentive. As a result of the interviews conducted with the nuclear community for this study, it has become clear that another strong motivation for nuclear utilities to participate in and support the System could be provided if the NRC established a policy for mitigating penalties for incidents reported through the NPSRS where the utility could demonstrate that they were substantial, active supporters of the System. A precedent exists within the NRC for the mitigation of utility penalties for regulatory violations where prompt self-reporting and correction of infractions have occurred (cf, Ref. 10, CFR Part 2, App. C). A formal policy that would extend this consideration to utilities participating in the NPSRS could apparently provide a strong incentive for encouraging utility participation in and support of the NPSRS. An example of a conceptual NRC policy statement outlining a position on the NPSRS is provided in Appendix D.

Finally, the success of a NPSRS depends upon the support of all of the members of the nuclear power community, including representatives of operational personnel, utility management personnel, reactor manufacturers, professional societies, and government agencies. A representative body is needed that can consider the interests of nuclear industry participants and work out the compromises that are needed to make the NPSRS an effective, mutually acceptable system for all members of the community, and can monitor and evaluate NPSRS performance. This function would be provided through an advisory committee to the NPSRS that would be similar to the ASRS Advisory Committee.

3.0 FUNCTIONAL DESCRIPTION OF THE NUCLEAR POWER SAFETY REPORTING SYSTEM

3.1 Overview of System

The NPSRS is designed (Ref. 1) with functional mechanisms for collecting reports, for analyzing and evaluating the data associated with the reported incidents, for cataloging and storing the data from the reports, for reducing and analyzing the safety-related data, and for informing those who need to know and can do something about the safety problems that are revealed by the data. NPSRS analysts will also identify and publicize trends in human performance from their data and identify situations which will not only serve to alert the nuclear power community to developing problems but will also provide useful results that may aid in the resolution of safety problems. The functional relationships of the NPSRS are shown in Figure 2.

3.2 Submission of Incident Reports

The first step in the functional flow of the NPSRS, the submission of an incident report from a reporter in a nuclear plant, is shown in Figure 2 - Block 1. NPSRS reports would be solicited from any person in the nuclear power production community who witnessed, was involved in, or otherwise had knowledge of an occurrence or situation which they believed posed an actual or potential threat to nuclear plant safety or represented a significant positive action or situation that contributed to improved safety in the plant. Reporters would be encouraged to use NPSRS incident report forms (cf, Ref. 1, Appendix A) whenever possible.

Report forms would be made available to plant personnel through a designated non-management individual within each plant. In order for a utility to be eligible for possible mitigation of NRC sanctions for potential regulatory violations, the utility would be required to demonstrate substantial, active support for the NPSRS. As partial evidence of their support, the utilities would be required to select and sustain a non-management individual for distributing blank NPSRS report forms in their plants. Utilities would be required to submit to the NPSRS (and keep current) the name, address, and local telephone number of their designated representative. With this information, the NPSRS could make regular contacts with the designated individuals to assure that supplies of report forms were available at all times within each plant. Report forms would be made available to plant personnel by means of appropriately and discretely located report supply stands or distribution boxes within each plant or would be mailed out with company newsletters, safety messages, etc. They would also be made available to reporters directly through the NPSRS office.

The NPSRS Incident Report Form (cf, Ref. 1, Appendix A) has been designed as a single-sheet questionnaire that is self-addressed and postage-guaranteed, for mailing to the NPSRS. The report form includes: the submitter's identification that is located on a detachable portion of the top of the report form; a checklist of descriptive parameters for a top-level summary of a number of generally applicable factors related to the incident; and space for a concise, first-hand narrative description of the incident. The checklist of descriptive parameters is designed for quick and easy completion by the

NUCLEAR POWER SAFETY REPORTING SYSTEM

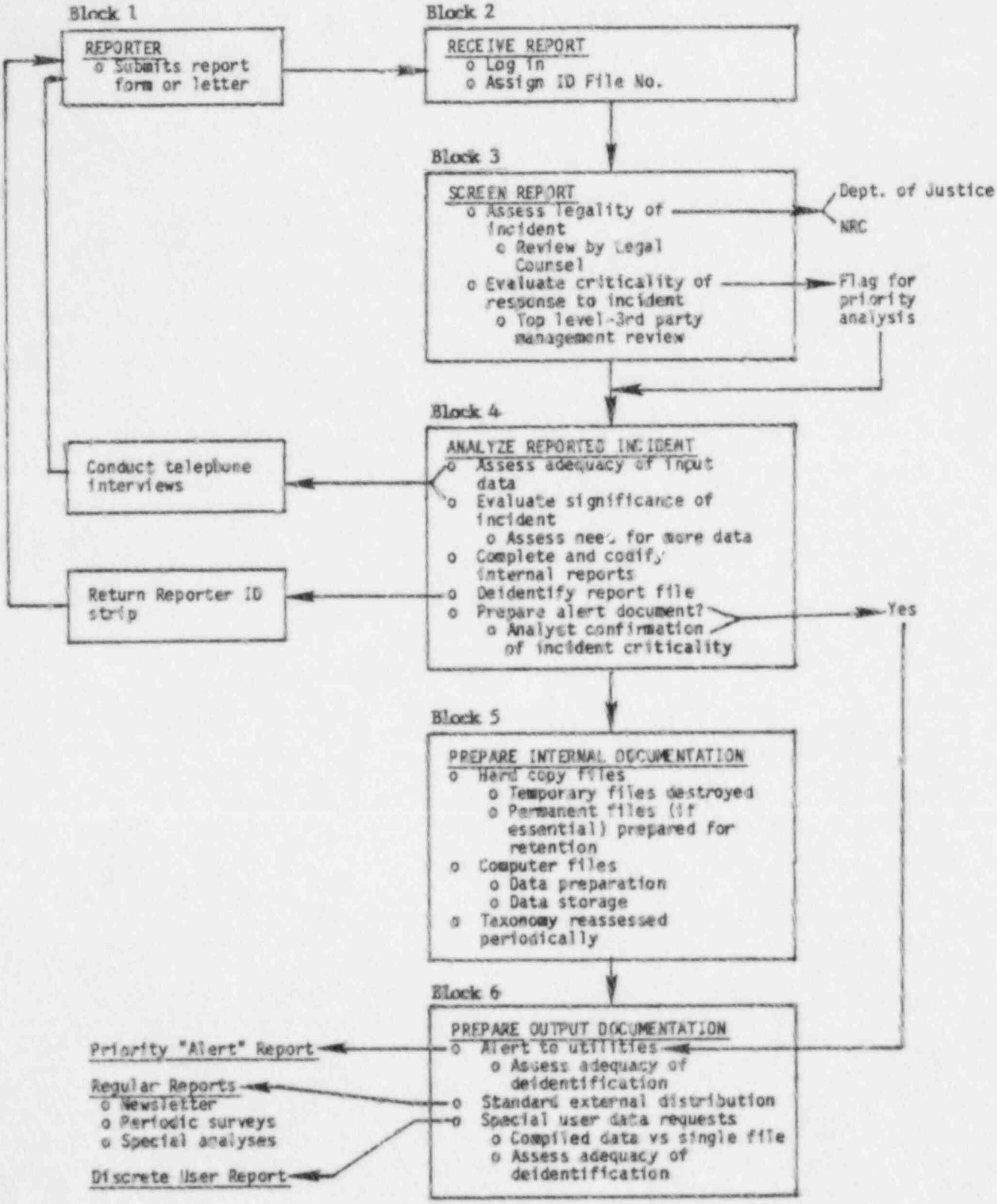

Figure 2.

reporter. The checklist includes important items for analysis and codification of the incident such as plant type, plant operational status, time of day, the reporter's job description and experience, and the job or task being performed, etc. The detachable identification section, containing the reporter's address and home phone number, is returned as a receipt to the sender. This receipt would become the reporter's proof of having filed a report, if it should become necessary for him to exercise his warranty of immunity.

3.3 Initial Receipt and Processing of Incident Reports

The NPSRS administrative procedures associated with receiving and processing incident reports are shown in Block 2 of Figure 2. Upon receipt of an incoming report, an NPSRS administrative clerk would log the report into the system by assigning it a file identification and accession number. The file identification number would be used for internal control and tracking of the report as well as for identification of the final data storage location of the report. The clerk would also be responsible for maintaining a file for identifying the processing status of individual reports as they moved through the system.

3.4 Screening of Incident Reports for Legality and Handling Priority

The functional relationship of the screening processes associated with individual reports is shown in Block 3 of Figure 2. After the report is received and logged into the system, the NPSRS program manager would screen the report for information that indicated whether the incident involved a criminal offense, or was of sufficient significance to require preparation of an Alert Report.

3.4.1 Criminal Offenses

If the reported incident was associated with a criminal offense, it would be forwarded without further NPSRS processing to the NRC and/or appropriate law enforcement agencies. However, the NPSRS program manager would not screen incoming reports for violations of NRC regulations. To do so could seriously compromise the willingness of plant operational and maintenance personnel to report conditions or situations which might pose a threat to nuclear safety.

3.4.2 Alert Reports

Concurrent with the screening process for criminal offenses, the NPSRS program manager would examine each incoming report for incidents containing time-critical information of major specific or generic significance to nuclear utilities, or for incidents that might be forerunners of potentially high public-risk events. Reports containing such information would be candidates for publication of NPSRS Alert Reports. Most reports containing information about time-critical, high-risk incidents would normally be submitted independently to the NRC through the local utility associated with the event in accordance with the NRC's established communications channels (e.g., Licensee Event Reports, etc.). For incident reports that appear to meet the high-risk and time-criticality criteria for Alert Report preparation, the NPSRS program manager would request the NRC to provide a listing of all accidents submitted to the NRC through their established channels in the time period immediately prior to and following the reported NPSRS incident. The NPSRS report which was judged to be of critical safety significance would be compared with the NRC listing to see whether it had been reported in parallel to the NRC through other channels. If the NPSRS incident had been reported through normal channels to the NRC, no further consideration would be given to publication of the subject incident as an Alert Report. Under these conditions, responsibility for further dissemination of information about this incident to the industry would be assumed to reside with the NRC. The incident would, however, be flagged for potential assessment in subsequent publications of incident trend analyses prepared by the NPSRS.

If the incident had not been reported to the NRC, the NPSRS program manager would contact the individual submitting the report and discuss the implications of possible Alert Report publication with him. In general, the program manager would encourage the reporter to submit an additional report on the incident directly to the NRC or to his own plant management through an established communication channel, thereby obtaining immunity (if possible) directly from the NRC for circumstances related to the incident. If the reporter could not be persuaded to do this, the program manager would negotiate directly with the NRC on the reporter's behalf, attempting to establish a mutually acceptable channel for publicizing the critical information while retaining the anonymity of the reporter. Deidentified Alert Reports would be prepared by the NPSRS with sufficient constraints on the level of detail so that the reporter's anonymity would (if at all possible) be preserved, and yet with sufficient data so that the hazards associated with failure to introduce the information to the nuclear power community would be reduced.

In the event that an acceptable Alert Report could not be generated and the reporter's identity would be put at risk if one were distributed, then the NPSRS program manager and the NRC would have to jointly determine the disposition of the matter.

It should be noted that NPSRS Alert Reports would be sent to the NRC, utilities, and individual nuclear power plants for information purposes only. No action would inherently be required on the part of the recipients of the Alert Report, although action could be taken voluntarily on the part of the utility recipients. It would be the responsibility of the NRC to make and implement any actions which might be imposed upon individual recipients of Alert Reports.

3.5 Analyses of Reported Incidents

The steps associated with NPSRS analysis of reported incidents are outlined in Block 4 of Figure 2. Following the initial processing for criminal offenses or Alert Report requirements, as shown in Figure 2, the Incident Report would be assigned on a routine basis to an analyst for detailed assessment and processing. The analyst would assess and codify the input data in the report. If after examining a report, an analyst believed that further information was needed to clarify the contents of the report, the analyst would contact the reporter at his home by telephone (or by mail - if the reporter couldn't be reached by phone outside of his workplace). Results of the interview would be appended to the internal data files as required by the interview results.

When the analysis of the report was complete, the original report form would be deidentified by removal of the identification strip and obliteration of other identifying information in the body of the report. As indicated in Figure 2, the identity slip would be returned to the addressee as his proof of submission of the report to the NPSRS in case it was necessary for him to exercise his warranty of immunity in connection with the incident.

As necessary, the NPSRS analyst would purge critical references to the specific nuclear plants involved in the incident as well as their parent utilities from NPSRS generated internal reports in order to preserve reporter anonymity. Original documents would be destroyed when the analysis results had been codified for computer input.

3.6 Preparation of NPSRS Internal File Documentation

The functional relationship of the internal documentation resulting from the NPSRS analyst's evaluations of incident reports is shown in Block 5 of Figure 2. Following report deidentification, the report would be prepared for data bank entry. An analyst would make the needed judgments regarding the coding of information in the report. The resultant temporary file of data and information would then be processed for entry into the data bank. A verbatim transcript of the deidentified narrative portion of the original report would be entered into the data bank along with the analyst's comments on the results of his interviews with the reporter, and his summary of the significant elements of the incident.

Individual reports would be codified in terms of the NPSRS taxonomy and added to the system data base. The taxonomy of the NPSRS information system has been designed to provide an extensive indexing system to facilitate retrieval and analysis of reports (cf, Ref. 1, Appendices D and E). The structure of the data base includes key descriptive parameters related to human behavioral attributes (e.g., distraction, forgetting, failure to monitor, complacency, etc.); nuclear power system attributes that may be associated with problem reports (e.g., degraded information exchange processes, ambiguous procedures, equipment failure); and incident descriptors (e.g, plant type, status, time of occurrence, system hardware, components, etc.).

3.7 Preparation of NPSRS Documents for External Distribution

The categories and functional relationships of external reports and outgoing documents prepared by the NPSRS are shown in Block 6 of Figure 2. The information in the NPSRS data base would be routinely searched by NPSRS analysts for trends that could identify existing or developing human factors problems. Special technical reports describing findings of trend analysis results would be issued regularly by the NPSRS staff. As previously discussed, Alert Reports on high-risk, time-critical safety issues would be issued promptly to those with a specific requirement for the information. The NPSRS would also publish a periodic newsletter/safety bulletin that would provide a regular, widely circulated forum in which important aspects of nuclear power safety would be reviewed. The topics presented in the newsletter would be derived from analyses of the NPSRS data base and would be designed to be of general interest to operational personnel in nuclear power plants. The newsletter publication would also provide a mechanism for presenting concise reviews of safety-related topics prior to formal publication of generic studies on problems. The newsletter would also provide feedback on the operation of the NPSRS to nuclear power personnel so that the system could achieve greater recognition and utilization by potential reporters.

In addition to research requests received from the NRC or studies initiated by the NPSRS staff, it is anticipated that requests would be received for special studies of interest to specific industry or academic organizations. Within the limit of its resources, the NPSRS staff would attempt to support special requests for data bank searches and/or analyses in a manner that would not compromise the security of the data or the anonymity of reporters. The results would generally be provided to requestors in terms of consolidated, uninterpreted output from searches of the data bank.

4.0 NPSRS FEASIBILITY ASSESSMENT

As noted in Section 1.2, the NPSRS feasibility has been assessed against its practicality, usefulness and acceptability. The specific issues against which the NPSRS was evaluated were outlined in Section 1.3. The assessment of each of these issues is presented in this Section. The analysis methods used to perform the issue assessments are also reviewed in this Section. Issues that could be significant to the System, but that were beyond the scope of this investigation are also outlined.

4.1 Assessment Approaches

In the preliminary NPSRS development/evaluation efforts, (Refs. 2 and 3) an initial set of specifications for the System was prepared. The initial specifications included a preliminary description of the functional aspects of the System, its forms and procedures (Ref. 6). As the initial specifications were developed, a preliminary plan was also prepared for evaluating NPSRS feasibility (Ref. 7).

The preliminary plan (Ref. 7) for NPSRS evaluation identified a set of issues which were pertinent to the feasibility of the System. In the performance of the feasibility evaluation, the issues were addressed by three principal mechanisms: 1) by conducting interviews with opinion leaders in the nuclear industry, operational personnel, the NRC and the ASRS; 2) by performing an Operability Demonstration of the functional effectiveness of the preliminary organizational structure of the System, its forms, procedures, and its personnel and logistical requirements; and 3) by conducting retrospective and internal analyses of information related to the System and to its data gathering counterparts in other industries (such as the ASRS).

As part of the assessment, structured interviews were conducted with 11 management representatives from four nuclear utilities, with 18 staff members from the NRC (who represented the EDO, AEOD, NRR, RES, ELD, I&E, and NMSS), with 8 experienced operational personnel, as well as with NASA, ASRS, FAA, and other Department of Transportation personnel. A typical protocol for the structured interviews has been attached to this report as Appendix A. The results of the interviews are reviewed in this Section.

The Operability Demonstration was conducted in accordance with its final test plan (Ref. 8). Supporting personnel for performing the Operability Demonstration were obtained from one of the major nuclear service organizations in the U.S., the Quadrex Corporation, Tulsa, Oklahoma. The services of eight highly experienced nuclear plant operational personnel were obtained (most of whom had been licensed plant operators) to perform the functions of NPSRS staff personnel or to act the parts of reporters from industry. The prototypal NPSRS staff personnel and reporters had no previous exposure to the System prior to the Operability Demonstration. Personnel from The Aerospace Corporation and NRC acted as proctors for the Demonstration. The ASRS provided an observer for evaluation of the Operability Demonstration procedures (cf, Appendix E).

Ten simulated incident reports were analyzed by each of five individuals performing the roles of NPSRS staff analysts. Brief summaries of the example incident reports are attached to this document as Appendix B. Each of the prototypal NPSRS staff analysts interviewed each of the "reporters" about the incident reports which they had prepared and submitted. Thus, five detailed, independent analyses of each of the incidents were prepared by the prototypal staff analysts. The procedures of the draft NPSRS specifications (Ref. 4) and the associated forms were utilized in the Operability Demonstration for analysis and codification of the simulated incident reports.

The results of the repeated, independent analyses of the incident reports have been reviewed, compared, and evaluated in terms of a discussion of analyst reliability in performing their tasks (Section 4.2.15). A more detailed assessment of the data processing reliability of the prototypal analysts is presented in Appendix C. The participants in the Operability Demonstration for the System were also asked to evaluate the forms and procedures used in the Demonstration. The participants also provided written assessments of the quality and effectiveness of the draft NPSRS forms and procedures based on their performances of the roles of prototypal staff members. The results of these evaluations are summarized in Section 4.2.10, 4.2.11, 4.2.12, 4.2.14. The significant comments and recommendations of the participants in the Operability Demonstration have been incorporated into the final System Specifications (Ref. 1).

A number of issues were identified that appeared to be pertinent to the evaluation of the NPSRS in its draft format (Refs. 3 and 6), but were beyond the scope of the study. These issues would require field implementation before they could be adequately evaluated. They include the following topics:

1. The adaptability and flexibility of the System; i.e., the capability of the NPSRS taxonomy to grow and to be adapted gracefully to the potential richness of the data expected from a voluntarily-based reporting system.

2. The effectiveness of NPSRS safeguards for identifying and rejecting potentially specious reports; i.e., reports that might be submitted on irrelevant or insignificant incidents to satisfy non-safety-related objectives of reporters.

3. The effectiveness of NPSRS safeguards for preventing misuse of material from the data base.

4. The quantities and types of plant specific and generic information that might be received most frequently by the NPSRS.

5. The validity of the NPSRS data; i.e., whether the results of analyses of the accumulated data would properly reflect objective truth or generally accepted authority.

6. The reliability of the NPSRS data; i.e., the repeatability of reported events or reproducibility of System data or analyses.

7. The completeness of information reported to the NPSRS; i.e., the adequacy of the descriptions of the reported incidents relative to the requirements of human reliability and human factors analysts.

4.2. Assessment of Issues

In the following presentations, the issues are defined at the beginning of each section followed by a summary assessment of the issue.

4.2.1 System Management Modes

How important would it be to have a third-party manager for the NPSRS that isolated reporters from direct interaction with the users of the reported data, such as the NRC, utilities, and others? What kinds of organizations would make good candidates for the third-party manager?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, DOT, and GAO personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS, NPSRS, and other human performance data gathering systems.

An independent, third-party manager would be an essential element of a successful NPSRS. Only by isolating reporters from the potentially punitive, regulatory arm of the NRC, from their nuclear utilities, and from other users of the system can reporter anonymity be assured. The use of a third-party manager (NASA) for operation of the ASRS has been crucial to the successful operation of that system.

Some NRC and utility management interviewees expressed concerns that the voluntary aspects of reporting to the third-party managed NPSRS might tend to separate the plant managers from information which should come directly to them from operational personnel. There were also some concerns that the reports from the NPSRS could be subject to delays between receipt and publication and, hence, might not be timely enough to aid the NRC to meet their allegation tracking requirements or to help in resolving potential utility in-plant problems. Nevertheless, the need to preserve reporter anonymity is crucial to the success of the NPSRS (cf, Section 4.2.4). Isolation of the reporters from utility management and the NRC appears to be an essential element for assuring reporters that their anonymity will be preserved. The potential benefits of the third-party management concept, as noted below, would seem to outweigh the costs of delays in information transfer and some apparent separation between utility management and operational personnel.

The choice of the type of organization that would make the most effective manager of the NPSRS is a somewhat subjective matter. On one hand, a knowledgable, unbiased federal government agency could provide a measure of apparent public support for the system. However, such an organization would inherently be subject to budgetary vagaries and public demands for information from the NPSRS data bank that might jeopardize the capability of the organization to protect the reporter's anonymity (the fundamental reason for which the organization was selected in the first place). On the other hand, a non-government organization (possibly a non-profit) with personnel having extensive experience in the nuclear power industry, which also had a strong reputation for independence and objectivity, would also be acceptable to most people in both industry and the NRC as a third-party manager for the System. One possibly advantage of a non-government organization is that it would not be directly subject to arbitrary demands for releasing data from the System that might jeopardize the confidentiality of the data base and the anonymity of reporters.

The third-party manager organization (whatever type of agency it was) would have to be staffed with personnel who have broad and extensive backgrounds in nuclear power plant operations. Moreover, the manager of the organization should have an outstanding reputation of his or her own in the nuclear industry that would project a public image of strength, independence and capability for the organization. A relatively small organization would probably be adequate to provide for the initial implementation of the program. It appears that a total of about 10-15 full-time equivalent technical staff members would be sufficient for implementing the system initially (cf, Ref. 1, Sections 2.9 and 2.10).

4.2.2 Reporters

What types of nuclear industry personnel should be encouraged to submit reports to the NPSRS? What nuclear plant on-site personnel are acceptable? What off-site personnel categories?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, and NASA personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS and NPSRS data gathering systems.

It should not be necessary to preclude anyone from submitting reports to the NPSRS. All types of operational and administrative personnel from nuclear plants and utilities should be encouraged to report safety-related incidents to the System. However, no explicit attempts should be made to encourage non-nuclear layman plant visitors or NRC personnel to report through the System. Nevertheless, NRC personnel should be permitted to submit reports to the NPSRS for incidents which they believed might not otherwise be included in the System's data base -- assuming that they had reported in parallel through their regular NRC channels. NPSRS staff analysts would have to draw upon their backgrounds and expertise to evaluate the significance and relevance of reports submitted to the System in order to put them in their proper perspective.

4.2.3 Reports

What restrictions, if any, should be imposed upon the kinds of reports submitted to the NPSRS? Are reports related to the following subjects acceptable: Utility or plant administrative or operational policies? Quality of supervision? Working conditions? Quality of management? Are reports on positive, accident preventive human actions, outstanding plant procedures, etc. appropriate for solicitation in a NPSRS?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, DOT, and GAO personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS, NPSRS, and other human performance data gathering systems.

Nuclear plant operational personnel indicated that they felt strongly that many safety-significant near-miss incidents were not being reported to the NRC. These potentially unreported incidents were categorized as events where the efforts of plant operational personnel may have prevented a potentially significant event from escalating to the level where a report to the NRC would have been required. Most of these incidents were felt to involve significant aspects of human behavior that could be important to those who are responsible for understanding and modeling human performance. The operational personnel indicated that the NPSRS would furnish a very useful and desirable mechanism for reporting near-miss incidents of this type.

Thus, it does not appear to be advisable to place restrictions on the acceptability of any categories of subject material that might be reported to the NPSRS, as long as reporters believed the information to be important enough to justify its submittal. However, there are clearly several categories of information for which reporters' viewpoints could tend to be subjective, such as those related to plant policies or quality of supervision. For evaluating incidents on these subjects, it would be necessary to select analysts for the system with extensive backgrounds in nuclear power plant operation, who are capable of exercising good, solid judgement. These capabilities would be essential to place reports on subjective material in their proper perspective relative to other safety-related information/data.

In interviews with utility managers, concerns were expressed about potentially specious (or improperly motivated) reports that might be submitted to the NPSRS. The managers were concerned that such reports might be sent in by individuals with a variety of motivations. For example, managers were concerned that reporters might be trying to avoid being terminated from construction jobs, or that they might be attempting to sway public (or NRC) opinions with respect to union or job-security-related goals or objectives by reporting incidents that were not really significant to plant safety.

To gain data on the potential for improperly motivated reporting to the NPSRS, ASRS interviewees were questioned about their experience with reports of this sort. The ASRS staff members acknowledged that some improperly motivated reports may have been submitted to their System from time-to-time. However, the ASRS personnel believe that reports of this type have not had a significant impact on the collective data in the ASRS data bank for several reasons. First, they observed that the ASRS staff analysts routinely comment upon the veracity and motivation of reporters in the section of the ASRS analysis forms set aside for analyst's observations. Secondly, these comments are based upon interviews with reporters. In the interviews, the ASRS staff analysts specifically inform the reporters that their allegations will not be individually (or collectively) published unless they are deemed by the ASRS to be of safety significance and to be broadly applicable to the industry. Consequently, the ASRS analysts have indicated that the reporters who might have been engaged in such actions become discouraged about submitting reports that are improperly motivated. No individual is known to have repeatedly submitted such reports to the ASRS. Similar actions on the part of NPSRS staff analysts could also discourage those who might submit improperly motivated reports to the NPSRS.

It would be useful to solicit reports of a positive nature about outstanding plant procedures, or about incidents that prevented accidents, or led to safety improvements within the plants, or that heightened the safety awareness of individuals. Such reports would probably require special categorization in the NPSRS taxonomy and might be particularly useful for reporting to the community as NPSRS newsletter items. It should be noted that a substantial fraction of the reports received by the ASRS (perhaps as high as 30 percent) have been determined to be "positive" reports.

4.2.4 Motivational Incentives to System Support: Reporter Anonymity

How effective and important would the prospect of anonymity be to potential reporters as an inducement for voluntary submission of reports to the NPSRS?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, DOT, and GAO personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS, NPSRS and other human performance data gathering systems.

Reporter anonymity appears to be an essential element of a successful voluntary, human performance reporting system. On occasion, nuclear operational personnel have been informed by their managers that their jobs will not be jeopardized by filing reports with management about safety-related incidents to which they may have contributed in some fashion. However, the potential reporters appear to have an intuitive belief that if their names become associated with an incident which appears to reflect poorly on their job performance they will ultimately suffer from it. Contrary to the opinions of utility management, potential reporters indicated that in spite of the inherent professionalism of operational personnel, professionalism alone would not be a sufficient motivation for reporting if the reporters' indentities could be connected with an incident.

Alert Reports (cf, Section 3.4.2) appear to have a potential for compromising the anonymity of reporters if they were indiscriminately published. As noted subsequently in connection with Section 4.2.16, most of the NPSRS incident reports will not meet the criteria for publication of Alert Reports. The current information transfer channels of the NRC and utilities will provide individual plants and the NRC with descriptions of the majority of the significant safety-related problems in the plants. In those relatively rare instances where a significant incident was not reported through regular NRC channels, but was reported to the NPSRS, procedures have been recommended for preparing and publishing Alert Reports that would minimize the potential for loss of reporter anonymity (see also, Ref. 1, Section 2.7).

A number of interviewees expressed concern about maintaining the integrity and confidentiality of the NPSRS data base itself. In particular, plant operational personnel expressed universal concern about this problem. They indicated that they were worried about attempts that might be made to obtain and publish individual incident reports that were submitted to the NPSRS. The potential reporters (as well as other interviewees from all aspects of the nuclear community) felt strongly that the NPSRS should be implemented in a manner that would prevent anyone from arbitrarily obtaining individual reports for their exploitation, irrespective of the motives of the person attempting to gain access to the reports. Loss of reporters' anonymity through this mechanism could have very damaging repercussions to the NPSRS.

The NPSRS has been designed as a long-term source of analyzed human factors data rather than a supplementary allegation tracking system for the NRC. The NRC's allegation tracking system requires the person submitting the allegation to provide his identification along with the details of the incident to the NRC. In light of these requirements, the NPSRS would not appear to be a useful adjunct to the NRC's allegation tracking endeavors. Information identifying the utility, power plant, or individuals associated with an incident that had been reported to the NPSRS would not ordinarily be provided to the NRC by the NPSRS. Serious damage to the credibility of the NPSRS could result from failure to preserve reporter anonymity. In those instances where the safety-significance threshold for preparation of an Alert Report about an incident had been crossed, the responsible parties would have to carefully weigh the potential benefits of such a publication in relation to the potential damage that might result to the viability of the NPSRS from the publicity that might accompany the loss of anonymity for a reporter.

4.2.5 Motivational Incentives to System Support: NRC Warranty of Limited Immunity to Reporters and the Feedback of System Results

How effective would the prospect of receiving a grant of limited immunity from NRC regulatory enforcement actions be as a motivational mechanism to an individual for reporting to the NPSRS? How important would it be for the NPSRS to show its usefulness to the nuclear community by feeding-back System results to reporters?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, and DOT personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS and NPSRS data gathering systems.

There are apparently several important personality characteristics that would motivate individuals to report to the NPSRS. These motivational mechanisms include professionalism, concern for individual and societal safety, and a variety of other individual characteristics. As a supplement to these characteristics, potential reporters stated that a limited warranty of individual immunity from punitive action on the part of the NRC for an inadvertent violation of Commission regulations would also be a significant factor in motivating support for the NPSRS. The ASRS attributes the motivation for submission of about one-half of their reports to the FAA's limited warranty of immunity (one application of the FAA's warranty of immunity is permitted to a reporter in a five-year period). It was nearly universally agreed by all interviewees that a similar warranty from the NRC of limited individual immunity would be a worthwhile motivational feature for obtaining a reporter's support for the NPSRS. Interviewees from the NRC's Office of the Executive Legal Director (ELD) stated that since a precedent for such a warranty already existed in "whistle-blower" regulations, the Commission would probably be receptive to application of such a concept to the NPSRS.

As indicated, professionalism, concern for individual and societal safety, and the welfare of their nuclear industry would also be strong motivators for encouraging operational personnel to report to the NPSRS. To permit characteristics such as these to be fully effective as motivators for reporting, results of the implementation of the System must be apparent to the operational personnel. If the operators are to be aware of NPSRS activities, there must be direct feedback between the System and potential reporters. This type of feedback would be provided through publication of an informal newsletter (as described in Section 3.7) and through the annual NPSRS training sessions that utilities would be required to conduct (cf, Ref. 1, Section 2.2.3). Potential reporters that were interviewed indicated that this type of feedback of the results of their efforts would have an important motivational effect on their support of the System.

4.2.6 Motivational Incentives to System Support: Mitigation of Sanctions Against Utilities

How far should the concept of grants of limited individual immunity from NRC regulatory enforcement actions be extended? Would a limited grant of immunity to the nuclear electric utility for which a reporter worked be required? Or would an NRC policy of mitigating sanctions against utilities be needed to provide them with sufficient motivation to support the System and to ensure that they would not penalize their employees for filing incident reports?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS and NASA personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS and NPSRS data gathering systems.

Utility support of the NPSRS would be an important feature both for motivating reporters and for success of the system. The relatively small size of the nuclear industry and the provincialism of a nuclear plant could make it difficult to prevent repercussions from occurring to reporters without the support of their utilities. In order to provide an incentive for utility support of the NPSRS, operational personnel indicated in interviews that the NRC should extend some limited warranty of immunity to utilities (or assurance of potential mitigation of civil penalties) for potential regulatory infractions associated with incidents reported to the NPSRS. Such benefits to the utilities were seen as being needed to motivate the utilities to support the NPSRS concept and to persuade them not to take retribution against reporters in the event that publication of an individual's report on an incident was necessary.

Apparently, a warranty of complete immunity to utilities for reported incidents would not be desirable from the standpoint of either the utilities or the NRC. However, an NRC policy of mitigation of sanctions for potential regulatory violations where the utility could demonstrate vigorous support of the NFSRS would apparently have a beneficial effect on utility attitudes toward for the System. Some utility managers stated that if the NRC extended a policy of limited mitigation of its punitive actions for potential regulatory violations that might be reported to the NPSRS, such support would be forthcoming. If such a policy were implemented, it was stated that supporting utilities would be unlikely to exact retribution on reporters.

As a necessary demonstration of NPSRS support, utilities should provide evidence that they were making an active effort to foster human factor improvements in plant safety. Such demonstrations of active utility support for the NPSRS should include evidence that regularly scheduled, annual training sessions were being held in the plant for educating and motivating the support of operational personnel. The utility should demonstrate that they were making blank NPSRS incident report forms available to employees under non-threatening conditions in several convenient locations within the plant. As evidence of this, the utility should show that they had clearly identified a non-management individual who was responsible for maintaining an adequate supply of the blank NPSRS reports. The utility should also demonstrate that they regularly updated the NPSRS organization with respect to the name, address, and local telephone number of the designated individual. In addition to this external evidence of utility support to the NPSRS, reporters from the plant should be encouraged to communicate evidence of subsequent discrimination against them (if any should occur) to the NPSRS and NRC for investigation.

Interviews with NRC staff members from the Offices of ELD and I&E have indicated that a precedent may exist for establishing a policy of mitigation of penalties for utilities for prompt self-reporting and correction of potential violations of NRC regulations (cf, Ref. 10, 10 CFR Part 2, App. C). It appears that if such a policy were applied to incidents reported to the NPSRS, it could have substantial positive benefits for both utility and operational personnel support for the NPSRS. A suggested outline of an NRC policy statement describing the relationship between the NPSRS and the NRC is presented in Appendix D.

4.2.7 System Oversight and Evaluation Committee

How important would it be to have a top-level independent advisory committee for oversight and evaluation of NPSRS activities? What should the characteristics of its membership be?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, DOT, and GAO personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS and NPSRS data gathering systems.

An independent advisory committee would be an important element of the implementation and continued operation of the NPSRS. The ASRS and FAA interviewees all expressed the opinion that one of the most important actions taken by NASA at the time of the initiation of the ASRS was the establishment and selection of an advisory committee for their system. The NASA committee has eleven members who represent a cross-section of senior representatives of the professional organizations, aircraft manufacturers, etc. within the aviation community. Members have a nominal tenure on the committee of three years plus a potential one-year extension. Interviewees from the ASRS and their advisory committee believe that the advisory committee has served the aviation community and the ASRS well. The committee members have been strong supporters of the ASRS. Under the committee's oversight, the independence and integrity of the ASRS have been ensured. The ASRS Advisory Committee has considerable political influence as well as technical oversight. With its political influence, the committee has helped keep the funding for the system adequate, even in years when budget problems could have been severe.

Like the ASRS advisory committee, the NPSRS advisory committee should represent a broad cross-section of the nuclear community. The committee should include members with backgrounds in nuclear power plant operations, instrumentation and control, health physics, reactor manufacturing, academicians, professional organizations, EPRI, INPO, designated legal representatives for operational personnel, as well as an NRC representative. Opinion leaders from within the nuclear power community and those persons widely recognized for their professional competence should be selected for membership on the NPSRS advisory committee. A committee of about the same size as the ASRS advisory committee (7-11 members) was recommended by interviewees with nominal tenures of about three years (also similar to the ASRS committee). The committee would be organized initially by the NPSRS third-party manager on the basis of nominations from the principal organizations in the industry (such as those listed above).

4.2.8 NRC Liaison Organization

Which organization within the NRC should have the liaison responsibility for the NPSRS? What staff qualifications (backgrounds and numbers) would be appropriate for the liaison function?

Data to address these questions were obtained through interviews with NRC managers and staff members.

Considering the breadth of interests and variety of objectives for using human factors data represented by the NRC staff members (cf, Section 4.2.18) it would appear advisable to select a liaison office that could encourage and support the NPSRS to maintain diverse interests (and perhaps to expand the scope of its investigation to include incidents in other regulated parts of the nuclear fuel cycle besides light-water power reactors alone). The office should report at a high organizational level within the NRC. A program office within the Office of Analysis and Evaluation of Operational Data (AEOD) or the Office of Research (RES) was most often recommended by the NRC staff members as an appropriate potential location for a liaison office given these considerations. Of 18 NRC staff members interviewed, about one-third suggested the RES would represent their interests most effectively; about one-fifth recommended a program office in the AEOD; the remainder recommended offices in the I&E, the OIA, or had no particular preference.

4.2.9 System Implementation Mechanisms

How should the responsibility for implementing the NPSRS be transferred from the NRC (the funding agency) to a third-party operational agency? What steps should be taken to publicize, educate, and generally make users aware of the implementation and continuing operation of the NPSRS?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members, ASRS, NASA, DOT, and GAO personnel. Interview results were supplemented with data gathered from retrospective and internal analyses of information related to the ASRS and NPSRS data gathering systems.

If the NPSRS were implemented, the transfer of the responsibility from the NRC to a third-party management organization could be accomplished with a Memorandum-of-Agreement or Memorandum-of-Understanding (or Statement of Work in case of a non-government organization) that would be prepared a implemented with the selected third-party operational manager. When this was completed, the NPSRS could then be initiated essentially immediately. An annual budget should be allocated to publicity for the NPSRS. It should be recognized that publicity will be important to the NPSRS not only for initiation of the System but also for its longer-term life span. These publicity efforts should include NPSRS publications and an NRC mandated training program (to be conducted on an annual basis) in all nuclear power plants. At these training sessions (part of the regular plant training program for operational personnel) materials that were developed by the NPSRS staff would be presented and distributed to the utility personnel. The training session would describe the System's functions, its interfaces with the NRC and the nuclear community, and would emphasize the importance of the NPSRS the NRC in maintaining industrywide safety consciousness (cf, Ref. 1, Section 2.8.3).

4.2.10 System Forms and Procedures

Are the specifications, forms, and procedures that have been developed for the NPSRS adequate for implementation by someone other than the system developer?

The adequacy of the NPSRS Incident Report form, Administrative Log, Analyst Action form, Taxonomy, and Taxonomy Data Collection form, and the procedures for completing the forms were assessed from written reviews submitted by the participants in the NPSRS Operability Demonstration as well as by comments from interviews with ASRS, utility and NRC personnel.

Essentially all of the participants in the Operability Demonstration felt that the existing forms and procedures were adequate for performing the functions described in them. Some constructive suggestions were made by the participants with respect to each of the forms and procedures. Their comments have been incorporated as revisions into the forms and procedures as presented in the Appendices to the NPSRS Implementation and Operational Specifications

(Ref. 1). Thus, it appears that the forms and specifications that have been developed would be adequate for implementation by a third-party manager.

4.2.11 System Personnel Requirements

What skills and personality characteristics would be needed by NPSRS personnel? By the program manager? By the staff analysts? By editorial and support staff members? What training needs and additional support needs would be projected for the NPSRS and its staff members?

To obtain data to evaluate this issue, Operability Demonstration participants were cycled through all significant NPSRS staff assignments. The participants prepared written comments on the results of their assignments and were interviewed along with personnel from the ASRS, several utilities and the NRC with respect to their perceptions of NPSRS staff skill needs and background requirements.

The Operability Demonstration participants all agreed that broad and extensive backgrounds in nuclear power plant operations were the most significant skill requirements for NPSRS staff members. For the program manager's position, an effort should be made to find a practicing attorney with an engineering background and the needed plant operational background. Both legal and technical skills are needed for screening and evaluating reports as they come into the system. If the program manager was selected for his technical background alone, a lawyer should also be retained as a consultant to aid in legal evaluation of the incoming reports.

Systems analysts should be chosen with both broad technical backgrounds in nuclear plant operations and specialized skills in areas such as plant maintenance, chemistry, health physics, licensing, etc. Human factors skills would be important for analysts. However, on-the-job training would probably be more effective for developing human factor skills in the staff analysts than it would be for developing nuclear operational skills in people without an appropriate technical background. Based upon experience in the ASRS, about six months of on-the-job training would probably be needed before the analysts achieved reasonably high proficiency at their tasks. In addition to the basic NPSRS staff members described above, an editor, a staff research analyst, word processing support, and a librarian would be needed for the System when it achieved full implementation. Some experience with the nuclear power industry would be useful to these staff members, but would not be essential.

4.2.12 System Facility Requirements

What office facilities, space, equipment, reference materials, and other resources would be needed to implement and operate a NPSRS?

Data to address this issue were obtained through a week-long Operability Demonstration of the prototypal NPSRS, through retrospective analyses of ASRS facility and staffing requirements, through internal analyses of the NPSRS specifications (Ref. 1), and through interviews with ASRS, and DOT personnel, utility representatives and NRC staff members.

A nominal amount of space (on the order of 100 square feet per office) would be needed for private offices for the program manager and for individual staff analysts. Analysts need privacy for conducting telephone interviews with reporters. If part-time staff members were used as analysts by the NPSRS, some office sharing could be possible -- but privacy for interviewing would still be essential. A conference room for staff meetings and meetings with visitors would also be needed for the System. In addition, a room for a library where reference material would be available for the analysts would be important. The library should contain reference material such as NRC regulations (e.g., 10 CFR Chapter 1) and regulatory guidelines, as well as up-to-date plant descriptions and technical specifications for U.S. nuclear power plants. (A total of about 1600 to 2000 square feet of office space would evidently meet the initial and probable growth requirements for the NPSRS staff.)

A computer terminal (or netted microcomputers) in the staff analyst offices that permitted interactive preparation of incoming report assessments would be useful for expediting data processing. The normal complement of office equipment such as desks, chairs, pens, pencils, note pads, telephones, etc. would also be essential for system implementation. A complete inventory of NPSRS requirements for personnel, facilities, logistics and other resources is presented in Reference 1, Section 2.

4.2.13 System Cost Estimates

How much will it cost to implement the NPSRS? How does this compare with operational expenses of similar voluntary safety reporting systems such as the Aviation Safety Reporting System?

Some utility managers expressed concerns about potential costs of NPSRS implementation and operation. To resolve the issue, a retrospective analysis of the ASRS costs of operation was conducted in order to provide a basis for estimates of the cost of implementing the NPSRS. Costs have been evaluated based upon draft information on ASRS historical operational expense experiences for an initial implementation period and upon their experiences for a longer-term steady-state operational period (Ref. 12).

The first 25 months of ASRS operation from April 1976 through May 1978 were spent in design, implementation, and evaluation of their system. The total cost of system operation during this approximately two-year implementation period was $401,015 (Ref. 12). Approximately 70 percent ($280,000) of the total operational expense during this period was associated with taxonomy development, computer selection and acquisition, and development and testing of computer data base management software to use in evaluating the codified results of report analyses. Over $200,000 of this portion of the costs was expended on the development and testing of the computer data base management software. The training of analysts and preliminary preparation and testing of operational procedures cost $50,220 (about 12.5 percent) of the total expenses during this initial period. At the conclusion of the period, the review and analysis of the procedures, taxonomy, and data processing methods cost another $50,615 (about 12.6 percent of the total incurred expenses during the initial system development period).

Relative to NPSRS development at this time, probably about one-half of the work associated with the initial ASRS system design, implementation, and development has already been performed during the initial design, evaluation, and prototypal testing period for the NPSRS. Thus, a substantial amount of system design, testing, and implementation planning has already been performed in the initial studies for the NPSRS and should not require repetition during a system implementation period.

During the subsequent 35 months of ASRS operation (June 1978 through March 1981) the total costs of the system operation were $4,942,050 (Ref. 12). During this approximately three year period, about 24,000 reports were submitted and processed by the system. The costs of processing the reports during this period were $2,657,120 (about 54 percent of the total operational costs), or about $110 per report. About 60 percent of these report processing costs ($1,552,000) were associated with analysis of the reports (i.e., processing them for entry into the data base, and actually entering the reports into the data base). During this period, the cost for the preparation, publication, and distribution of major technical studies of the contents of the ASRS data base were about $1,352,000 (or about 27 percent of the total operational costs [illegible] the systems). The remaining 19 percent of the total operational cost was associated with educational activities (about $184,000), processing special requests for data base analyses (about $280,000), and preparing and issuing Alert Bulletins (about $68,000). About 76 percent of the total expense of operation was stated to be associated with "direct" costs and the remaining 24 percent of the expense was attributed to "distributed" costs.

More recent costs were estimated in terms of a functional breakdown (Ref. 12) for the seven-month period, June 1984 through December 1984. Extrapolating the estimated partial 1984 costs to a full-year period suggests that 1984 total annual costs should be about $1,400,000. Within these projections of total 1984 operational expenses, the estimated cost of report processing is $420,000; of data base administration/operation is $250,000; of research is $130,000; of report and information publication is $210,000; and of management/facilities/equipment is $400,000. Based on the seven-month results, about 7000 incident reports are estimated to have been submitted to and processed by the ASRS staff during 1984. Combining the first three elements of the projected annual cost breakdown suggests a total cost for processing reports during this period of about $100/report (or nearly the same relative cost as was incurred during the earlier reporting period).

It appears that operational costs for the NPSRS might be quite similar to those for the ASRS if the NPSRS was fully operational -- or about $1.5 to $2 million. A major factor in the low overhead costs of the ASRS has been the utilization of retired, highly experienced pilots and flight controllers as system analysts who were employed by ASRS as consultants with a very low resultant overhead. During the 60-month period of operation reviewed above (1976-1981) nearly 100 individuals worked on the project with total hours corresponding to a full-time equivalent staff of about 14 persons. If the system analysts had been actual employees of the ASRS instead of relatively independent consultants, operational costs "would have been much higher" according to the ASRS (Ref. 12). The average ASRS staffing level is quite similar to the projected staff requirements for the NPSRS (Ref. 1, Section 2).

This again suggests that estimated costs for the two systems may be quite similar, especially if retired nuclear plant operational personnel could be retained to act as NPSRS analysts on a consultant basis similar to the arrangements used by the ASRS.

4.2.14 Reliability of Task Frequency Estimates

Will NPSRS reporters be able to make reliable estimates of how frequently they perform the tasks that led to the incident being reported? Could these estimates be used as a basis for PRA estimates of human reliability for such tasks?

Data to address this issue were collected as part of the Operability Demonstration. For the incident reports submitted for analysis in the Operability Demonstration, the reporters were asked to estimate how frequently the task which led to the reported event would be performed during normal operations at their nuclear power plant. Subsequently, the systems analysts for the Operability Demonstration were asked to examine the frequency estimates provided by the reporters for the simulated incidents and indicate if they agreed or disagreed with the stated task frequencies. In instances where they disagreed, they were also asked to explain their reasons for disagreement.

In the resultant direct assessments of task frequency estimates, the analysts agreed with the reporters' estimates 90 percent of the time. In the relatively infrequent circumstances (only ten percent of the estimates) where the reporters and analysts disagreed, no identifiable systematic trend towards higher or lower frequency projections could be detected.

These results suggest that reporters can (and probably will) make reasonably reliable task frequency estimates in their reports. The results also suggest that the frequency estimates for incidents reported to the NPSRS can be a viable and relatively reliable means of projecting the frequency of opportunities for particular events to occur. Thus, NPSRS reports can be expected to furnish evidence supporting (in part) an evaluation of both the numerator and denominator of human reliability estimates for safety-related incidents in nuclear power plants.

4.2.15 Reliability of Incident Analyses

If several NPSRS analysts were asked to process the same incident report using NPSRS forms and procedures, how much similarity would exist between their independently produced data summaries?

Data to address this issue were collected as part of the Operability Demonstration. The five analysts participating in the Operability Demonstration were each tasked with the assessment of a set of nine identical input reports of simulated incidents (cf, Appendix B). The products resulting from the analysts' individual interviews with reporters and their analyses of the reported incidents were examined to determine the degree of agreement (reliability) between each element of their data summary forms. The reliability results are summarized in this section and presented in more detail in Appendix C.

The Taxonomy Data Collection forms prepared by each of the five analysts from the results of their report analyses and reporter interviews were compared on an item (field) by item basis for all nine of the input incident reports. Fifty-five separate fields were coded for each report, and the five analysts each coded the same nine reports (cf, Appendices D and E of Reference 1 for the fields and elements of the Taxonomy Data Collection Forms). All told, there were 495 items (55 fields times nine reports) or opportunities upon which the five analysts could agree or disagree in their selections. An index of the reproducibility of the coding of these items was generated by examining the level of consensus achieved between analysts in their coding of each of the 495 items. This index of reproducibility for any field could assume any value between one and five. That is, in instances where all five analysts agreed about the coding of an item, the index's value was five. In instances where none agreed, the index was assigned a value of one (the logical equivalent of each person agreeing only with themselves).

An example is shown of the reliability obtained in the codification of the Performance Shaping Factors for the incidents analyzed, a field where the analysts were required to apply their own judgment. In Field No. 37 (cf, Ref. 1, Appendix D) the analysts were required to evaluate the performance shaping factors that exercised fundamental influences on human actions taken in the incident. The analysts were required to choose from among 45 possible options in this field of the taxonomy in order to determine the one they felt best described the specific performance shaping factor for the event they were coding. The agreement results are graphically presented in Figure 3. For this relatively difficult field to evaluate, the following results were obtained.

- In no instance did all five analysts agree on the choice of the most significant performance shaping factor.
- In only one instance, 11 percent of the reports, did at least four analysts agree.
- In 45 percent of the reports, at least three analysts agreed.
- Eighty-nine percent of the time at least two analysts agreed.

An overall summary of the level of agreement reached by the analysts for the coding of all 55 fields in each of the nine reports appears in Figure 4. The integrated results for all nine reports were as follows:

- Thirty-six percent of the time the analysts agreed unanimously about the coding the fields.
- Fifty-six percent of the time at least four analysts agreed about the field codings.
- Seventy-five percent of the time there was agreement between at least three of the analysts about the coding of the fields.
- Ninety percent of the time at least two analysts agreed about the codification of the fields.
- In only ten percent of the cases did the analysts find they could not come to any internal agreement about the coding of the fields.

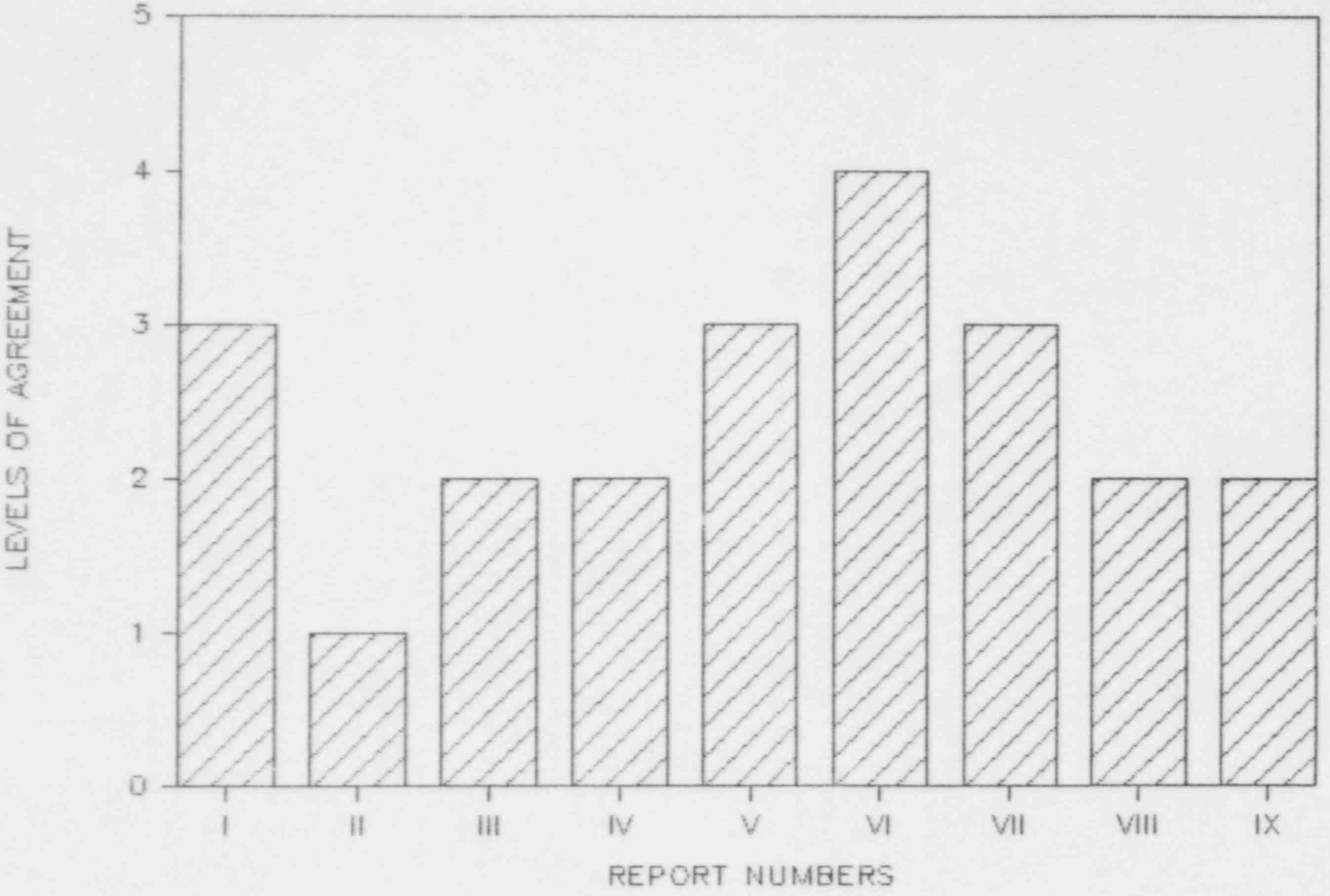

Figure 3. Reliability of Analyst Codification For Performance Shaping Factors As a Function of Reported Incidents

Figure 4. Overall Reliability of Analyst Codification of Data As a Function of Reported Incidents

Thus, a reasonable degree of reliability has been shown for novice system analysts when they were using the draft forms and procedures prepared for the NPSRS program (cf, Ref. 6) to process incident reports. As noted, when all entries in the Taxonomy Data Collection forms for all nine reports are considered, four of the five analysts agreed over half of the time about the coding. With the editorial improvements that have been made in the forms and with the additional formal and on-the-job training recommended for the actual Systems analysts, the degree of agreement between independent analyses of the same incidents would be expected to improve substantially. Approximately six months is needed for ASRS analysts to achieve their maximum levels of productivity and report processing reliability.* Similar lengths of time would probably be required for NPSRS analysts.

4.2.16 The Usefulness of Published Incident Reports and Their Implications to Reporter Anonymity

Would NPSRS reports still contain useful information if identifying data had been deleted to protect the anonymity of reporters? Which of the data items in the NPSRS input report that might compromise the identity of reporters could be removed from the report without compromising its usefulness? What is the potential impact of the Alert Report concept on the NPSRS?

To determine which, if any, of the items in a published incident report might compromise the identity of the reporter, interviews were conducted with representatives from the ASRS, the NRC, utility management, and from representative plant operational personnel. Interviewees were shown an example of a completed NPSRS report form and asked to specify which items on the form might compromise the identity of the reporter if a published summary of the single report (i.e., an Alert Report) were made available to them or to others.

On the basis of the example NPSRS incident report used in the interviews, it appeared that virtually any of the data contained in the report form pertaining explicitly to the reported incident could compromise the identity of the reporter. This appeared to be a particularly difficult problem if the report was published without being co-mingled with data from other reports. The principal complication in preserving the anonymity of the reporter has to do with the limited number of nuclear power plants in the country (less than 90), the relative uniqueness of most of them, and the closeness of working relationships in the operational plants. It was generally agreed that with a little detective work plant managers would be able to determine whether a report had originated from within their plant, if they were exposed to the gist of the incident scenario. Moreover, plant managers felt they would be able to make a good estimate of who the individual was that was involved in the incident, even if the data were subjected to intensive deidentification before publication. Almost any of the data items that were associated with the description of a particular incident scenario might be enough to permit a reasonably firm iden-

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* Harry W. Orlady, ASRS Senior Research Scientist, personal communication to F. C. Finlayson, The Aerospace Corporation, January 18, 1985.

tification of the reporter to be made. If all of the potentially compromising data were deleted from a single report prior to its publication by the NPSRS, the unexpurgated data that would remain were generally perceived as being limited in value. Based on these observations and the concerns of potential reporters, it would apparently be necessary to severely constrain the Alert Report preparation/distribution procedures.

Recommended procedures for determining whether an Alert Report would be needed, and the mechanisms for its preparation and publication have previously been discussed in Section 3.4.2. Fortunately, it appears that Alert Report publication should rarely be needed. Most events with time-critical safety response requirements should be submitted to the NRC as LERs under normal circumstances. Consequently, if the recommended Alert Report publication procedures were followed, it should be possible for the NPSRS to inform the NRC and utilities about risk significant incidents (that might have slipped through the LER net) without excessively jeopardizing the potential anonymity of reporters.

4.2.17 NPSRS Interfaces with Users

Would the data produced by the NPSRS be useful to other data bases such as the Human Reliability Data Bank (HRDB)? Would it be a useful support to the human reliability estimates of PRA analysts and methodology developers?

This issue was assessed via a retrospective analysis that involved a comparison of the taxonomies used with the HRDB and with the ASRS to the taxonomy and data elements proposed for the NPSRS (cf, Ref. 1, Appendix D).

At its inception, the NPSRS taxonomy (Ref. 6) was correlated with an early form of the taxonomy developed for the HRDB (cf, Ref. 13). Consequently the taxonomies for the NPSRS and HRDB have some strong parallels. However, the HRDB system has not been designed to accept unprocessed human performance data. The HRDB requires input data to be submitted in a preprocessed human reliability format (i.e., one where the probability of error per number of task performance opportunities is explicitly specified). As a result, some preprocessing of the NPSRS data would be required before it could be directly assimilated by the HRDB. In order to meet the current HRDB input requirements, the NPSRS data would need to be aggregated over a period of time and assimilated into a form where estimates were made of the frequency of data base events and the human reliability of associated tasks. The Technical Specifications for the NPSRS call for publications of such analyses of aggregated results from the System data base to be made on a regular basis (cf, Ref. 1, Section 2.7).

The ASRS taxonomy and data base were examined to see how the NPSRS taxonomy compared with the ASRS parameters. Both systems are designed to identify and retain information pertaining to human performance errors or successes that might affect the safety of their respective systems. Both systems also attempt to relate human causal factors for incidents with the equipment and procedures associated with the incidents. The ASRS taxonomy has evolved over a number of years. In some ASRS taxonomy fields, several parameters appear to be redundant in their descriptions of similar aspects of an event. The lesson that the NPSRS could learn from this is to make the introduction and formalization of new terms into its taxonomy subject to thorough review.

The NPSRS appears to have the potential to make valuable contributions to developers and analysts of PRAs. Useful qualitative (and some quantitative) information on both denominator and numerator data for human reliability estimates could be derived from systematic analyses of reports collected by the NPSRS. Additionally, the System is very likely to capture information which might otherwise be unavailable on errors in human performance in nuclear power plants, and to identify mechanisms by which humans correct faults that may have been introduced into the nuclear systems and by which they restore System stability.

4.2.18 Nuclear Community Needs for Human Performance Data

How important are human performance data to nuclear power industry personnel? To NRC personnel? How adequate are currently available sources of data on human performance?

Data to evaluate this issue were obtained through structured interviews with nuclear power industry and NRC personnel at management and staff engineer levels.

All of the utility and NRC personnel interviewed stated that they were users of human performance data. Utility interviewees were generally associated with management and higher-level supervisory ranks. Most were responsible for top-level nuclear safety management or were associated with conducting PRA activities for their facilities. All of the utility personnel interviewed indicated that human performance data played an important part in their day-to-day tasks. NRC interviewees represented various offices in the organization including: AEOD, NMSS, ELD, I&E, NRR (personnel from the Division of Human Factors Safety and from Allegation Management), RES (personnel from the Division of Risk Analysis and Operations), and the EDO. The variety of objectives and responsibilities represented by the NRC interviewees led to identification of a wide variety of human performance data needs. These included needs for data on the effects of quality assurance procedures that might be applied to human performance, data on human performance aspects of facility safeguards activities, data on non-LWR plant aspects of the nuclear fuel cycle (e.g., fuel fabrication facilities, etc.), data for development of criteria for guard qualifications for nuclear facilities, data on root-causes for human error-related incidents in nuclear power plants, performance-shaping factor evaluation data, precursor event (near-miss) data for use in probabilistic risk analysis, and "positive" reports on the relationship of human reliability to particularly effective nuclear power plant systems and equipment interfaces with operational personnel.

Some NRC interviewees stated a belief that most near-miss data were already reported to the NRC through LERs, morning reports, etc. Utility management and some NRC staff representatives expressed the feeling that the NPSRS might be redundant with other reporting systems in use by the NRC, as well as potentially being redundant with systems that were being maintained by the utilities themselves and by INPO. Those who held these opinions often expressed the belief that most significant incidents were being reported under the present INPO and NRC systems and that improvements should be made to these information channels before attempting to implement any new concepts. On the other hand, the utility managers that were interviewed stated that their in-house safety-related incident data gathering programs had collected substantially more data (for their specific plants) than had been submitted by them to the NRC in LERs. These supplemental data were being analyzed at some of the individual plants, but neither the analyses nor the data are being shared across the industry. As previously noted, however, operational personnel were convinced that many near-miss events of safety significance are not being reported to the current NRC or utility information gathering systems.

There was broad agreement that more data and more analyses of human performance data were needed. Most interviewees acknowledged that an unobtrusive, voluntary, anonymous, nonpunitive reporting system like the NPSRS could be effective in recovering data on some of the unreported incidents that may be occurring in the industry, especially if reporter anonymity could be guaranteed by the system.

In general, it was recognized that a need also exists for reports on "positive" events in the nuclear industry (i.e., incidents or situations where humans were able to achieve above average performance as a result of specially designed equipment or particularly good operating procedures, etc.).

4.2.19 NPSRS Implementation: An Asset or an Intrusion?

Considering the data needs and potential problems with existing human performance data collection mechanisms, would implementation of the NPSRS be accepted as an asset by the nuclear power industry? By the NRC? By reporters?

Data to address these questions were obtained through interviews with plant operational personnel, nuclear utility representatives, NRC managers and staff members.

Whether members of the nuclear industry, the NRC, and potential reporters viewed the possibility of implementation of the NPSRS as an asset or an intrusion depended heavily upon their perceptions of the objectives and functions of the System, as well as their own roles and responsibilities in the industry. With certain caveats, nonmanagement, nuclear plant operational personnel were strong supporters of the concept. Aside from their obvious concerns over potential penalties from the NRC and/or utilities for filing reports about incidents involving human errors, the main concern of plant operational personnel was that the data extracted from their reports should result in useful applications within the industry. Utility management representatives had mixed responses to the question. While some managers were opposed to implementation of the System, others felt that it should be implemented and given an opportunity to demonstrate whether it could produce useful results. The managers who supported NPSRS implementation stated that since the NPSRS was a voluntary program, they could see no obvious mechanism by which any unusual burdens could fall from the System onto their utilities. In their opinions, if beneficial results were not achieved by the NPSRS in a reasonable period of time, it could always be discontinued. NRC interviewees were most often supportive of the NPSRS concept (with some reservations). If the System were implemented in accordance with the current NPSRS design and specifications (cf, Ref. 1) many of the reservations of interviewees both in and out of the NRC about the implementation of the System as it appeared in its earlier draft form might be overcome. To overcome the reservations of others, it would probably be necessary to conduct a full-scale demonstration of the operability of the NPSRS.

4.3 FAA, NASA, and ASRS Opinions About NPSRS Feasibility

Staff members from the ASRS, NASA, and the FAA participated as reviewers of draft NPSRS documents, were the subjects of structured interviews, and served as participating observers in the Operability Demonstration. The following observations summarize the opinions expressed about the feasibility of NPSRS implementation by representatives from these organizations.

The personnel from the ASRS-related activities were strong supporters of development and implementation of a voluntary, confidential, and nonpunitive incident reporting system for the nuclear power industry. Based upon their ASRS experience, they stated that a system like the NPSRS had the potential for making a substantial safety contribution to the nuclear power industry of the United States.

In the opinion of the ASRS observer to the Operability Demonstration, the NPSRS system features (including concepts, staffing, procedures and forms) appeared to be entirely workable. With the modifications suggested during the post-Operability Demonstration discussion periods, the ASRS observer felt that the NPSRS could be successfully implemented. Planned personnel requirements were judged to be both reasonable and realistic.

The ASRS observer noted, however, that the institution of a voluntary, confidential, and non-punitive incident reporting program for collecting and assessing human performance data in the nuclear power industry inevitably would involve new, and consequently unsettling concepts for many of the NPSRS participants. It was observed that these new concepts would impact large portions of the nuclear community including potential reporters, plant managers, regulatory officials and perhaps others. Implementation of the NPSRS would require many of its participants to modify long and potentially strongly-held beliefs. It was noted that modification of well-established thought processes or behavior is never easy and that as a result, considerable resistance to NPSRS implementation could be expected from some of the participants. It was recommended that the NPSRS (and NRC) should conduct a carefully organized informational and educational campaign to aid nuclear community participants with this potential problem. Such a program should make it possible for all of the potential users, and any others who would be affected by the NPSRS, to more fully understand the NPSRS goals, its implementation processes, and the implications that this new safety reporting system would have on their day-to-day activities. The ASRS observer noted that this educational program would be particularly important for those who have plant management and regulatory enforcement responsibilities who otherwise might find the transitional period of NPSRS implementation rather difficult.

A clear and unequivocal method of providing confidentiality and meaningful immunity from potential sources of adverse consequences to reporters was felt to be a key element for successful implementation of the NPSRS. Regardless of whether the perceived threat to the reporter was from the Nuclear Regulatory Commission or from some level of utility management, the perception of protection from punitive action was believed to be an important element for the NPSRS. If the characteristics of the nuclear power industry are such that a meaningful analysis of an incident report could make it possible for the utility involved to be identified and could then result in the possibility of punitive action being taken against it, it was felt that the utility very obviously would also need some effective protection against such punitive actions. The content and distribution of published "Alert Bulletins" was considered to be of particular potential sensitivity in this regard.

The content of the NPSRS taxonomic analysis forms was identified as being very important. Based upon ASRS experience, it was felt that several revisions would probably be required to the NPSRS taxonomy in the course of the evolution of the System. The development of both the form and content of any good analytic taxonomy package was recognized as almost inevitably being an evolutionary process.

Finally, the ASRS participant observer at the NPSRS Operational Demonstration made the following observation:

> "The most impressive and the single most important observation that I made during the demonstration was that I did not hear anything regarding the proposed NPSRS that I had not heard many times before in discussions of the desirability, feasibility, and implementation of nonpunitive incident reporting systems in aviation. This is not only true in regard to the ASRS, but it is also true in regard to the development of the confidential nonpunitive incident reporting program on a major U.S. airline that was its precursor.
>
> "In aviation we have learned a tragic and a very expensive lesson. 'We no longer have to kill people to learn important things about safety.' There is no reason that the nuclear industry, or any other industry that is dependent upon human behavior, should find it otherwise." (ASRS observations are presented in full in Appendix E.)

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Feasibility Overview

Operational personnel indicated that they would have an inherent reluctance about submitting reports of events involving potential human errors in a system that circulated the reports through the utility management chain. They believed (with some justification) that a report (even a voluntary one) calling attention to an inadvertent human error could cause their line management to develop negative opinions about the reporter's competence. As a consequence, they stated their belief that many safety significant, near-miss incidents go presently unreported. Considering the apparent reluctance of operational personnel to submit reports on near-miss events, it is unlikely that reports of this type that might be submitted voluntarily to the NPSRS would otherwise be submitted to management. By failing to support a new, voluntary channel of safety-related incident communication, utility management could be separating themselves from more near-miss information than they might receive if they were active supporters more of the concept.

In the absence of any direct experience with the actual operation of the NPSRS, reporter anonymity and personal immunity from punitive actions on the part of the NRC and utility management are legitimate concerns of operational personnel. Policy statements from the NRC and from utility managements indicating their support of the NPSRS and their willingness to extend warranties of immunity to individuals could go far towards alleviating the concerns of operational personnel. (An example of a conceptual NRC policy statement has been provided as Appendix D.) However, the publication of an Alert Report is recognized by reporters as a potential pathway for loss of individual anonymity. Mechanisms for constraining the potential for loss of anonymity through such publications have been proposed in Section 3.4.2. If the recommended procedures were followed, only the most significant incidents reported to the NPSRS would be published as Alert Reports, and then only after an investigation had been made to ascertain that they had not already been submitted to the NRC through conventional channels. (c.f., Sections 4.2.4, 4.2.16, and Ref. 1, Section 2.7). If these policies and procedures were implemented, the potential for loss of reporter anonymity and the breakdown of immunity could be greatly diminished and the chances for success of the NPSRS correspondingly increased.

The confidentiality of the NPSRS data base is a correspondingly important issue. In order to assure that a reporter's anonymity is maintained, the third-party manager for the NPSRS must be able to control access to the data base. The need to assure control of access to the NPSRS data base may make a non-government organization a good choice for a managing agency for the NPSRS. A number of interviewees recommended consideration of a non-governmental, private industry-based organization for the managing agency of the NPSRS in order to maintain the security of the System's data base. Considering the critical requirement for anonymity expressed by the potential reporters to the System, it may be appropriate to give serious consideration to selecting a non-governmental organization to manage the System (cf, Section 4.2.1).

It appears that utility support for the NPSRS would be substantially enhanced by the adoption of an NRC policy of mitigating sanctions on utilities for regulatory infractions identified through NPSRS reports where utility support for the System could be demonstrated. Such utility support would play an important role in assuring reporters that retribution would not be exacted against them for incidents that might be published as Alert Reports. As noted, (Section 4.2.6) a precedent appears to exist in the NRC regulations (Ref. 10, 10 CFR 2, Appendix C) that define procedures for mitigating sanctions against utilities for regulatory infractions where the utility has both voluntarily and promptly reported and corrected the infractions. If these policies could be extended to embrace mitigation of sanctions for the utilities in accordance with the recommended practices for the NPSRS, the chances for System success could be substantially improved.

Preserving reporter anonymity would be very important to the success of the NPSRS. For that reason, it has been recommended that synopses of individual reports should only be published when all other communication channels with the NRC and the nuclear community had been foreclosed (cf, Sections 3.4.2 and 4.2.4). In its primary mode of operation, NPSRS reports should be collected and integrated over at least periods of a quarter-year as a basis for the trend analyses that would be the principal publications of the System. While Alert Reports might be a potentially valuable aspect of NPSRS implementation, their publication should not be considered the primary purpose of the NPSRS.

The concerns that the NPSRS might be expensive to operate were not supported by the study results. In particular, the participants in the Operability Demonstration as well as most NRC staff members believed that the recommended support level of about 10-15 full-time equivalent NPSRS staff members should be sufficient to perform the operational functions of the System. As discussed in Section 4.2.13, NPSRS annual costs are projected to be of the order of $1.5 to $2 million (cf, Ref. 1, Sections 2.9 and 2.10).

5.2 Conclusions and Recommendations

Research on the NPSRS concept was initiated in response to concerns that existing nuclear utility reporting systems (e.g., LERs, NPRDS) might not provide the complete and candid information on human performance that is required for human reliability evaluations (e.g., in PRAs) and other human factors research activities. This concern was (and is) appropriate because existing reporting systems, for the most part, solicit information which could be embarrassing to both individuals and utilities. Moreover, the solicited data might conceivably represent a regulatory transgression for which punitive actions could be taken against the reporters and/or the plants in which they work. Experiences of other industries (e.g., civil aviation) indicate that, among other things, extensive and candid reporting of incidents where human performance has played a significant role is dependent on the perceptions of reporters that their anonymity is being maintained and that immunity from punitive action is available to them.

The results of this study of the NPSRS indicate that similar concerns exist among the operational personnel of the nuclear industry. As in the aviation industry, nuclear plant operational personnel would apparently be willing to report potentially unreported incidents, if they were confident that their anonymity would be maintained and that both immunity from regulatory action and maintenance of job security could be secured in some manner.

There is evidence that some significant safety-related, near-miss incidents in nuclear power plants involving important aspects of human behavior may presently go unreported. The NPSRS has the potential of accessing these unreported incidents and providing a new and important source of data on human performance and reliability.

A more complete and impartial data base on human behavior in nuclear plants (including their successes as well as their errors) would seem to be very valuable for establishing valid performance standards and guidelines, and establishing a more credible basis for developing estimates of error probabilities for use in reliability evaluations (e.g., the NRC's probabilistic risk assessment programs). The NPSRS has the potential for providing such a data base of candid, impartial reports of human performance. Results of the study indicate the NPSRS would be practical to implement and operate, that it could provide useful data in significant amounts, and that it would be broadly acceptable, if implemented in general accordance with the operational specifications outlined in this report and detailed in Reference 1.

In general, it appears that the features of the NPSRS as they have been finally developed in the relevant documents of this study (e.g., Ref. 1) should overcome most of the concerns expressed by interviewees. In fact, a significant effort has been made to resolve these concerns in the current structure of the NPSRS. For example, a serious effort has been made to ensure that the anonymity of reporters can be secured and maintained within the System. Mechanisms have been recommended for constraining publication of Alert Reports in order to minimize the potential for loss of reporter anonymity, while the possibility of publishing critically important incidents has been preserved. An approach has been developed and recommended that provides for both limited warranties of individual immunity and potential mitigation of civil actions taken against utilities.

If implemented, the NPSRS could apparently provide a number of benefits to the nuclear community. It would provide a significant new source of data and reports on safety-related incidents involving humans in nuclear power plants. These reports would provide a quantifiable basis for assessment of human performance trends in events of significance to human factors designers in plants and would aid PRA systems analysts in their efforts to model human impacts on safety-related incidents. The NPSRS taxonomy has been designed to identify the influences of human performance shaping factors (such as the impacts of control room design features, the effectiveness of plant operating procedures, and the influences of physio-psychological factors) on human actions. The collective results from operation of the NPSRS would represent a rich, diverse source of additional data for input to users such as the human factors community, PRA model developers, and the NRC's proposed Human Reliability Data Bank. With this major new source of data, users such as the

HRDB would have a better basis for making judgments with respect to the probability of human error contributions to accident sequences in PRAs. The NPSRS data would also provide a substantial source of information on problem solving mechanisms used by humans when positive intervention is taken by them to reduce the probability and potential severity of accidents. This very significant safety mechanism has been largely overlooked in PRAs as a result of uncertainties in the methods used for modeling the role of positive human intervention in mitigating the effects of accidents.

It is therefore recommended that the NRC take steps to implement the NPSRS in full as soon as is reasonably possible. Consideration has been given to the option of further field evaluations, but such research is not likely to change the overall conclusions above. The Operability Demonstration has shown the fundamental workability of the NPSRS. Implementation of the System without further delay will provide for an early start on collection and processing of the important data needed by human performance data users.

REFERENCES

1. R. D. Newton, J. R. Ims, and F. C. Finlayson, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Implementation and Operational Specifications", USNRC Report NUREG/CR-4133, May 1985.

2. F. C. Finlayson and J. R. Ims, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Feasibility Analysis", USNRC Report NUREG/CR-3119 Vol. 1, April 1983.

3. F. C. Finlayson, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Concept Description", USNRC Report NUREG/CR-3119 Vol. 2, May 1983.

4. U.S. Nuclear Regulatory Commission, "Reactor Safety Study - An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants", Main Report, WASH-1400 (NUREG-75/014), October 1975, pp. 162-165.

5. F. C. Finlayson, T.A. Hussman, Jr., et al., The Aerospace Corporation, "Human Engineering of Nuclear Power Control Rooms and Its Effect on Operator Performance", USNRC Report, Aerospace Report ATR-77(2815)-1, February 1977.

6. J. R. Ims, P. J. Moran, and F. C. Finlayson, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Implementation Plan", Aerospace Draft Report ATR-84(4818)-1ND Vol. I, February 1984.

7. R. D. Newton, and F. C. Finlayson, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Concept Evaluation and Operability Demonstration Test Plan", Aerospace Draft Report ATR-84(4818)-1ND Vol. II, April 1984.

8. R. D. Newton and F. C. Finlayson, The Aerospace Corporation, "Nuclear Power Safety Reporting System: Operability Demonstration Test Plan, Aerospace Draft Report ATR-84(4818)-2ND, December 1984.

9. NASA Advisory Council, Aeronautics Advisory Committee, Advisory Subcommittee on the Aviation Safety Reporting Systems (ASRS), "Supplementary Findings and Recommendations of the Advisory Subcommittee on the Aviation Safety Reporting System (ASRS)", Letter Report to NASA and the FAA, April 5, 1982.

10. "General Statement of Policy and Procedures for Enforcement Actions", Appendix C to Part 2 of Title 10 of the Code of Federal Regulations, Federal Register, Vol. 49, No. 47, March 4, 1984, pp. 8583-8594.

11. M. K. Comer and M. D. Donovan, General Physics Corporation, "Specification of a Human Reliability Data Bank for Conducting HRA Segments of PRAs for Nuclear Power Plants", USNRC Report NUREG/CR-4010, February 1985.

12. Letter from Ed S. Cheaney, ASRS Program Manager, to Fred C. Finlayson, The Aerospace Corporation, Subject: ASRS Historical Cost Analysis, dated April 2, 1985.

13. M. K. Comer, E. J. Kozinsky, et al., General Physics Corporation, "Human Reliability Data Bank for Nuclear Power Plant Operations, Volume 2: A Data Bank Concept and System Description," USNRC Report NUREG/CR-2744 Volume 2, February 1983.

APPENDIX A

Protocol for Industry Interviews

I. ACCEPTABILITY - USERS (Part 1)

1. Do you feel that human performance data are needed for maintaining or improving the quality of safety-related procedures in nuclear power plants?

2. If so, what kinds of human performance data do you feel are needed, and what would you use these for?

3. How adequate do you feel the currently available human performance data are for meeting the needs of utility safety systems staff members?

4. How effective do you think a voluntary, anonymous, third-party managed system might be in providing human performance data not currently available or not adequate?

II. CRITERIA OF REPORT ACCEPTABILITY

1. What restrictions (if any) do you feel should be imposed upon the kinds of reports submitted to the NPSRS? (e.g., Would you feel uncomfortable if reports pertaining to the following subjects were submitted by reporters?):

Utility or plant policy?	Why?
Quality of supervision?	Why?
Working conditions?	Why?
Quality of management?	Why?

2. What kinds of positive reports might be appropriate for solicitation in a system like this?

III. ACCEPTABLE REPORTING GROUPS

1. How broad a cross-section of individuals should be encouraged to provide reports to the NPSRS? For example, should the following on-site personnel be permitted to submit reports?

   a. Nuclear plant operational, maintenance, safeguards and trainer personnel
   b. Nuclear administrative personnel
   c. Contractor personnel
   d. NRC inspector personnel
   e. Other government personnel? (OSHA, Fed. DOE, State, Local)
   f. Plant visitors

2. Should the following off-site personnel be permitted to submit reports?

   a. Utility staff
   b. Utility supervisors
   c. NRC staff (Headquarters, Regional)

IV. THIRD-PARTY MANAGER

1. How important do you feel it would be to the success of a voluntary reporting system to have an independent, third-party manager interposed between the reporter and the NRC and other users such as the utilities?

2. What qualities would a third-party manager contribute to the reporting system that would be desirable and/or beneficial? What qualities (if any) would be undesirable from your perspective?

   o Would any of the potentially undesirable qualities have a major impact on the feasibility of the system in your opinion?

3. What kinds of qualities do you feel would be appropriate to look for when selecting possible third-party candidates to manage the NPSRS?

4. Should the candidates be government agencies? Should they be independent business firms, industrial concerns, academic institutions, or some other type of organization?

5. How important do you feel it would be to have a third-party manager with experience with nuclear power plants? If you feel it is important, how much experience, and what kinds of experience?

6. Could you give some examples of organizations that meet the qualifications you've stipulated that might make good third-party managers for the NPSRS?

V. ADVISORY COMMITTEE

1. How important do you feel it would be to have a top-level advisory committee for a system like the NPSRS that incorporated industry representatives as well as representatives of reporters, the NRC, and other users?

2. How many people do you suppose might be needed for the advisory committee?

3. How long do you think the tenure of committee members should be?

4. What should the backgrounds for persons on the advisory committee include?

5. How should members for the advisory committee be selected?

6. What do you see as the organizational requirements for the advisory committee?

VI. MOTIVATIONAL MECHANISMS FOR REPORTING -- ANONYMITY AND IMMUNITY

1. What do you think could be done to motivate people to submit reports to the NPSRS and to otherwise use the system? (i.e., What specifically could be done to motivate people to use the NPSRS?)

2. How effective and important do you feel the prospect of anonymity would be to reporters in inducing them to submit reports voluntarily to a system like the NPSRS?

3. How effective and important do you feel that the prospect of receiving a grant of limited immunity from regulatory procedures will be to potential NPSRS reporters?

4. If the NRC were to begin to take more direct positive actions against individual operational personnel, would that change your opinion about the importance of personal immunity as an incentive for reporting?

5. If such grants of immunity were provided, how far should they extend? (i.e., Should they cover only the reporter or could they be extended to cover the entire plant, or perhaps the utility?)

6. What kind of an effect do you think that immunity grants of this sort would have upon the regulatory process of the NRC? Potential benefits? Potential disadvantages?

7. What measures (if any) would need to be taken by the NRC to offer an incentive to utility management to actively support a system like the NPSRS?

VII. ANONYMITY

1. Given the example of a completed NPSRS report form, what elements do you believe might compromise the anonymity of the reporter, if summaries of one or more reports were available to you?

2. Could anonymity realistically be preserved with a system like the NPSRS in which Alert Reports were fed back to selected sets of nuclear plants?

3. Anonymity of reporters has been an assumed key element of success in encouraging them to submit reports to the system. It has the evident advantage of providing the reporters with the feeling that they are not jeopardizing their job security.

VIII. UTILITY OF DATA TO USERS

After having deidentified the report to protect the anonymity of the reporter, which parts of the remaining information do you think will have the greatest utility to the users of a NPSRS type system? Is reference to specific hardware important? Reactor manufacturer? et cetera?

IX. ACCEPTABILITY TO USERS

1. What possible problems do you see associated with a voluntary, anonymous, third-party managed system for the nuclear utility industry? What benefits?

2. Do you see a voluntary, anonymous, third-party managed system as a potential asset or unnecessary regulatory intrusion on the nuclear utility industry?

3. If you feel problems with such a system might outweigh the benefits, what changes do you believe could be made to the concept to make it more acceptable to the industry so that human performance data not currently available, or not adequately available could be acquired?

4. What factors do you feel would be of greatest concern to nuclear plant operational personnel with respect to a voluntary system like the NPSRS for reporting safety-related incidents?

5. Would you recommend the adoption of the concept of a voluntary, nonpunitive, third-party managed system for the nuclear utility industry? Why?

APPENDIX B

Prototypal Incident Reports from Operability Demonstration

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (117) Number 941- 1905 Best time(s) ______
Area code (____) Number Ext. 410 Best time(s) ______

Name Alan Aikens. Date of Incident Jan - 9 - 1985 (Mo. Day Year)

Address 9956 So. Rutland Ave.
Jonesboro, IA 48801

Time of Incident (24 hour clock) 04:45

Power Plant Name Applegate -1

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☒ General Electric
   - ☐ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☒ 500-1000 MW
   - ☐ Over 1000 MW

3. Location in plant where incident was observed: Control Room

4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☒ Steady State
     - ☐ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Tech. Spec. Req.
     - ☐ Refueling

5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☐ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☒ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above

6. Experience in Nuclear Power: 9 years 2 months
   Experience in present position: 1 years 2 months

7. Hours on Shift Prior to Incident
   - ☒ 0-2 hours
   - ☐ 8-12 hours
   - ☐ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☒ 0-40 hours
   - ☐ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 4 times per Year

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

INCIDENT

During a routine control room panel walkdown my shift supervisor found the HPCI auxiliary oil pump control switch in the "pull-to-lock" position. The "pull-to-lock" position prevents the aux. oil pump from starting upon HPCI initiation and supplying the necessary control oil pressure to open the HPCI turbine stop valve. This then made the HPCI (an ECCS system) inoperative during power operation when required to be operable by Technical Specifications.

My shift supervisor, assuming no one else was aware of the problem, simply placed the HPCI aux. oil pump control switch in "auto" and continued his panel walkdown. After conducting my own investigation, I found that the control switch had probably been out of position since the previous day when an I&C HPCI initiation logic functional surveillance had been performed. I said nothing to anyone about this since I did not want to get my supervisor and the others involved (i.e., I&C personnel and other shift operators) into trouble.

I should also mention that besides operating with an inoperable HPCI, Technical Specifications requires operability demonstrations to be performed on other ECCS and safety systems when HPCI is inoperable. In addition, the HPCI system's operability should have been demonstrated before declaring it operable.

1. Failure of the I&C and operation personnel to follow procedure, which contains a step requiring the control switch to be returned to "auto".
2. Failure of subsequent operations shifts to perform adequate panel walkdowns, which would have uncovered the problem a lot sooner.
3. Failure of my shift supervisor to report his findings and perform the required surveillances.
4. Failure on my part for not reporting the incident.

SUGGESTED CORRECTIVE ACTION

1. Addition of alarm or some sort of indicative device which would alert the operator whenever the aux. oil pump was not in the "auto" position.
2. Training for all plant personnel emphasizing the importance of:
    a. following procedures,
    b. reporting unsafe or questionable practices, situations, and observations
3. Strict enforcement of the requirement for control room panel walkdowns.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (273) Number 790-1535 Best time(s) ____ ____________

Area code (_____) Number EXT. 410 Best time(s) ____________

Name BARRY BAKER. Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 5102 GREEN CREST RD.
ISLA VISTA, KY 46706

Time of Incident (24 hour clock) 14:30

Power Plant Name BUTTERMILK -3

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☒ General Electric
   - ☐ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☒ 500-1000 MW
   - ☐ Over 1000 MW

3. Location in plant where incident was observed: CONTROL ROOM

4. Operational Status

Power Operation	Hot Standby	Hot Shutdown	Cold Shutdown
☐ Startup	☐ Grid Request	☐ Grid Request	☐ Grid Request
☒ Steady State	☐ Maintenance Outage	☐ Maint. Outage	☐ Maint. Outage
☐ Load Changes	☐ Technical Spec. Req.	☐ Refueling	☐ Tech. Spec. Req.
☐ Stretch Out		☐ Tech. Spec. Req.	☐ Refueling

5. Reported by:

Management	Maintenance
☐ Plant Management	☐ Mechanical
☐ Quality Assurance	☐ Electrical
☐ Engineering Staff	☐ Instrumentation/Controls

Support Personnel	Operator
☐ Health	☐ Shift Supervisor
☐ Contractor/Consultant	☒ Licensed Control Room Operator
☐ Chemistry	☐ Non-Licensed Operating Personnel
☐ Outside Inspectors	☐ None of the above

6. Experience in Nuclear Power: 8 years 3 months
   Experience in present position: 2 years 4 months

7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☐ 2-6 hours
   - ☐ 12-16 hours
   - ☒ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☒ 0-40 hours
   - ☐ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 12 times per YEAR

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

INCIDENT

While performing the service water pump monthly operability surveillance a fellow control room operator violated the technical specification LCO for drywell/torus differential pressure. This incident was compounded by his shift supervisor's failure to report the incident as any Technical Specification violation should be, i.e., by log entry, personnel notification, and event report. The shift supervisor's rationale for his negligence was that since the drywell to torus vacuum breaker operability surveillance was to be performed that same shift anyway, it was not actually a Technical Specification violation.

Cause

1. Exceeding the Drywell/Torus Differential Pressure Limit

A primary function of the service water pump operability surveillance is to ensure each pump is capable of providing $\geq$ 8000 gpm. The only flow path that can accommodate this flow rate during power operation must include the out of service REC heat exchanger. Also, the "A" and "C" service water pumps will only supply the "A" REC heat exchanger and the "B" and "D" pumps will only supply the "B" REC heat exchanger. In addition, one REC heat exchanger must be kept in service at all times maintaining a very narrow temperature band. Due to these factors, an on-line heat exchanger swap must be performed. To perform this heat exchanger swap, one must have precise control over heat exchanger flow. This is impossible since the heat exchanger flow control valve will pass as much as 3000 gpm, even when fully closed. To help combat this problem it was been common practice to station a plant operator at the associated manual valve with headphones to control heat exchanger flow rate. This lack of control is the actual cause of the D/P violation.

2. Failure to Report a Technical Specification Violation

Negligence on the part of all licensed operators involved.

Suggested Corrective Action

1. Repair the heat exchanger flow control valves
2. In-house punitive action against all operators involved

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (387) Number 351 - 0279 Best time(s) ______

Area code (____) Number Ext. 410 Best time(s) ______

Name Charles Corwin Date of Incident Jan - 9 - 1985 (Mo. Day Year)

Address 1040 Medford Road
Holden Heights, IL 71459

Time of Incident (24 hour clock) 01:30

Power Plant Name Columbine - 2

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☒ General Electric
   - ☐ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☒ 500-1000 MW
   - ☐ Over 1000 MW

3. Location in plant where incident was observed: Control Room

4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☒ Steady State
     - ☐ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Tech. Spec. Req.
   - ☐ Refueling

5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☐ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☒ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above

6. Experience in Nuclear Power: 8 years 4 months
   Experience in present position: 3 years 2 months

7. Hours on Shift Prior to Incident
   - ☒ 0-2 hours
   - ☐ 8-12 hours
   - ☐ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☒ 0-40 hours
   - ☐ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 3 times per Shift Cycle

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

INCIDENT

The Turbine Building watch asked me to place the vacuum tank pump in the "pull-to-lock" position while he isolated and drained the vacuum drain tank. When I walked over to the control panel to trip the vacuum tank pump I was also discussing an upcoming surveillance with a new plant operator. When I reached the panel I mistakenly tripped one of the main condensate pumps instead of the vacuum tank pump. I realized that I had tripped the wrong pump and immediately reenergized the condensate pump. Luckily I caught it quick enough with only a small perturbation in reactor level being the consequences of my action and not a loss of feedwater and scram. I then placed the correct control switch for the vacuum tank pump in "pull-to-lock".

Cause

1. Inattentiveness on my part by not making sure I grabbed the right switch.

2 Control switches for the main condensate and vacuum tank pumps being too similar and too close to each other.

3. Control switch labeling not distinctive enough.

Suggested Corrective Action

1. Move vacuum tank pump control switch to location that is not so close to the condensate pump controls

2. Change switch labeling for condensate and/or vacuum tank pump controls to make them more distinctive

3. Change the pump switch control handles so they are not the same shape, size, color, etc.

4. Be more attentive while manipulating equipment controls.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (419) Number 280 - 3619 Best time(s) ______

Area code (___) Number EXT. 225 Best time(s) ______

Name DANIEL DAVIS Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 3333 BARTLETT AVE.
GRANBY, GA 96706

Time of Incident (24 hour clock) 22:50

Power Plant Name DARWIN - 1 & 2

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☐ General Electric
   - ☒ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox
2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☐ 500-1000 MW
   - ☒ Over 1000 MW
3. Location in plant where incident was observed: CONTROL ROOM
4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☐ Steady State
     - ☐ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☒ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Tech. Spec. Req.
     - ☐ Refueling
5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☒ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☐ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above
6. Experience in Nuclear Power: 11 years 8 months
   Experience in present position: 2 years 1 months
7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☐ 2-6 hours
   - ☐ 12-16 hours
   - ☒ 6-8 hours
   - ☐ More than 16
8. Hours on Shift in Week Prior to Incident
   - ☐ 0-40 hours
   - ☒ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours
9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 3-4 times per YEAR
10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical
11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical
12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

Unit 1 had been brought to HSD in preparation for a maintenance outage. The reactor was shut down and primary system temperature was being maintained with the RHR system. The turbine-generator had been cooled down and was on the turning gear. All unit one electrical loads were being carried by the station transformer.

An auxiliary operator was directed to secure cooling water to the Unit 1 turbine lube oil system. The cooling water supply for Unit 2 was secured by mistake. This error was undetected until a turbine vibration and high bearing temperature alarms were received on Unit 2. Unit 2 turbine was tripped and a station blackout occurred.

This is a twin unit station with a common turbine building. The turbine lube oil cooling water supply valves are next to each other on the center-line of the building. However, U-1 is on the U-2 side of the center-line and U-2 on the U-1 side; i.e., the valves are reversed.

Possible corrective actions would be to color code the valves, or lock them in position with each valve having a different key.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

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Area code (503) Number 283-2938 Best time(s) ________

Area code (____) Number EXT. 225 Best time(s) ________

Name EDWARD EVANS Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 2175 ROANOKE ROAD
FAIRFIELD, FL 06443

Time of Incident (24 hour clock) 10:30

Power Plant Name EVERGREEN-1

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☐ General Electric
   - ☒ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☐ 500-1000 MW
   - ☒ Over 1000 MW

3. Location in plant where incident was observed: NA

4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☐ Steady State
     - ☐ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☒ Maint. Outage
     - ☐ Tech. Spec. Req.
     - ☒ Refueling

5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☒ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☐ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above

6. Experience in Nuclear Power: 17 years 6 months
   Experience in present position: 7 years 11 months

7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☐ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☐ 0-40 hours
   - ☐ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 1 times per YEAR.

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 4 5 [✓ Critical]

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 4 5 [✓ Critical]

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

Unit One was S/D for a maintenance/refueling outage. The primary side of the C S/G was being prepared for an eddy current inspection of the S/G tubes when severe denting and damage to the tube sheet surface was observed. A closer inspection of the S/G head found parts of a piano hinge and some wood screws lodged in some of the tube ends.

During the previous refueling outage, eddy current examination and tube plugging operations had been conducted. To prevent foreign materials from entering the RCS, covers are placed in the bottom of the S/G head in the RCS pipe. These covers are constructed of plywood with aluminum sheet metal covers attached with wood screws. To enable the covers to be installed, they are fabricated as two semi-circles connected by a stainless steel piano hinge.

After the maintenance activity was completed, the S/G was closed out and sealed by procedure. The RCS was filled and a plant S/U conducted. When the calorimetrics were performed at higher power levels, there was a slight power imbalance between the C S/G and the other three. An engineer evaluation was made that this was due to instrument calibration. The temperature and flow instruments were re-calibrated and power was then within tolerance.

In fact, one of the covers had been left in the cold leg of the C S/G and there had been a flow blockage. Over the course of operation, the chemical action of reactor coolant and the physical impact on the tube sheet "dissolved" the aluminum and plywood such that the only things left were some wood screws and the SS piano hinge.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

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Area code (637) Number 722 - 2467 Best time(s) __________

Area code (____) Number EXT. 225 Best time(s) __________

Name FRANK FORESTER Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 1890 LUPINE AVE.
ELSMERE, CT 19720

Time of Incident (24 hour clock) 13:30

Power Plant Name FRONTIER

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For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☐ General Electric
   - ☒ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☒ 500-1000 MW
   - ☐ Over 1000 MW

3. Location in plant where incident was observed: VARIOUS

4. Operational Status

   Power Operation
   - ☐ Startup
   - ☒ Steady State
   - ☐ Load Changes
   - ☐ Stretch Out

   Hot Standby
   - ☐ Grid Request
   - ☐ Maintenance Outage
   - ☐ Technical Spec. Req.

   Hot Shutdown
   - ☐ Grid Request
   - ☐ Maint. Outage
   - ☐ Refueling
   - ☐ Tech. Spec. Req.

   Cold Shutdown
   - ☐ Grid Request
   - ☐ Maint. Outage
   - ☐ Tech. Spec. Req.

   ☐ Refueling

5. Reported by:

   Management
   - ☐ Plant Management
   - ☐ Quality Assurance
   - ☐ Engineering Staff

   Maintenance
   - ☐ Mechanical
   - ☐ Electrical
   - ☐ Instrumentation/Controls

   Support Personnel
   - ☐ Health
   - ☒ Contractor/Consultant
   - ☐ Chemistry
   - ☐ Outside Inspectors

   Operator
   - ☐ Shift Supervisor
   - ☐ Licensed Control Room Operator
   - ☐ Non-Licensed Operating Personnel
   - ☐ None of the above

6. Experience in Nuclear Power: 20 years 1 months
   Experience in present position: 10 years 6 months

7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☒ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☐ 0-40 hours
   - ☒ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. UNKNOWN times per ________

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

While developing new procedures for the Frontier station it was necessary to conduct an extensive evaluation of the inter-relationship of existing plant procedures. It was discovered that many of the procedures directed operators to non-existent procedures or steps. This is a serious situation if the operator is utilizing the concept of "procedural compliance" during a casualty and ends up in "no man's land".

To date, no specific corrective actions have been initiated by the plant beyond the procedures currently being developed.

I believe this is only the tip of the iceberg and a complete review and evaluation of procedures is required.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we reed to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (791) Number 961-3093 Best time(s) ________
Area code (____) Number Ext. 212 Best time(s) ________

Name GERALD GILES Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 15364 E. SHEFFORD AVE.
DANBURY, DE 32055

Time of Incident (24 hour clock) 11:15

Power Plant Name GOLCONDA - 3

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☒ General Electric
   - ☐ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox
2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☒ 500-1000 MW
   - ☐ Over 1000 MW
3. Location in plant where incident was observed: CONTROL ROOM
4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☒ Steady State
     - ☐ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Tech. Spec. Req.
   - ☐ Refueling
5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☐ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☒ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above
6. Experience in Nuclear Power: 6 years 3 months
   Experience in present position: 1 years 1 months
7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☒ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16
8. Hours on Shift in Week Prior to Incident
   - ☐ 0-40 hours
   - ☒ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours
9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. ______ times per ______
10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical
11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical
12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

I was the control room operator on Unit 3. I had a trainee on shift with me. We were discussing the recirc system, when I noticed reactor power going up. This was observed by the APRM recorders, LPRM hi alarms and a rod block alarm on the 905 panel. I noticed that the recirc pump A was running away, ramping power up. I took control of the plant by running to a back panel and running the speed controller output to zero. This locked the recirc pump so that power changes could not be made from the control room using that recirc pump. This has happened before. Due to this incident, a non-licensed operator now has to make power changes by manually adjusting recirc pump speed at the recirc pump, while in communication with the control room. If I had not been talking to the trainee at the panel, I might not have been able to catch the incident before a scram occurred. This recirc pump has been known to do this before, but I am told it won't be fixed until the next outage. I believe this event is significant because uncontrolled reactivity additions occur when the pump does this. I think the recirc pump control circuits should be fixed as soon as possible by shutting the plant down and troubleshooting the problem. In addition, using a non-licensed operator, locally, even though he may be in communication with the control room, could be a violation of 10 CFR.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (965) Number 446 - 2214 Best time(s)________

Area code (____) Number EXT. 202 Best time(s)________

Name HARRY HAMILTON Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 1312 E. ADAMS PARK DR.
CLIFTON, CO 93203

Time of Incident (24 hour clock) 22:45

Power Plant Name HALLMARK

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type: ☒ General Electric ☐ Westinghouse ☐ Combustion Engineering ☐ Babcock & Wilcox

2. Electrical Capacity: ☐ Less than 100 MW ☐ 100-500 MW ☒ 500-1000 MW ☐ Over 1000 MW

3. Location in plant where incident was observed: AT GENERATOR H_2 CONTROL RACK

4. Operational Status
   - Power Operation: ☐ Startup ☒ Steady State ☐ Load Changes ☐ Stretch Out
   - Hot Standby: ☐ Grid Request ☐ Maintenance Outage ☐ Technical Spec. Req.
   - Hot Shutdown: ☐ Grid Request ☐ Maint. Outage ☐ Refueling ☐ Tech. Spec. Req.
   - Cold Shutdown: ☐ Grid Request ☐ Maint. Outage ☐ Tech. Spec. Req. ☐ Refueling

5. Reported by:
   - Management: ☐ Plant Management ☐ Quality Assurance ☐ Engineering Staff
   - Maintenance: ☐ Mechanical ☐ Electrical ☐ Instrumentation/Controls
   - Support Personnel: ☐ Health ☐ Contractor/Consultant ☐ Chemistry ☐ Outside Inspectors
   - Operator: ☐ Shift Supervisor ☐ Licensed Control Room Operator ☒ Non-Licensed Operating Personnel ☐ None of the above

6. Experience in Nuclear Power: 3 years 3 months
   Experience in present position: 2 years 10 months

7. Hours on Shift Prior to Incident: ☐ 0-2 hours ☐ 8-12 hours ☐ 2-6 hours ☐ 12-16 hours ☒ 6-8 hours ☐ More than 16

8. Hours on Shift in Week Prior to Incident: ☒ 0-40 hours ☐ 40-60 hours ☐ 60-80 hours ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 1 times per SHIFT

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 [✓ 3] 4 5 Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 [✓ 3] 4 5 Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

I was taking my rounds when I found that the generator H_2 pressure was reading low. This reading is "radioed" by operating people all the time. Of course, I always check the reading. I had just come back from vacation, and wanted to make a thorough check of the plant to find out if any major changes had taken place while I was gone. After discovering the low pressure, I went to the control room and informed the R.O. He said his indicator looked O.K. - it was reading 60 psig - that's normal. The local was reading 10 psig. The R.O. tapped on his meter, and it went down to 10 psig. This indicated that several days had elapsed since the reading was actually checked, since the generator only normally loses 1-2 psig every week due to bleed-through to the H_2 seal oil. The R.O. told the S.S., who ordered a load reduction on the generator. All readings (temperature, stator cooling) were O.K. It was lucky that the generator didn't overheat and/or explode due to lack of cooling. Careful attention and proper watch standing could have easily prevented this.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (972) Number 579-4082 Best time(s) ____

Area code (____) Number EXT. 202 Best time(s) ____

Name IVAN INGRAM Date of Incident JAN - 9 - 1985 (Mo. - Day - Year)

Address 8842 FAIRVIEW AVE.
BISBEE, AL 72015

Time of Incident (24 hour clock) 10:30

Power Plant Name IMPERIUM

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type:
   - ☒ General Electric
   - ☐ Westinghouse
   - ☐ Combustion Engineering
   - ☐ Babcock & Wilcox

2. Electrical Capacity:
   - ☐ Less than 100 MW
   - ☐ 100-500 MW
   - ☐ 500-1000 MW
   - ☒ Over 1000 MW

3. Location in plant where incident was observed: ____

4. Operational Status
   - Power Operation
     - ☐ Startup
     - ☒ Steady State
     - ☒ Load Changes
     - ☐ Stretch Out
   - Hot Standby
     - ☐ Grid Request
     - ☐ Maintenance Outage
     - ☐ Technical Spec. Req.
   - Hot Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Refueling
     - ☐ Tech. Spec. Req.
   - Cold Shutdown
     - ☐ Grid Request
     - ☐ Maint. Outage
     - ☐ Tech. Spec. Req.
     - ☐ Refueling

5. Reported by:
   - Management
     - ☐ Plant Management
     - ☐ Quality Assurance
     - ☐ Engineering Staff
   - Maintenance
     - ☐ Mechanical
     - ☐ Electrical
     - ☐ Instrumentation/Controls
   - Support Personnel
     - ☐ Health
     - ☐ Contractor/Consultant
     - ☐ Chemistry
     - ☐ Outside Inspectors
   - Operator
     - ☐ Shift Supervisor
     - ☒ Licensed Control Room Operator
     - ☐ Non-Licensed Operating Personnel
     - ☐ None of the above

6. Experience in Nuclear Power: 7 years 0 months
   Experience in present position: 3 years 2 months

7. Hours on Shift Prior to Incident
   - ☐ 0-2 hours
   - ☐ 8-12 hours
   - ☒ 2-6 hours
   - ☐ 12-16 hours
   - ☐ 6-8 hours
   - ☐ More than 16

8. Hours on Shift in Week Prior to Incident
   - ☐ 0-40 hours
   - ☐ 40-60 hours
   - ☐ 60-80 hours
   - ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 2 times per WEEK

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

During a normal control rod swap, the reactor scrammed on main steam line high radiation. The high radiation was due to fuel element failures from the rod swap. The fuel element failures occurred because after the swap, control rods tilted the flux in a way that higher than expected power generation occurred in segments of fuel that had previously only been exposed to lower LHGR's. We did not violate the tech spec LCO's, because the LHGR did not exceed the tech spec limits. It has been known for a long time that when fuel is exposed to drastic changes in heat flux, it will fail. At our plant, the nuclear engineers are trained in the process computer and in how to read the printouts. They are also trained on how to control flux distribution. The operators receive little or no training at all in these procedures, even though we are held legally accountable for the safety of the public. We are told to believe the nuclear engineer's judgment. In effect, they tell us where to position the rods, what rods to position, where to control power, but they very seldom tell us why we do it. I think this is seriously wrong and needs immediate action. Several operators have voiced this concern to management - but it appears to be to deaf ears. But I can't pin it down to just a lack of knowledge on my part - it's a problem in our attitude to wanting to known more about the computer. As operators, half would like to know more, the other half wouldn't. I guess not enough of us voice our concerns. I really believe that if we knew more about the process computer and how to read these printouts, we could have prevented this incident from happening, because we could act as back-up checkers for the nuclear engineer.

NUCLEAR POWER SAFETY REPORTING SYSTEM INCIDENT REPORT

Identification Strip. Please fill in all the blanks. This section will be returned to you promptly. Your name, address and phone numbers will not be retained in connection with any records kept of this incident.

We may need to call you to clarify certain elements of this event. Will you please provide us with telephone numbers away from work where we may reach you if we need to obtain further details. Also, please provide a mailing address in the event that we are unable to contact you by phone.

Area code (109) Number 695-0965 Best time(s) ________

Area code (___) Number ________ Best time(s) ________

Name JACK JAMESON Date of Incident JAN - 9 - 1985 (Mo. Day Year)

Address 5127 S. CANTABRIAN COVE
ANDALUSIA, AR. 36027

Time of Incident (24 hour clock) 19:30

Power Plant Name JUBILEE -1

Except for reports of criminal activities and deliberate misconduct or gross negligence, all identities contained in this report will be removed to assure complete confidentiality.

For the following questions, please indicate your response by placing an "X" in the box beside your answer or by filling in the blank(s) where appropriate. Please try not to skip any of the questions.

1. Plant Type: ☒ General Electric ☐ Westinghouse ☐ Combustion Engineering ☐ Babcock & Wilcox

2. Electrical Capacity: ☐ Less than 100 MW ☐ 100-500 MW ☒ 500-1000 MW ☐ Over 1000 MW

3. Location in plant where incident was observed: UNDER REACTOR VESSEL

4. Operational Status
   - Power Operation: ☐ Startup ☐ Steady State ☐ Load Changes ☐ Stretch Out
   - Hot Standby: ☐ Grid Request ☐ Maintenance Outage ☐ Technical Spec. Req.
   - Hot Shutdown: ☐ Grid Request ☐ Maint. Outage ☐ Refueling ☐ Tech. Spec. Req.
   - Cold Shutdown: ☐ Grid Request ☐ Maint. Outage ☐ Tech. Spec. Req. ☒ Refueling

5. Reported by:
   - Management: ☐ Plant Management ☐ Quality Assurance ☐ Engineering Staff
   - Maintenance: ☐ Mechanical ☐ Electrical ☐ Instrumentation/Controls
   - Support Personnel: ☐ Health ☐ Contractor/Consultant ☐ Chemistry ☐ Outside Inspectors
   - Operator: ☐ Shift Supervisor ☐ Licensed Control Room ☒ Non-Licensed Operating ☐ None of the above

6. Experience in Nuclear Power: 1 years 2 months
   Experience in present position: 1 years 2 months

7. Hours on Shift Prior to Incident ☐ 0-2 hours ☒ 8-12 hours ☐ 2-6 hours ☐ 12-16 hours ☐ 6-8 hours ☐ More than 16

8. Hours on Shift in Week Prior to Incident ☐ 0-40 hours ☒ 40-60 hours ☐ 60-80 hours ☐ More than 80 hours

9. If a work related task led to the incident, estimate the number of times the task is performed (in a month, in a year, etc.) by everyone who has the responsibility for performing such tasks in the plant. 1 times per REFUELING

10. How important do you think the incident was? (Circle one #)

    Not Important 1 2 3 [✓ 4] 5 Critical

11. How important is it that something be done about the incident? (Circle one #)

    Not Important 1 2 3 4 [✓ 5] Critical

12. Narrative Description. Please describe the incident as clearly as possible. Include information on: what happened, how the problem was discovered, what actions were taken; and potential hazards that existed. What factors contributed to the incident? Why do you believe the incident happened? Please give suggestions as to how to prevent a recurrence. (Use additional space on reverse side if needed.)

INCIDENT

During this refueling outage, I was tasked with performing the under vessel operations associated with LPRM replacement. I was told by my supervisor to set up on LPRM 26, 43. This setup process involves removing the LPRM retainer nut and seal and hooking up a drain rig. I accidentally performed this setup process on LPRM 26, 35 which is located next to LPRM 26, 43. Just as I completed the setup, my relief got there and I told him I had just set up on 26, 43. My relief noticed my mistake and we both returned 26, 35 to normal and correctly set up on 26, 43. Luckily I hadn't informed the refueling floor supervisor that I was set up and he was none the wiser.

Cause

1. Insufficient LPRM identification under the reactor vessel.
2. Inattentiveness on my part for not double-checking myself.

Suggested Corrective Action

Provide a positive means of identifying LPRM's under the vessel - perhaps some sort of tags.

APPENDIX C

Data Processing Reliability Assessment
for
NPSRS Analysts from Operability Demonstration

Appendix C

1.0 Reliability of Analysts' Evaluations

If several NPSRS analysts were asked to process the same incident report using NPSRS forms and procedures, how much similarity would exist between their independently produced data summaries?

1.1 Evaluation Method

The five analysts participating in the Operability Demonstration were each provided with the same, identical set of nine input reports of simulated incidents to be processed. The products resulting from their individual interviews with reporters and the analysts' analyses of the incidents were examined to determine the degree of agreement between analysts (reliability) for each element of their data summary forms.

1.2 Levels of Agreement

The Taxonomy Data Collection forms prepared by each of the five analysts from the results of their report analyses and reporter interviews were compared on an item (field) by item basis for all nine of the input incident reports. For an example of how this comparison was conducted, Field No. 11 of the Taxonomy Data Collection form (cf, Appendices D and E, NUREG/CR-4133, Ref. 1) pertains to the day of the week on which the reported incident occurred. Any of the seven days in a week could be specified in the data summaries by the five analysts. (The day of the week must be derived by the analysts from the calendar date specified by the reporter.) An index of the reproducibility of this field between analysts was generated for each of the nine reports by assessing the number of times the analysts agreed about the identification of the day in which the incident occurred. If all five chose Monday as the day of the incident, then the maximum level of agreement would be five. If each analyst chose an entirely different day, then the minimum level of agreement would be one. The level of agreement between analysts (some value between one and five) obtained for a particular field was assessed for each of the 31 fields in all nine reports.

1.3 Examples of Levels of Agreement for Specific Fields

As an example of the reliability obtained for a field where the analysts were required to apply their own judgment, Field No. 14 requires the number of participants involved in a reported incident to be specified. The level of agreement obtained for each of the nine reports is graphically presented in Figure 1. For two of the nine input reports all five analysts agreed (the indicated level of agreement is five) about the number of participants. Thus, for 2/9 = 22% of the reports evaluated, complete agreement existed between all analysts. Similarly, for five of the reports, at least four analysts agreed on the number of participants. Thus, for 56% of the reports agreement existed between four or more of the analysts. For seven of the reports, at least three or more analysts agreed (78% of the reports) and at least two or more analysts agreed in 100% of the reports analyzed.

Field No. 37 is an example of a taxonomic parameter that shows less robust agreement between analysts. In this field, the analyst was required to evaluate the performance shaping factors that were fundamental in influencing the human performance in the incident. The analysts were required to choose from among 45 possible options in the taxonomy to determine the one that they

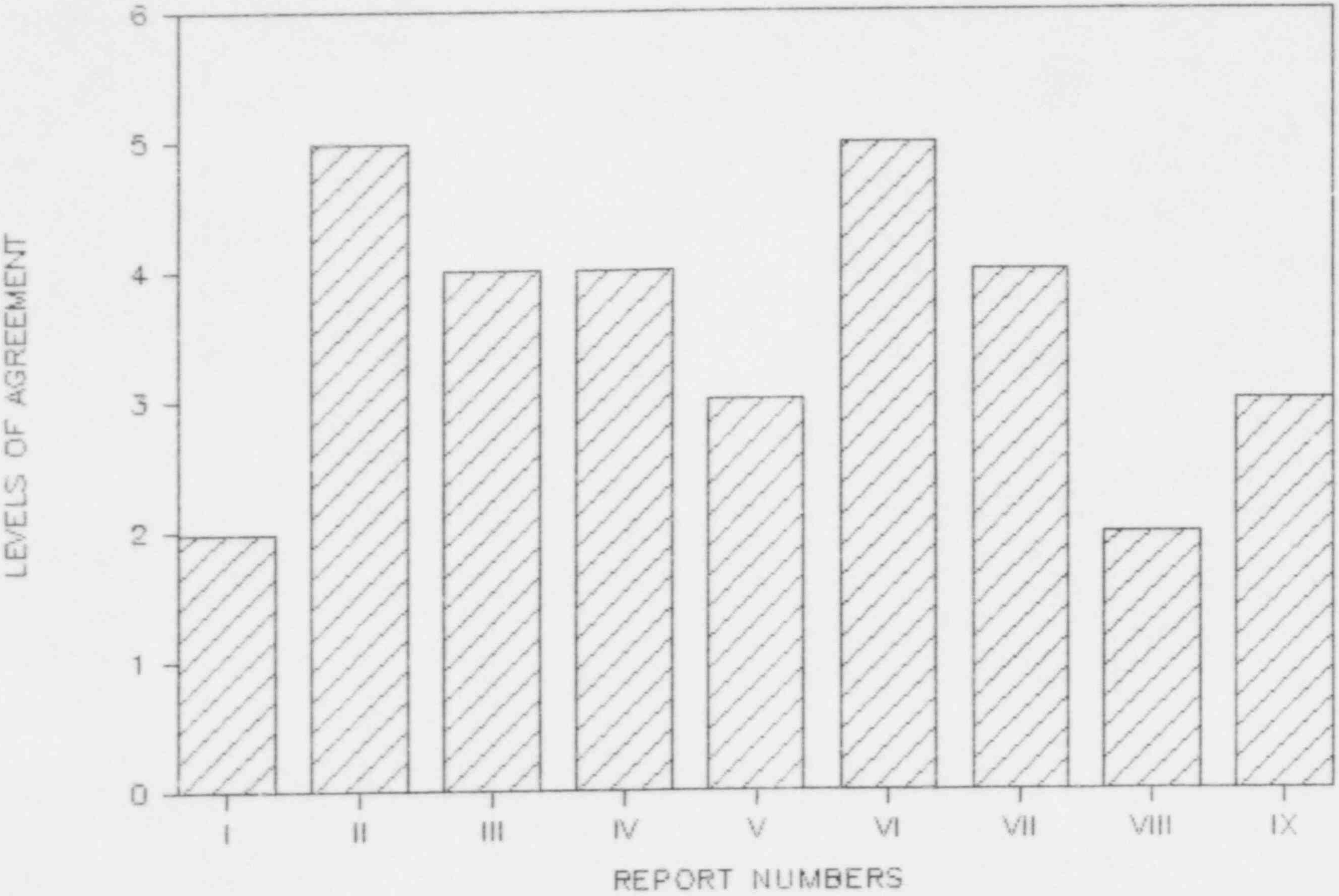

Figure 1. Agreement among analysts on numbers of participants in each reported incident

felt best described the specific performance shaping factor for the event they were coding. The results are graphically presented in Figure 2. In this instance the following results were obtained:

1) In no instance did all five analysts agree on the choice of the most significant performance shaping factor.

2) In only one instance, 11% of the reports, did at least four analysts agree.

3) In 44% of the reports, at least three analysts agreed.

4) Eighty-nine percent of the time at least two analysts agreed.

Field No. 51 is an example of a parameter where the level of agreement was poor. This field addressed the "Message Type" involved in the reported incident. The taxonomy contained nine possible options for "Message Type" from which the analysts had to choose such as, "Request for clearance to proceed" or "Data, Text, Graphic, or Instrument Readings" etc. As may be seen in Figure 3, the differences of opinion between analysts were substantial with respect to this parameter. In only two of the nine reports (22%) did as many as two of the analysts agree about the coding of this field. The rather poor agreement on this field probably reflects the limited training period available for the analysts in connection with the Operability Demonstration.

1.4 Overall Agreement for all Taxonomic Entries

For all nine reports, across all 34 taxonomy parameters, the following overall results were obtained, as shown in Figure 4:

- Thirty-six percent of the time all five analysts agreed about the overall coding of items.
- Fifty-six percent of the time at least four analysts agreed about the choices in all taxonomic entries.
- Seventy-five percent of the time there was agreement between at least three of the analysts.
- Ninety percent of the time at least two of the analysts agreed.
- In only 10% of the cases was it impossible for the analysts to come to any agreement at all among themselves regarding taxonomic codings.

1.5 Observations

A reasonable degree of reliability has been shown for novice systems analysts when they were processing the forms and procedures drafted for the NPSRS program. Considering all entries in the Taxonomy Data Collection forms for all nine reports, over half of the time four of the five analysts agreed about the coding. With the editorial improvements that have been made in the forms and with additional formal and on-the-job training for the analysts, the

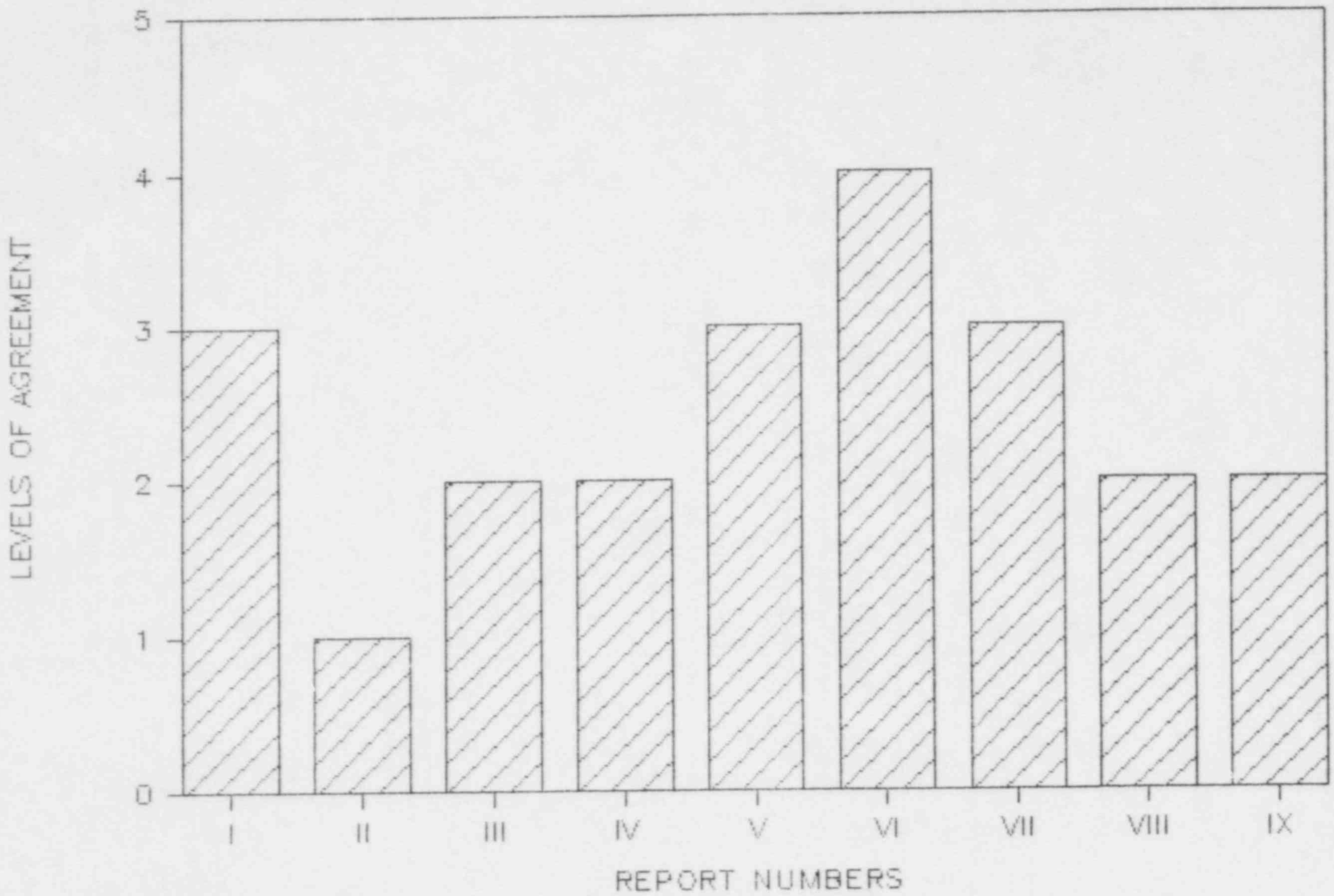

Figure 2. Agreement among analysts on performance shaping factors influencing each incident

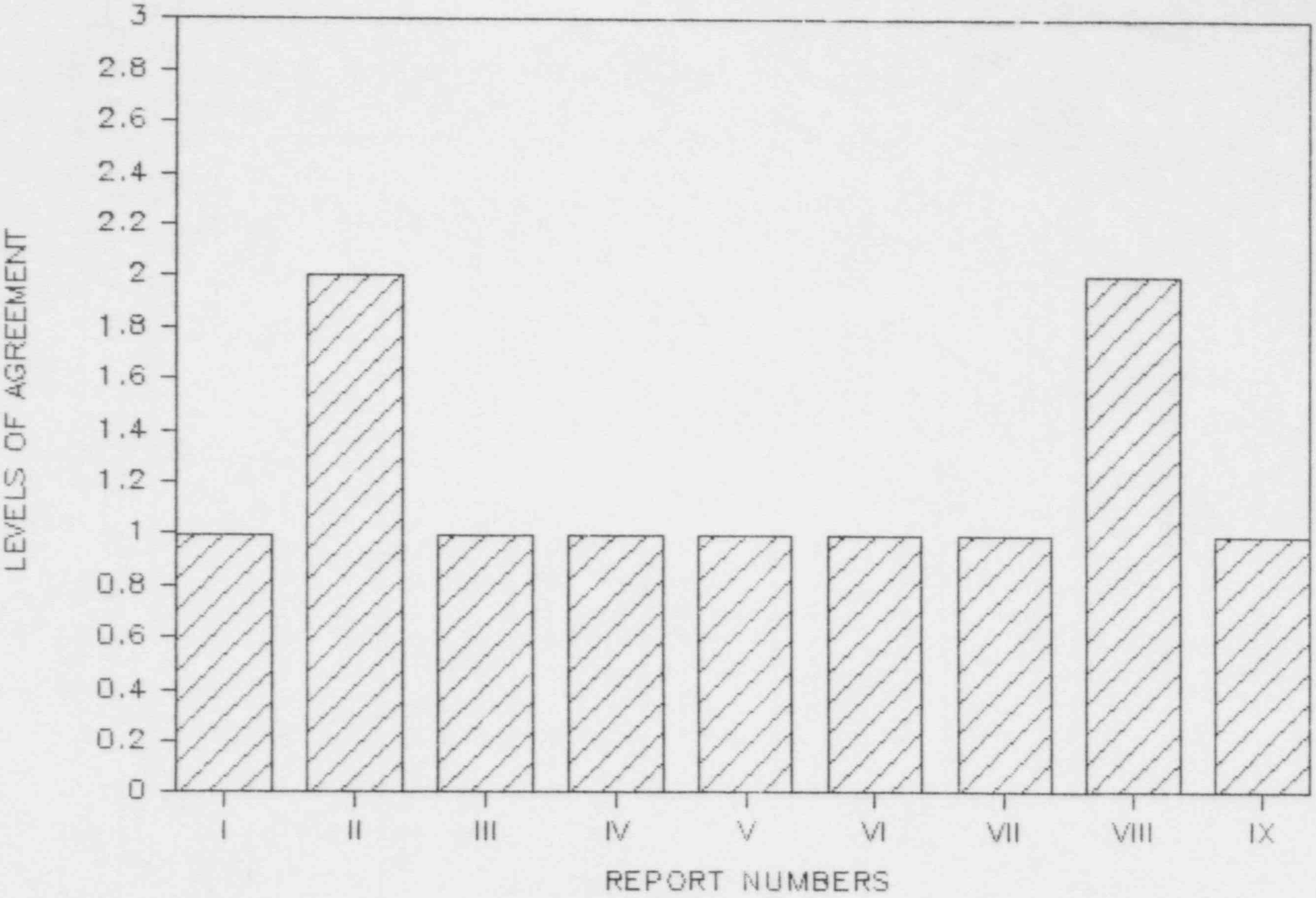

Figure 3. Agreement among analysts on the message type involved in each incident

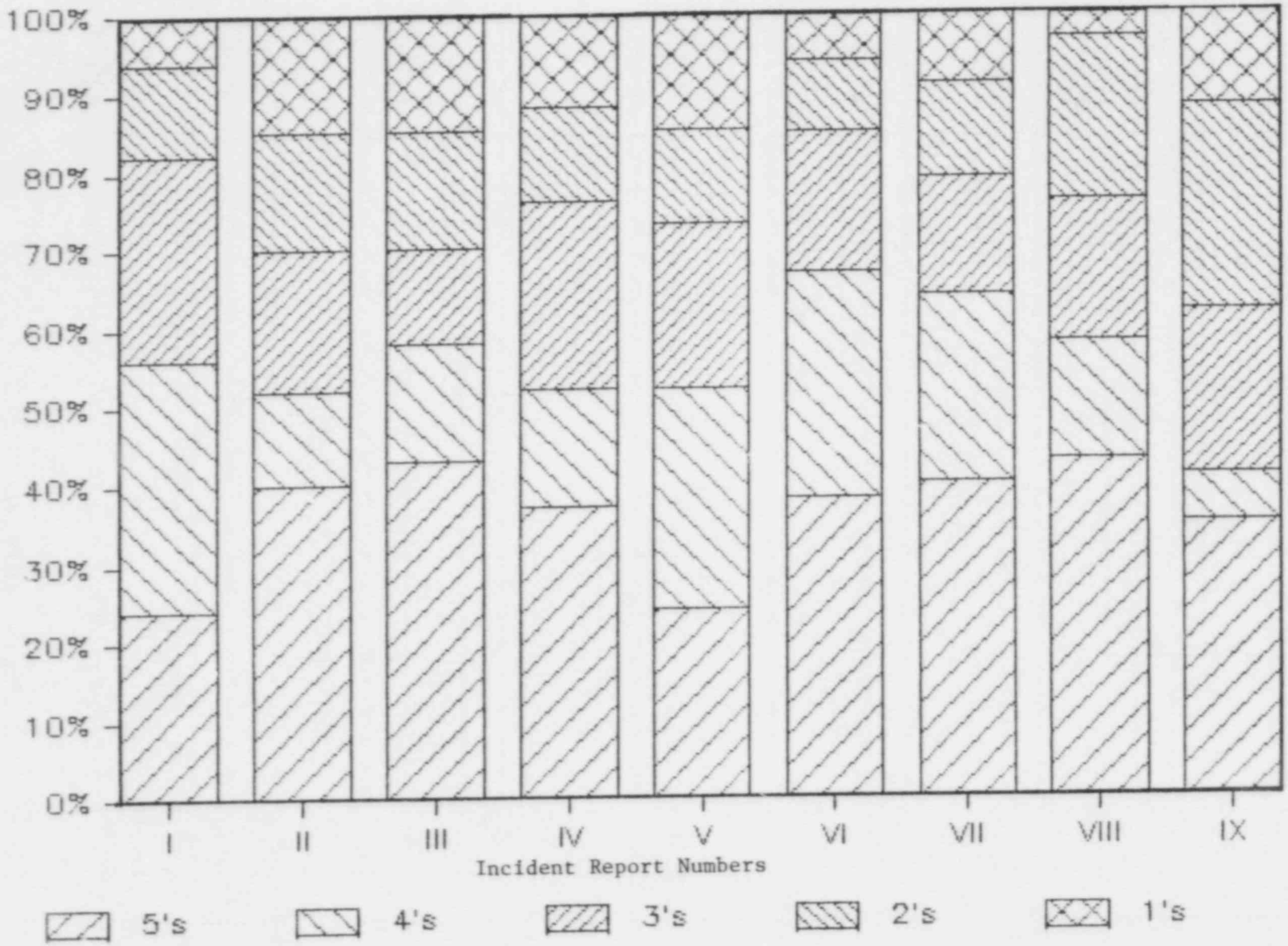

Figure 4. Overall agreement among analysts for all reported data fields in each incident

degree of agreement between independent analyses of the same incidents would be expected to improve substantially. Approximately six months is needed for ASRS analysts to achieve their maximum levels of productivity and report processing reliability.* Similar lengths of time would be expected to be required for NPSRS analysts.

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* Harry W. Orlady, ASRS Senior Research Scientist, personal communication to F. C. Finlayson, The Aerospace Corporation, January 18, 1985.

APPENDIX D

Example USNRC Policy Statement
on
Nuclear Power Safety Reporting System

Date [As appropriate]

DRAFT

ADVISORY BULLETIN

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Nuclear Power Safety Reporting System

1. Purpose

a. This bulletin describes a voluntary, nonpunitive Nuclear Power Safety Reporting System (NPSRS) program that is being sponsored by the U.S. Nuclear Regulatory Commission (NRC). The Program utilizes the (TBD - National Third Party Organization - NTPO) as an independent, third party to manage and operate the program and to receive and analyze Nuclear Power Safety Reports. The NRC strongly encourages the participation of all operational personnel of the U.S. nuclear power production community, including operators, maintenance personnel, engineering staff members, and plant management personnel in this cooperative safety-related incident reporting program. Thus all operational personnel are invited to report any actual or potential situations or incidents that they have experienced involving the safety of nuclear power operations to NTPO. All elements of nuclear power plant operations are covered by this program including actual and near-miss incidents that have been experienced or observed by reporters that are associated with normal or abnormal conditions of power production in the plants; discrepancies or deficiencies attributable to preoperational design and construction problems that may interfere with safe operation of the plants; difficulties with maintenance and operational procedures; problems with equipment, instruments, plant operational communications; or any other factors that may have contributed to unsafe or hazardous working conditions relative to the incident upon which the report is filed.

b. The effectiveness of this program depends upon the free, unrestricted flow of information from the personnel of the U.S nuclear power production community to the NTPO. Thus the NRC has made extensive efforts to ensure that the anonymity of reporters is maintained and to provide them with immunity from regulatory action as long as the incidents reported are not criminal acts where federal, state, or local laws have been violated. In general, reports that are submitted to the NPSRS will not be screened to determine whether they describe incidents that should have been submitted to the NRC through its normal communication channels. In some cases, the NRC may find that an NPSRS report contains information that should have been submitted directly to them, but for some reason was not. In such cases, where an NPSRS report has been filed, the NRC will not deem an individual's failure to report directly to the NRC (in and of itself) a criminal act. However, the implementation of the NPSRS program does not alter, in any way, a utility's obligations and responsibility for submitting any reports presently required under NRC regulations on safety-related incidents occurring in the utilities nuclear plants. See Paragraphs 6, 8 and 9 below.

2. Background

a. A major objective of the NRC is the promotion of safety within the nuclear industry. To further this objective, the Rules and Regulations of the NRC require that the NRC be notified immediately concerning significant events that have occurred at nuclear power plants (10 CFR 50.72). These required reports are submitted as Licensee Events Reports (LERs) or through other channels. The accident at Three Mile Island (TMI) focussed attention on the importance of an effective understanding and feedback of operating experience within the nuclear power industry. Studies of the TMI accident emphasized the importance of collecting and evaluating operational experience as a basis for implementing corrective actions that might be needed within the industry. In addition, the NRC has added a new subsection to its Rules and Regulations, 10 CFR 50.73, that has modified and codified earlier LER requirements. Concurrent with its proposal to add 10 CFR 50.73 to its regulations, the NRC authorized studies to evaluate the feasibility and potential benefits of a voluntary, nonpunitive Nuclear Power Safety Reporting System (NPSRS).

b. The NRC determined that the effectiveness of its collection and evaluation of operating experience would be enhanced if a NPSRS were instituted as a supplementary communication channel to those of 10 CFR 50.72 and 50.73. In the NPSRS, the receipt, processing and analysis of raw data from reports of safety-related occurrences involving human performance will be accomplished by NTPO rather than the NRC. An independent, third-party administrator will be utilized for the NPSRS to ensure that the reporter and all parties involved in a reported occurrence or incident will remain anonymous. By assuring reporter anonymity, the NRC hopes to increase the quantity of information submitted to NTPO thereby contributing another pathway to the compilation of the substantial data base that is necessary for the evaluation of the safety and effectiveness of nuclear power production facilities. Accordingly, NTPO administers the NPSRS and performs its functions in accordance with a contract [or Memorandum of Agreement] executed by NRC and NTPO on (__date___).

3. NTPO Responsibilities

a. The NTPO Nuclear Power Safety Reporting System provides an operational mechanism for the receipt, analysis, deidentification, collection and evaluation of safety reports obtained voluntarily from personnel of the U.S. nuclear power industry. The deidentified elements of the data base developed by the NPSRS represent an important input to the human performance investigations within the industry. Periodic reports of findings obtained through the reporting program are published and distributed to the public, the nuclear power production community and the NRC by the NTPO. In addition, synthesized results from the NPSRS data base will be made available to qualified users upon application.

b. A NTPO NPSRS advisory committee comprised of representatives from the nuclear power industry, consumers, Department of Energy, NRC, and other selected individuals advises NPTO on the conduct of the NPSRS. The committee conducts periodic meetings and reviews the NPSRS activities to evaluate and ensure the effectiveness of the reporting system.

4. Prohibition of the Use of Reports for Enforcement Purposes

a. Appendix C of the NRC Rules and Regulations (10 CFR Part 2, Appendix C [to be modified]) prohibits the use against the reporter of any report submitted to NTPO under the NPSRS (or information derived therefrom) in any disciplinary action (with the exception of reports concerning criminal acts involving violations of federal, state, or local statutes which are covered under Paragraph 6a(1) below). As noted in Paragraph 1b above and 6a and 8 below, reports filed with the NPSRS may subsequently be determined to contain information about incidents for which reports should have been submitted through normal NRC communication channels. In such cases, the NPSRS reports will not (in and of themselves) be considered to be the basis for criminal sanctions that might be taken against the reporter for failure to report through formal NRC channels.

b. If a utility employee submits a voluntary report to the NPSRS, the submission does not relieve the utility involved in the event from the responsibility for filing LERs or other obligatory reports which may be required under current NRC Rules and Regulations. Consequently, if a violation of NRC Regulations comes to the attention of the NRC from a source other than a report filed with NTPO under the NPSRS, appropriate action will be taken. However, evidence of the submission of a voluntary report on the incident to the NPSRS may, under certain circumstances, be used by the NRC as the basis for providing immunity to (or otherwise mitigating) possible regulatory action. See Paragraph 8c below.

c. The NPSRS security system is designed and operated by NTPO to ensure the confidentiality and anonymity of the reporter and other principal parties involved in a reported occurrence or incident. The NRC will not seek to obtain any individual report filed with the NTPO under the NPSRS that might reveal the identify of the reporter. Nor will the NRC attempt to seek aggregated results from the NPSRS data that might identify a utility or nuclear power plant in which NPSRS reporters work and to associate this information with the collective number of reports filed by that utility or by the plant's workers in any extended period. The contract [memorandum of agreement] between the NTPO and the NRC specifies that the NTPO will not release (or otherwise make available) to the NRC, or any other users, any information that might reveal the identify of any individual, any specific plant, or any specific utility involved in situations, occurrences, or incidents reported under the NRCs.

5. Reporting Procedures

The NPSRS report form (NTPO Form XX) which is preaddressed and postage free will be made available through a designated non-management individual within each nuclear plant. This individual will be selected and supported by the utility owners of the plant. The designated person will maintain a supply of forms that will be made available at several central, inconspicuous locations (e.g., in distribution boxes at security entrances of the nuclear plant, etc.). This form, containing a narrative report of the incident, should be prepared and mailed to: Nuclear Power Safety Reporting System, P.O. Box 54321, Erewhemous, MV 55555 [fictitious address].

6. Processing of Reports

a. Under the NTPO procedures for processing Nuclear Power Safety Reports, the reports are initially screened in accordance with the following guidelines:

(1) Information concerning criminal offenses involving violations of federal, state, or local statutes will be promptly referred to the Department of Justice and the NRC. Reports of criminal activities are not deidentified prior to their referral to these agencies.

(2) The NTPO will not in general screen reports to determine whether they have been reported to the NRC through other channels. As noted in Paragraph 1b and 4a above, reports that are filed with the NPSRS and are subsequently determined to be unreported incidents that should have been reported to the NRC through their normal channels will not, in and of themselves, subject the reporter to criminal sanctions. Only if the incident reported involves a specific violation of federal, state, or local statutes will the report be considered to fall under the requirements of Paragraph 6a(1) above.

(3) The reports will be screened for time-critical information concerning incidents that are judged to be of major local significance to the nuclear industry, or to be a forerunner of a potentially high public risk event. Most such information will also be reported independently to the NRC and the local utility associated with the event through the NRC's established communications channels. For reports that are deemed "time-critical" by the NPSRS, the NTPO may request the NRC to provide the NPSRS with a listing of all accidents submitted to the NRC through their established channels in the time period immediately prior to and following the reported NPSRS incident. The NPSRS report which is judged to be of critical safety significance will be compared with the NRC listing to see whether the reported incident has been submitted to the NRC through other channels. If the reported incident has been submitted through normal channels to the NRC, no communication on the subject NPSRS report will be made between the NTPO and the NRC. If the report has not been received by the NRC, the NTPO will communicate with the individual submitting the report and discuss the implications of possible NPSRS or reporter actions with him. In general, the NTPO will encourage the reporter to submit an additional report on the incident directly to the NRC or his own plant management through an established communication channel thereby obtaining immunity directly from the NRC, if possible. If this proves to be unworkable, the NTPO will negotiate directly with the NRC in regards to the report on behalf of the reporter, attempting to retain his anonymity. Recognizing the value of data obtained by good faith reporting to the NPSRS, the NRC has agreed to cooperate with the NTPO in accepting deidentified information related to the incident. Deidentified reports will be accepted from the NTPO with a level of detail that will attempt to preserve the reporters'

anonymity, and yet provide sufficient data so that the risks associated with failure to introduce the information to the nuclear power community will be reduced. The NRC recognizes the importance of preserving reporter anonymity to the potential success of the data gathering efforts of the NPSRS. Hence, a collaborative effort will be made between the NRC and the NTPO to preserve the reporter's anonymity for the few reports that are expected to be submitted to the NPSRS where data must be shared directly with the NRC.

b. Each NPSRS report (NTPO Form XX) has a tear-off portion which contains the information that identifies the person submitting the report. This tear-off portion will be removed by NTPO, time stamped with the date of receipt, and returned to the reporter as his receipt. This will provide the reporter with proof that he filed a report on a specific incident or situation in a timely fashion (i.e., within 10 days after the event occurred). See Paragraph 8c(6) below.

c. The identification strip section of the NPSRS report form provides NTPO program personnel with a means by which reporters can be contacted in case additional information is sought in order to understand more completely the report's content. No contacts will be made with anyone except the reporter in connection with any report submitted, except in the case of an incident involving criminal action. No copy of an NPSRS report form's identification strip is created or retained for the NPSRS files. Prompt return of identification strips is a primary element of the NPSRS program's report deidentification process and assures the reporter's anonymity.

7. Deidentification

All information retained in the NPSRS data base that might establish the identification of persons filing NPSRS reports and parties named in those reports will be deleted from analyses of the reports, except for reports covered under Paragraph 6a(1) above. This deidentification will normally be accomplished within 24-48 hours after NTPO's receipt of the reports if no further information is required from the reporter.

8. Enforcement Policy

a. It is the policy of the Commissioners of the NRC to perform their responsibilities under the NRC Enabling Act(s) (Atomic Energy Act of 1954 and/or Title II of the Energy Reorganization Act of 1974) for the enforcement of the Act(s) and the NRC Rules and Regulations in a manner that will best tend to reduce or eliminate the possibility of (or recurrence of) nuclear power plant accidents. The NRC enforcement procedures are set forth in Part 50 of the U.S. Nuclear Regulatory Commission Rules and Regulations (10 CFR Part 50).

b. In determining the type and extent of the enforcement action to be taken in a particular case, the NRC considers the following factors as a matter of general practice:

(1) The nature of the violations and their relationship to the Technical Specifications for the operation of the facility involved;

(2) Whether the violation was inadvertent, caused by negligence, or was deliberate; and whether deliberate acts were intended for beneficent or malicious purposes;

(3) The attitude of the violator(s) as demonstrated by previous records concerning the individual and/or the utility involved in the incident;

(4) The hazard to safety which should have been foreseen;

(5) Remedial action taken on the initiative of the utility owner of the facility to prevent (or reduce the probability of) similar adverse incidents;

(6) The length of time which has elapsed since any prior or subsequent violation;

(7) The needs for special deterrent action in a particular regulatory area, or segment of the nuclear power production community; and

(8) The presence of any factors involving substantial risks to the community, such as the occurrence of a particularly severe incident involving releases of radioactivity to the external environment of the facility.

c. The voluntary filing of a report with NTPO concerning an incident or situation (even though the incident may involve a potential violation of the Enabling Act(s) of the NRC Rules and Regulations) is considered by the NRC to be indicative of a constructive attitude on the part of the reporter towards nuclear power plant safety. The NRC believes that the filing of a report with the NPSRS represents evidence of an attitude on the part of the reporter that will tend to reduce the probability of future violations. The NRC expressly desires to encourage such attitudes individually on the parts of members of nuclear plant operational staffs and collectively through utility owner-operators of nuclear facilities. Accordingly, although a parallel report of a voluntarily reported incident may be brought to the attention of the NRC through some other source than the NPSRS and a subsequent finding of a violation may be made against an individual or a utility, neither a civil penalty nor license revocation will be imposed upon the reporter, and potential penalties will be mitigated for the plant in which the incident occurred if:

(1) The violation was inadvertent and not deliberate in a malicious sense;

(2) The incident did not involve violation of federal, state or local criminal statutes;

(3) The incident associated with the violation did not involve substantial risks to the community, as described under paragraph 8b(8) above;

(4) The person has not been found to have been involved in any prior NRC enforcement action and/or to have exercised his immunity under this program for a violation of any regulation promulgated under the Enabling Act(s) within five years prior to the reported incident;

(5) The plant in which the incident occurred has maintained a record of safe operations whereby no civil penalties have been levied upon the plant within the five years prior to the reported incident and the utility demonstrates that a program of adequate encouragement has been provided to plant operational personnel to participate in the NPSRS. Adequate utility support to the NPSRS, will be demonstrated by the utility providing evidence of having made a good faith effort to educate their employees about the NPSRS program and to encourage them to participate in it. The utility must also demonstrate that they have specified and supported the activities of a non-management representative from within the operational staff who has been given responsibility for maintaining a supply of NPSRS report forms in boxes located at several, central locations throughout the plant where the plant personnel can conveniently and inconspicuously obtain them. Each utility will submit (and keep current) the name of their designated representative to the NTPO program manager so that the NTPO can contact the local plant representatives to assure themselves that supplies of NPSRS report forms are available at each plant;

(6) The individual reporter proves that, within 10 days after the violation, a written report of the incident or occurrence was completed and delivered or mailed to NTPO under NPSRS. See Paragraphs 4b and 6b above.

9. Other Reports

This program does not eliminate responsibility for submission of reports, narratives, or forms presently required by existing NRC directives.

10. Effective Date

The Nuclear Power Safety Reporting Program described by this Advisory Bulletin is effective (__date__).

11. Availability of Forms

Additional copies of the attached reporting form (NTPO Form XX) may be obtained free of charge from the NRC (__Address__) and NTPO general offices (__Address__).

Signed:

____

Chairman
U.S. Nuclear Regulatory Commission

APPENDIX E

Aviation Safety Reporting System
Comments on NPSRS Feasibility

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April 2, 1985

Dr. Fred C. Finlayson, Manager
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Dear Fred:

It was a pleasure to serve as a proctor for your demonstration of the proposed Nuclear Power Safety Reporting System. It was a good demonstration and you should be congratulated. The following are my specific comments:

1. I believe that a voluntary, confidential, and nonpunitive incident reporting system can make a substantial safety contribution to the Nuclear Power System in the United States.

   This comment is based upon my observation of the simulated nuclear power incidents reported during your demonstration and the analyses that were made of them. It is also based upon my personal experience with the air safety contributions non-punitive reporting systems have made, and are continuing to make in the United States and in several other countries throughout the world.

2. The reporting system demonstrated in Tulsa appeared entirely feasible and, with modifications suggested during the postdemonstration discussion periods, could be successfully implemented. Planned personnel requirements seemed reasonable and realistic.

   I do have a word of caution. The institution of a voluntary, confidential, and non-punitive incident reporting program for the nuclear power industry inevitably would involve new concepts for many of its participants. These include potential reporters, managers regulatory officials and perhaps others. Implementation of such a program will require many of them to modify long and strongly-held beliefs. Modification of well-established thought processes or behavior is never easy and considerable resistance can be expected.

Fortunately, this critical and unavoidable problem is far from insurmountable. However, successfully dealing with it does require a carefully organized informational campaign. All of the potential users and any other who would be affected by the NPSRS should fully understand its goals, its implementation processes, and the implications this new safety reporting system will have on their day-to-day activities. This is particularly important for those who have management and enforcement responsibilities.

3. Perhaps the single most important modification needed in the proposed NPSRS is the development of what is, and must be perceived by all to be, a clear and unequivocal method of providing confidentially and meaningful immunity from <u>any</u> possible adverse consequences to reporters to the NPSRS. Regardless of whether the threat is from the Nuclear Regulatory Commission or from any level of utility management, protection from punitive action is an absolute requirement. If the characteristics of the nuclear power industry are such that a meaningful analysis of an incident report could identify the utility involved and could then result in punitive action against it, the utility very obviously also needs effective protection against such action. The content and distribution of "Alert Bulletins" may be particularly sensitive.

4. While the analyst training in Tulsa was well-done within the time constraints of the demonstration, it was not adequate for a real-world operation. It will be necessary to provide additional training for the NPSRS analysts.

   The problem was not the analyst's technical knowledge. Their experience and familiarity with the industry were impressive. However, one cannot expect technical experts to be equally expert in the skills and knowledge required for the insightful analysis of incident reports or in the interviewing techniques required to secure important additional human factors information from voluntary reporters.

   ASRS experience has demonstrated the effectiveness of utilizing carefully selected retired pilots and air traffic controllers as aviation subject matter experts and then giving them additional training in selected human factors, system safety, and analytic and interviewing skills. It is believed that this has been much more effective than it would have been to first select individuals with human factors and analytic skills and then attempt to make them aviation safety experts.

5. The proposed analytic forms should be made easier for the analysts to use. The present ASRS analytic package (which has undergone several revisions) may suggest some possible formatting refinements, but to a considerable extent this will simply require additional experimentation.

6. The content of the analytic forms is perhaps even more important. You can expect to make several revisions. The development of both the form and content of any good analytic package is almost inevitably an evolutionary process. The suggestions for revision which were made during the discussions in Tulsa are a good example. Understandably, the taxonomy was one of the most obvious problems.

7. I was particularly impressed with the need to have a wide range of expertise for the analysis of reported nuclear incidents either on the analytic staff or available to it. Although I am not familiar with nuclear power operations, expertise in radiological protection, physical security, operations, and maintenance seemed a minimum requirement. While some of these requirements could perhaps be met with part-time or dual-qualified personnel, the contents of the reports submitted should be the final determinant.

Finally, and I believe this is worth special emphasis, the most impressive and the single most important observation that I made during the demonstration was that <u>I did not hear anything regarding the proposed NPSRS that I had not heard many times before</u> in discussions of the desirability, feasibility, and implementation of non-punitive incident reporting systems in aviation. This is not only true in regard to the ASRS but it is also true in regard to the development of the confidential non-punitive incident reporting program on a major U.S. airline that was its precursor.

In aviation we have learned a tragic and a very expensive lesson. "We no longer have to kill people to learn important things about safety." There is no reason that the nuclear industry, or any other industry that is dependent upon human behavior, should find it otherwise.

Sincerely yours,

Harry

Harry W. Orlady
Senior Research Scientist

HWO:dj

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This report is the second in a series of three investigating the feasibility of adapting a voluntary, anonymous, non-punitive, third party managed reporting system in a U.S. commercial nuclear utility industry environment. Such a system is intended for use in identifying and quantifying, in an uninhibiting manner, factors that contribute to the occurrence of significant safety incidents which elicit either positive or negative responses from equipment and humans in nuclear power plants.

This report presents the results of a limited evaluation of such a system, for its practicality, acceptability and usefulness in a commercial nuclear environment. Conclusions and recommendations resulting from the limited evaluation are also presented. A companion report (NUREG/CR-4133, "Nuclear Power Safety Reporting System: Implementation and Operational Specifications") presents in detail the personnel, materials and procedures required to establish and operate the system.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a. DESCRIPTORS

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Anonymity
Immunity
Nuclear Power Plant
Reporting System
Human Performance

17b. IDENTIFIERS/OPEN-ENDED TERMS

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