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FFTF Event Fact Sheet Root Cause Analysis Calendar Year 1985 through 1988

Prepared for the U.S. Department of Energy
Assistant Secretary for Nuclear Energy



Westinghouse
Hanford Company

Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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FFTF Event Fact Sheet Root Cause Analysis Calendar Year 1985 through 1988

G. B. Griffin

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*J. E. Nardal ca/ca/2012
DC/LM-REM*

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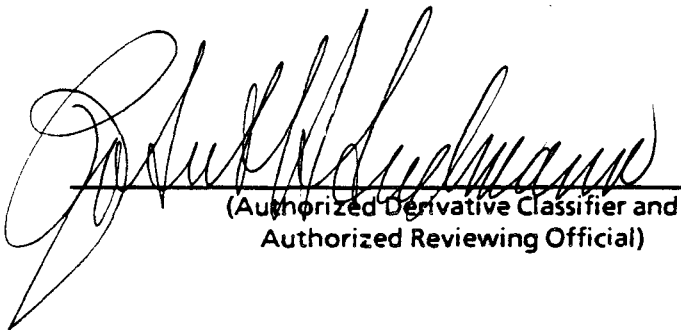
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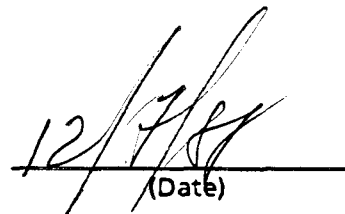
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SUMMARY

The Event Fact Sheets written from January 1985 through mid August 1988 were reviewed to determine their root causes. The review group represented many of the technical disciplines present in plant operation. The review was initiated as an internal critique aimed at maximizing the "lessons learned" from the event reporting system. The root causes were subjected to a Pareto analysis to determine the significant causal factor groups. Recommendations for correction of the high frequency causal factors were then developed and presented to the FFTF Plant management. In general, the distributions of the causal factors were found to closely follow the industry averages. The impacts of the events were also studied and it was determined that we generally report events of a level of severity below that of the available studies. Therefore it is concluded that the recommendations for corrective action are ones to improve the overall quality of operations and not to correct significant operational deficiencies.

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**FFTF EVENT FACT SHEET ROOT CAUSE
ANALYSIS 1985-1988**

INTRODUCTION

In early 1985, an analysis of the causes of FFTF Event Fact Sheets (EFS) was conducted by the Operations Department. This analysis was performed as a first attempt at characterizing the causes of events. At this time, no specific categories were specified on the EFS form to aid the author in making a determination of the cause of the event. Therefore the study used general classifications such as: Personnel, Procedure, etc. In 1986, the EFS form was modified to include blocks to check to identify the causal factor category. These categories were: Administrative Control, Design, Material, Other, Personnel, and Procedure.

In 1988 a decision was made to again do a statistical analysis of Event causal factors. The purposes of the study were:

1. Update the work which had been done in 1985.
2. Compare the FFTF with INPO studies.
3. Contribute to the Westinghouse Hanford Company goal of understanding and correcting the root causes of operations conducted with less than Total Quality.

The FFTF had recently acquired an affiliation with the Institute of Nuclear Power Operations (INPO) and studies^{1,2,3} they had conducted were reviewed in order to determine the current classification methods for event casual factors. These studies were useful in that they provided a baseline to compare our results to, but they did not sufficiently document the methods used to conduct the analysis. Subsequent to this review, a Root Cause Analysis Checklist was provided by Emil Leitz of Defense Reactor Division. This checklist was originated by the Boiling Water Reactor Owner's Group and had been used at the N Reactor with favorable results to conduct a review similar to the one we were planning. A sample of the checklist is provided in Appendix A.

¹ INPO 84-027, An Analysis Of Root Causes In 1983 Significant Event Reports

² INPO 85-027, An Analysis Of Root Causes In 1983 And 1984 Significant Event Reports

³ INPO 86-022, An Analysis Of Root Causes In 1985 Significant Event Reports

A task force was formed representing the majority of the departments at the FFTF Plant to conduct the review of these EFS's and develop recommendations based on their findings. This report documents the methods used, summarizes the findings, and itemizes the recommendations.

EVALUATION METHOD

As mentioned above, the method used to evaluate the Events was based on a Root Cause Checklist originated by the Boiling Water Reactor Owners Group. There are three major levels of causal factors, each level detailing the one above it. The first level contains factors that are similar to those used on the current EFS form (Personnel Error, Procedural Failure, Equipment Failure, Other, Unknown). The levels below the first (where they exist) provide increasing differentiation of the causes for various Events.

The task force was divided into teams of two and each team reviewed approximately 60 Events. The team members first reviewed their assigned events individually, then the two compared their individual determinations and came to a consensus for the cause(s) of the Event. No limitations were placed on how many causes could be assigned to an Event, and the 283 Events reviewed yielded 563 Root Causes. These causal factors were then entered into a data base to allow them to be analyzed and plotted. The listing of all events and their root causes is given in Appendix B.

In addition to determining Root Cause, the relative severity of these events was of interest. The method chosen to measure the severity was to use the categories in the INPO studies previously referenced. Each severity category has secondary impact categories below it. The following table shows the categories of impacts used by INPO and the relative fractions from their 1985 study:

Loss Of Safety Function	
Actual Loss, Actual Demand	7%
Actual Loss, Potential Demand	9%
Actual Loss, Test Demand	13%
Potential Loss	18%
Severe Plant Transient	
Potential Problem, Potential Transient	2%
Actual Problem, Potential Transient	5%
Actual Problem, Actual Transient	5%
Major Economic Impact	
Actual Problem, Potential Impact	7%
Actual Problem, Actual Impact	7%
Personnel Radiation Exposure	
Actual Hazard, Potential Exposure	1%
Potential Hazard, Potential Exposure	3%
Actual Hazard, Actual Hazard	5%

Radiation Release

Actual Hazard, Potential Release	2%
Potential Hazard, Potential Release	5%

The events were assessed for their impacts and these data were also entered into the data base. The assignment of events to the preceding categories was found to be somewhat difficult since the events studied were generally minor compared to the events studied by INPO. This is discussed in detail in the next section. A listing of the events and their impacts is given in Appendix C. A description of the program and data structure is provided in Appendix D.

The group started work on a Monday morning with a presentation planned for the following Friday afternoon. This relatively short period was chosen so as to minimize the impact of this study on the normal work of the team. It also provided them an uninterrupted, dedicated time period in which to conduct the review. Controlling the time period for the reviews limited changes in evaluation criteria or other biases that might introduce variance in the results. This technique worked quite well and the group was able to meet the targeted presentation time with analysis results and recommended improvements in hand.

After the work of the group was completed, a critique was held among the members concerning the analysis methods used. In general, the group found the Root Cause Checklist to be a very effective tool in narrowing down the actual root cause(s) of an Event. Other observations included:

1. The older Events were difficult to classify below the first level due to the lack of enough detail in the EFS to make these determinations.
2. The quality of the EFS's seems to have improved over the years; that is they contain more information and a better analysis of both causes and corrective actions.
3. The INPO Severity Categories do not characterize the events in our reporting system. These are used to classify Significant Event Reports (SER) which are generally more severe than those events covered on an EFS. A different impact checklist should be generated which will provide more meaningful data for FFTF.
4. A significant period (5 to 6 hours) was spent entering the information into the database. The group felt that trained clerical help could have sped up this phase of the effort.

ANALYSIS OF THE IMPACT DATA

Note: All graphs and/or data presented for the FFTF study represent the total data from January 1985 through mid August 1988 unless otherwise specified.

The following figure shows the impact data at the first (upper) level. It gives a comparison between the FFTF and INPO (1986 study) results.

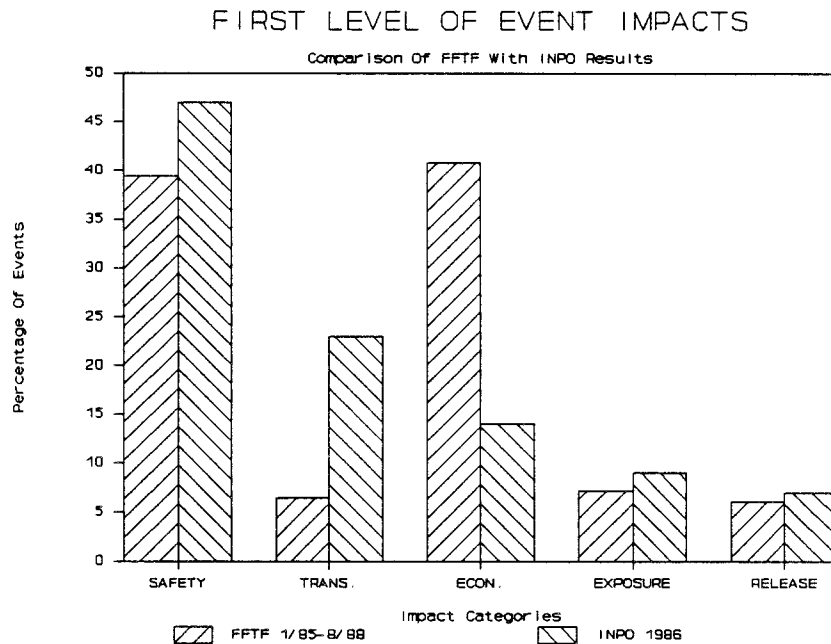


Figure 1 Comparison of FFTF and INPO Event Impacts

The comparison of the INPO SER study with the FFTF EFS study is of limited value. Although the INPO report does not define the level of event that is reported on an SER, it should be assumed that it is probably comparable to a Critique or Unusual Occurrence Report (UOR) at FFTF. Since the EFS study includes many events that are not as severe as an SER event, the fractions in any particular category are biased accordingly. For this reason, the following conclusions represent a best effort to correlate the two studies.

Very good agreement between the FFTF and INPO data exist for the Personnel Radiation Exposure and Radiation Release data. This is probably due to the use of similar criteria for events in these categories in each of the studies. There is a significant difference in the values for Severe Plant Transients, and probably reflects both the differences in the reporting criteria and a reduced number of transient related events at FFTF. Since scrams represent the only severe plant transients within the FFTF study,

they were singled out of the data. There were 12 such events which represents 4% of the total. The INPO study has a value for actual transients of 16%, nearly four times greater. The remaining transient events reviewed were generally minor and represent events which presumably would not meet the criteria for an SER.

The major areas where our data is believed to deviate from the INPO SER data in terms of severity are the Loss of Safety Function and Major Economic Impact categories. We found that we had to "force" events into these categories for a large fraction of events. In our study, we tended to use the Major Economic Impact category as the one to select when none of the others applied, and this surely biased the data somewhat. We also used the Potential Loss Of Safety Function category for events involving administrative procedure violations that are related to personnel safety such as the mishanging of tags. The INPO safety category presumably did not include these events. The category seemed to refer to plant versus personnel safety. It is not known if this is the case since the INPO reports did not give examples of the types of events in each category.

In order to better understand the relationships between the FFTF study and the INPO study, the events which did not seem to correlate with the INPO criteria were removed from the data base. Events removed included those in which only minor economic damage was involved, and those involving personnel safety problems. The remainder of the data was left untouched even though many of the other events were of minor nature. The goal was to attempt to remove the biases discussed above. This resulted in a sample size of 138 events out of the original 283. These were then plotted along with the INPO data as in the figure above with the following results:

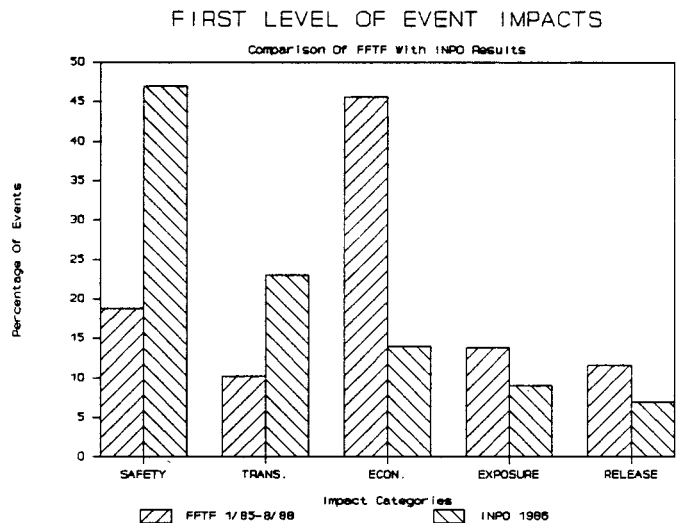


Figure 2 Comparison of Reduced FFTF Data With INPO Study

The results of filtering the FFTF data provide a better correlation with the INPO data. With a reduction in the sample size, all areas other than Loss of Safety Function increased on the order of 5%. However, the Loss of Safety Function is cut nearly in half. While this is an interesting exercise, it is not known whether this data set represents a better correlation with the INPO events. However, it can be concluded that the FFTF is being operated in line with, or better than, industry averages in the areas of plant and radiological safety.

Below, each of the five first level categories are broken down into their subcategories. Each chart is plotted with the same vertical axis height to aid comparing them. Following the figures is some discussion of the relative differences between the FFTF and INPO figures.

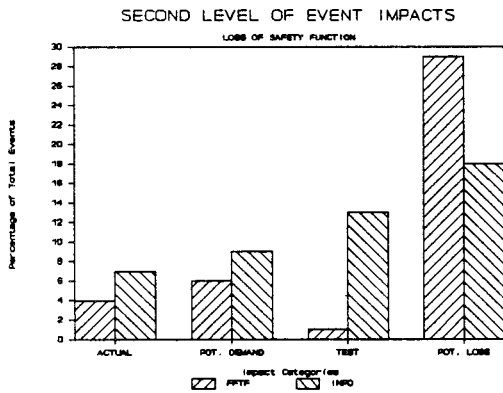


Figure 3 Loss of Safety Function Impacts

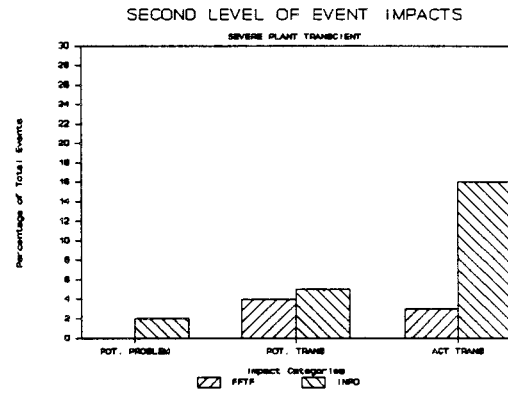


Figure 4 Severe Plant Transient Impacts

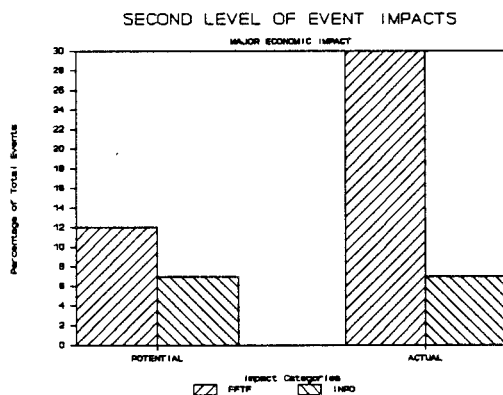


Figure 5 Major Economic Impacts

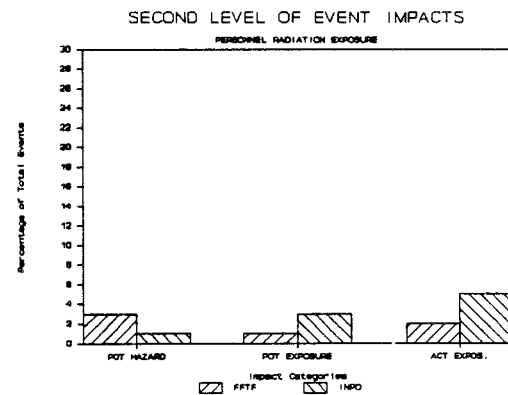


Figure 6 Personnel Radiation Exposure Impacts

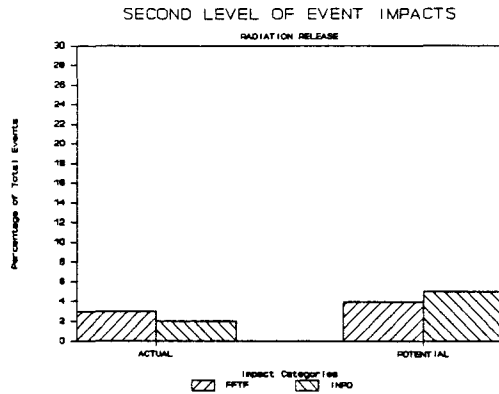


Figure 7 Radiation Release Impacts

The majority of the FFTF Loss of Safety Function category (72.3%) consisted of events with potential impact. Comparing this to 38.3% in the INPO study shows that nearly twice as many of the events studied by INPO resulted in an actual loss of safety function. As previously indicated, the potential loss of safety function category was used in our study to include those areas other than plant safety that the INPO study did not seem to address. The other categories in this group seem to address similar problems with loss of plant protection features. When these events are considered separately from the potential losses, it can be seen that the FFTF plant experienced less actual losses of safety functions than the plants covered in the INPO study.

The Severe Plant Transient category is another area that FFTF has lower numbers than the INPO values. While the number of potential transients is nearly the same, the number of actual transients is significantly below the INPO study values. The events in the FFTF study were generally not severe plant transients, but it is interesting to see how our reportable transient events compare favorably to the significant events studied by INPO.

The Major Economic Impact category was discussed briefly above. In general, an event was assigned to the potential subcategory of this area if it did not fit in any other group. Also, events were assigned to the actual economic impact category whether or not they were major economic impacts. This explains the nearly four fold increase in the actual area over the INPO values.

The group concluded that comparing Event Fact Sheet data with Significant Event Report data was of limited value. It is necessary to develop categories of impacts that better characterize the impacts of EFS's. The FFTF impact data could then be used to do historical trending of the impacts of events to determine if the events occurring are becoming more or less severe over time. Until other group studies report below the SER level, little will be gained by comparing FFTF statistics on EFS's to those of SER's.

CAUSAL FACTOR ANALYSIS

The following figure shows the distribution of the first level causes.

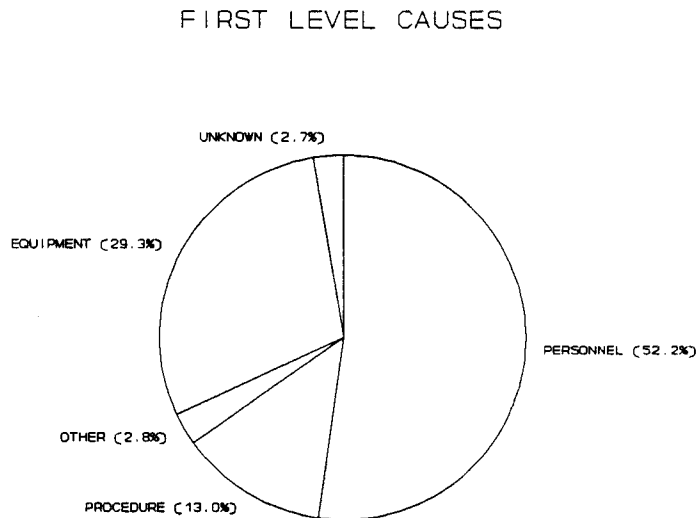


Figure 8 FFTF Event First Level Causes

A comparison of the FFTF Study to the INPO study from 1985 is given in the table below:

FFTF Causes	1985-88	INPO Causes
		1985
Personnel Error	52.2%	46%
Equipment Failure	29.3%	45%
Procedure Failure	13.0%	Note 1
Other	2.8%	Note 2
Unknown	2.7%	Note 2

Note 1: Procedure Failure was a second level cause under Personnel Error in the INPO study. It included those events that were personnel errors using procedures as well as procedure failures.

Note 2: Other and Unknown were combined as "Other" in the INPO study and equalled 9%.

These results indicated that there were no individual areas that required immediate correction to resolve a condition that was out of line with the industry's average performance. The relatively good agreement with the industry averages also lends credibility to the analysis which was done.

DETAILED ANALYSIS OF CAUSAL FACTORS

Examination of the results at the second level shows the relative distribution of the various causal factors. This data is a refinement of the first level factors and was useful in determining those areas where corrective actions would be most effective.

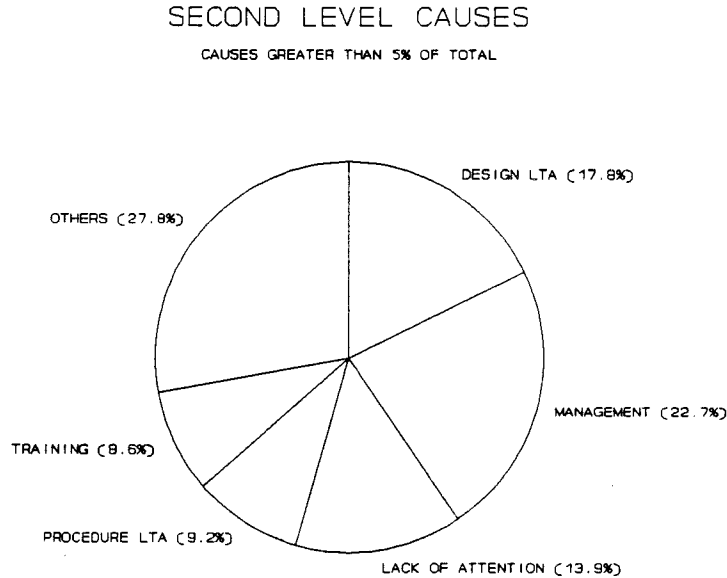


Figure 9 FTFE Event Second Level Causes

This figure shows those factors that make up the "significant few" of a Pareto analysis. The top 70% of the causal factors are the ones which will produce the greatest return when corrected. When this criteria is applied to the eighteen second level causes, we find that only five contribute to this significant group, and two of these five individually make up less than 10% of the total.

Once the major second level causes are identified, this information was used to guide the group's study of the data in more detail. The method used was to examine each of the first level categories concentrating on those areas identified as particularly significant in the breakdown shown above.

ANALYSIS OF THE PERSONNEL ERROR CATEGORY

The graph on the next page shows the distribution of the second level causes under Personnel Error:

SECOND LEVEL CAUSES

PERSONNEL RELATED CAUSE FRACTIONS

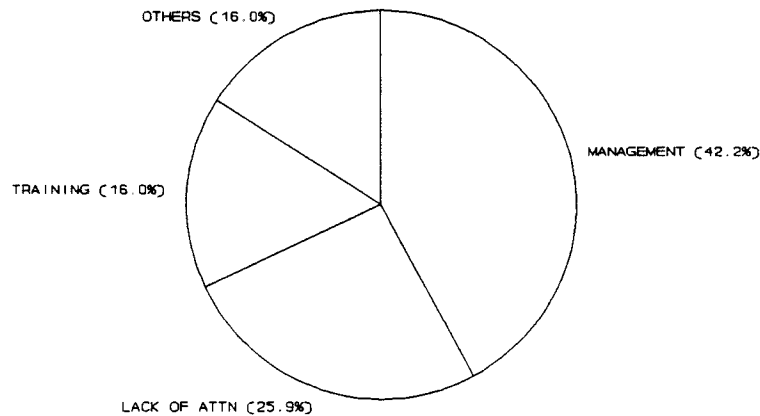


Figure 10 Second Level Causes Under Personnel Error

The items listed below are the most significant causes and their respective fractions:

Management Programs LTA ⁴	42.2%
Lack Of Attention Or Concentration	25.9%
Training LTA	16.0%

These categories are somewhat general and do not represent specific problems that can be solved. In order to understand the root causes of these deficiencies, the areas above were further analyzed at the third (root) level to determine candidates for recommended corrective actions. It is the subdivision of the individual causal factors into increasing levels of detail that are the strengths of the analysis tool used for this study. Without this level of detail, only general conclusions can be made as to the nature of the problem being solved. As the remainder of this section will show, there are distinct causal mechanisms that when corrected can make a statistically significant contribution to error reduction.

The view chosen for these third level causal factors was to plot the number of events in which a given factor contributed versus the factors themselves. A bar chart representation of this data makes it relatively straight forward to pick out those factors of greatest frequency of occurrence.

⁴ LTA is an abbreviation for "Less Than Adequate".

The following graph shows the data for the third level causes under Personnel Error in this format.

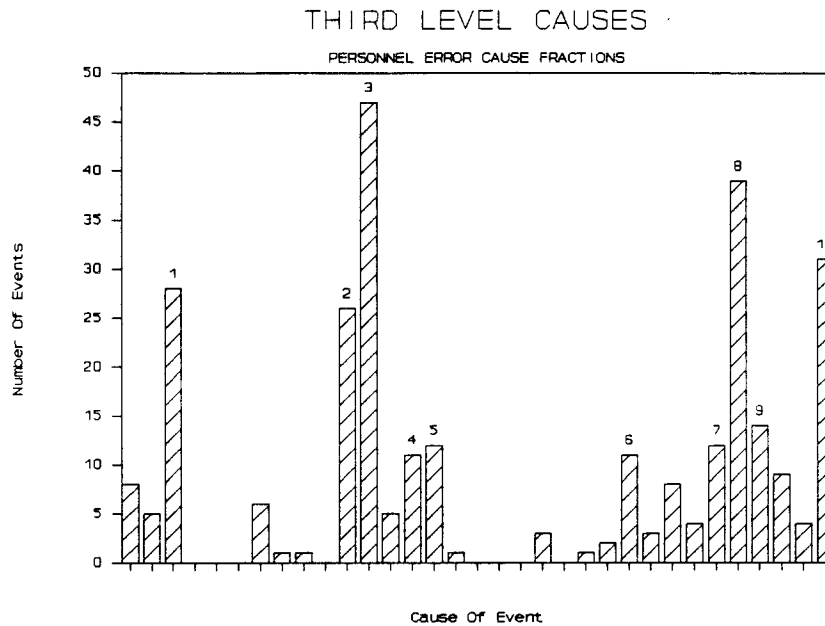


Figure 11 Third Level Causes Under Personnel Error

The numbers refer to the following causal factors which seemed to be the significant factors in this area:

- 1 - Incomplete Training
- 2 - Procedure Not Used (category added by the team)
- 3 - Preoccupation Of The Mind With Another Task
- 4 - Because Of Being Distracted
- 5 - Because Of A Differing Attitude
- 6 - Shift Turnover Incomplete
- 7 - Corrective Actions Not Implemented
- 8 - Work Practices LTA
- 9 - Planning LTA Or None
- 10 - Lack Of Management Direction

These factors fall into three categories which were identified among the significant causal factors in the second level data shown above. These are:

- Lack of Management Direction (22.7% of the total)
- Lack of Attention or Concentration (13.9% of the total)
- Training LTA (8.6% of the total)

The events in which incomplete training was an issue were primarily due to lack of understanding on the part of personnel outside of Operations of the various administrative requirements

for conducting work in the plant.

The other two factors seemed to be interrelated to some extent. The group discussed the interplay of these two and determined that careful consideration must be given to prevent the correction for one problem becoming an aggravation for the other. When the various events in these categories were studied in detail, it was determined that the appropriate time for management direction was prior to the job starting and at its completion. When work is in progress, distractions such as schedule changes, frequent status checks, and the like should be minimized. These discussions resulted in recommendations associated with control of the work pace, pre-job briefings, and times of planning meetings held during the normal work day. The recommendations are discussed in detail in a later section of the report.

ANALYSIS OF THE PROCEDURE FAILURE CATEGORY

The graph below shows the second level causes in the Procedure Failure area:

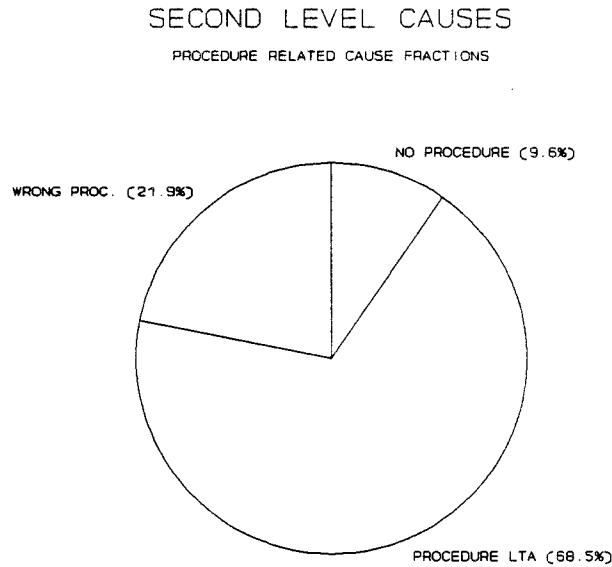


Figure 12 Second Level Causes Under Procedure Failure

The Procedure Failure area made up 13% of the first level causes and Procedure LTA was one of the top five second level causes making up 9.2% of the total. In this view we can see that Procedure LTA makes up nearly 70% of the procedure related causes. To gain a better understanding of the factors making up the Less Than Adequate Procedures group, the third level causes were studied

using the following frequency distribution bar chart:

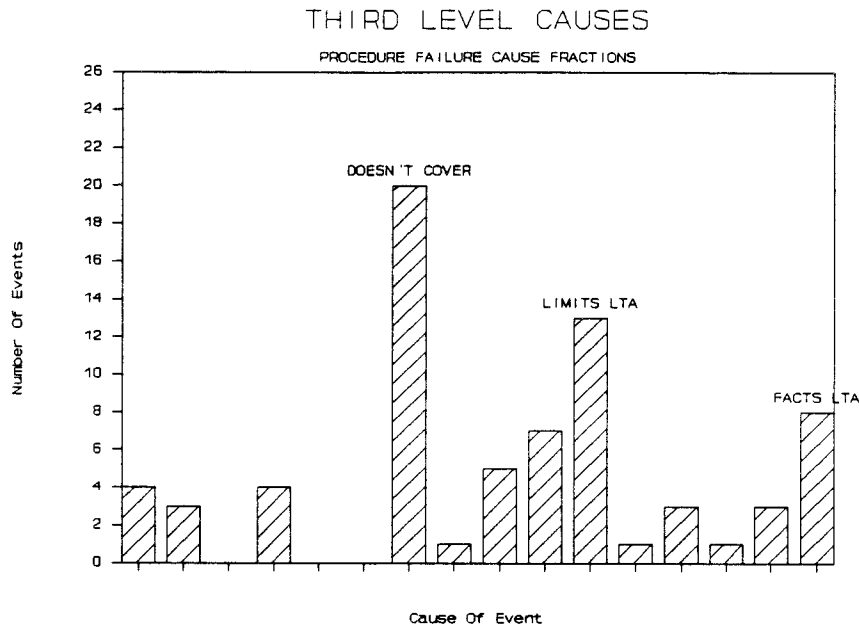


Figure 13 Third Level Causes Under Procedure Failure

The significant problem areas in this category appeared to be:

- Procedure Did Not Cover The Situation
- Procedure Limits LTA
- Procedure Facts/Information Was Incorrect

See the discussion below for a correlation of these factors with those in the Equipment Failure category.

ANALYSIS OF THE EQUIPMENT FAILURE CATEGORY

Equipment Failure contains the remaining second level causal factor which was in the top five second level causes: Design LTA. As a result, this area also warranted further study in order to determine the root causes of these design errors.

There are five second level categories under Equipment Failure, but two of these together make up over 70% of the total in this area: Design LTA and Material. This is shown on the graph on the following page.

SECOND LEVEL CAUSES
EQUIPMENT RELATED CAUSE FRACTIONS

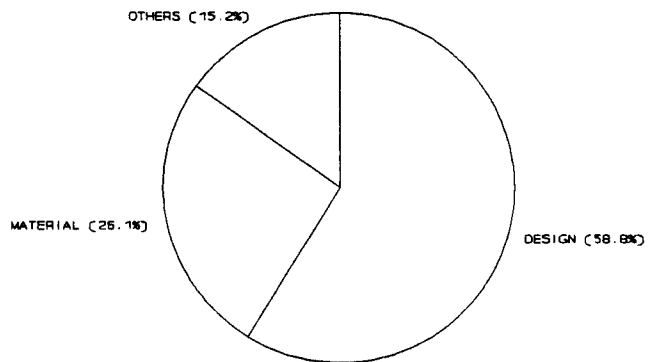


Figure 14 Second Level Causes Under Equipment Failure

Again it was helpful to view the causes in this area at the third level in order to better understand the root causes for the design errors. This breakdown in bar chart form is shown below:

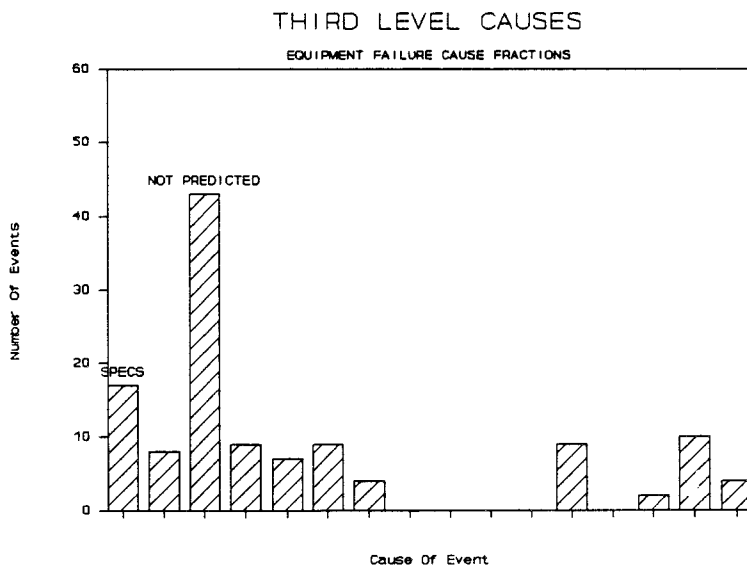


Figure 15 Third Level Causes Under Equipment Failure

Within this category, two major causes stood out:

Specifications LTA
Problem Was Not Anticipated

As was mentioned above, there seems to be a correlation with these factors and those in the Procedure Failure area. It stands to reason that if the design errors are typically ones of lack of anticipation of a particular failure, then it follows that the procedure(s) will lack instructions on how to deal with these conditions. It was no surprise to find that we had such a high fraction of events in this category since a large fraction of our activities fall into the research and development category. Bill Schuck of Engineering recounted some of his experience with the Bettis design review process and how it differed from the methods employed at FFTF. The recommendations for these problems centered around further study of the design review and configuration control processes at FFTF.

ANALYSIS OF THE "OTHER" CATEGORY

Using a strict Pareto Analysis, it would be unnecessary to analyze the remaining categories: Other and Unknown. However, for completeness, the distribution of causes at the second level within these categories is shown below:

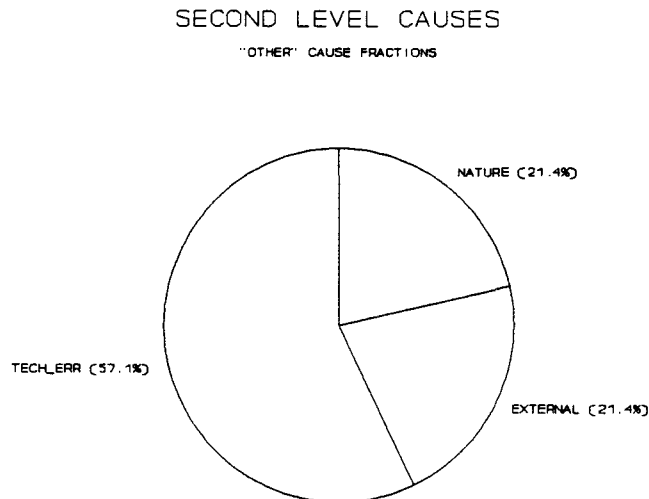


Figure 16 Second Level Causes Under "Other"

The majority of the events in this group fell into the Technical Error category. As is discussed in the Equipment Failure section above, the nature of the research and development activities at FFTF make us vulnerable to these kinds of errors.

DISTRIBUTION OF THE CAUSAL FACTORS WITH TIME

The assumption of the above analysis was that by studying a large number of events the group would be able to determine those areas which were significant contributors to the error rate at FFTF. One final step in validating this assumption was to determine if each year had a fairly consistent fractional distribution of the causal factors. The first level of factors was chosen as the group to use for this determination.

The events were separated by year and each of the major (first level) error categories plotted on a bar chart so their time behavior could be observed. The following graph shows the distribution of these factors with respect to time:

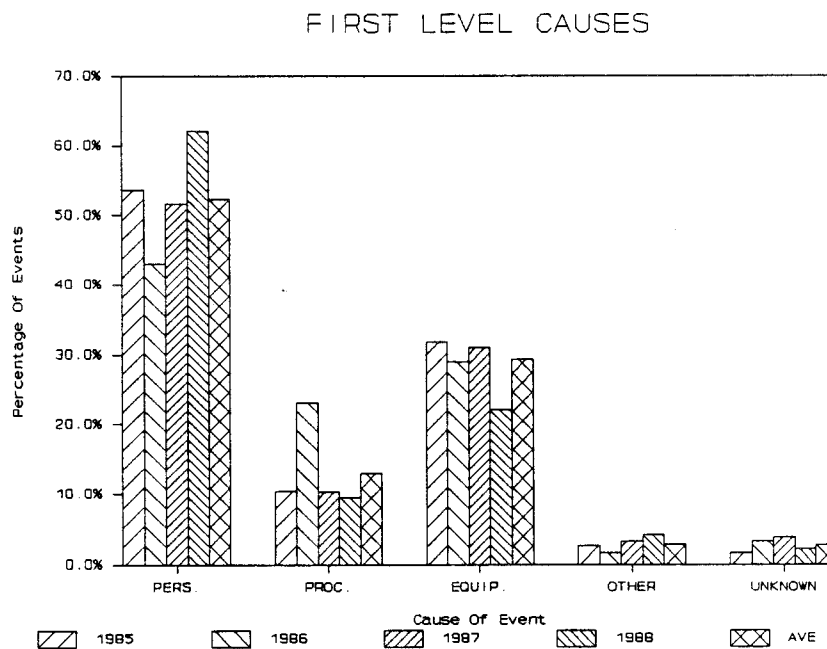


Figure 17 First Level Causal Factors By Year

Of particular interest was the Personnel Error category, since this was the largest fractional causal factor. The data shows that this category was nearly equal to the average of 50% for 1985 and 1987. It is interesting to note that there is nearly a 10% annual increase in the Personnel Error category since 1986. The 1986 value was 10% below average and the 1988 value is 10% above the average for the portion of the year studied. The value of the increase is not particularly noteworthy, but the steadily increasing trend deserves some careful attention.

The trend shown differs from that reported by the trend program used at FFTF. This program has shown some increase in 1988 personnel caused events, but within the control bands established

by that program. Therefore the trend shown on the figure above is in relative agreement with that shown by the system used for plant process control, but the magnitude of the increase is not nearly as large as the current study would indicate. A possible explanation for this can be arrived at by comparing the evaluation methods used in this study with those used in the preparation of an EFS.

The method for assigning root causes to the events studied differed from the method normally used in two important ways. First, the root cause checklist employed allowed the reviewer to explore the causes for the event in much greater detail than the EFS form provides. The listing of the various factors served as a reminder of aspects to consider that might otherwise be overlooked. In addition, the reviews conducted here were done in a very critical fashion. There were no penalties for selecting Personnel Error as a causal factor as there are when the EFS is written. Therefore this area was selected whenever it was a factor, not just when it was the primary factor. This very critical analysis does not cause the FTF data to exceed industry averages, and in fact shows that the plant has an excellent safety record. Therefore, the citing of an increasing trend in Personnel Error events must be viewed in the context of the review conducted and the objective nature of its techniques. Many of the following recommendations are directed at the significant contributors in this area and many of them are simple, inexpensive, and potentially effective solutions to many of the recurring personnel errors that have been made over the last three years.

RECOMMENDATIONS TO THE FTF PLANT MANAGER

The following recommendations were developed by the team and presented to the FTF Plant Manager and his staff. The recommendations resulted from careful study of the major causal factors observed in the study results. The group was careful to look at those factors which constituted significant fractions of the causal factors and not to try to determine a correction for each factor. This use of the Pareto Principle which is generally applied in Value Analysis and Quality Circle methods allowed the group to concentrate on the items which would provide the greatest return for corrective effort expended. This technique was highly endorsed by the Plant Manager and his staff. The recommendations are listed below in the functional groups to which each belongs.

TRAINING

The study indicated that the training deficiency was not a lack of training, but instead incomplete training. Much of this concerns the training of support personnel in the methods of performing work in the plant. Most of the errors noted in which

training was incomplete involved personnel outside the Operations department who were unfamiliar with the administrative procedures used in the plant. These procedures are written and maintained by the Operations department and the people in this group are thoroughly trained and familiar with their use. Other groups such as Engineering and Maintenance have received training, but the training needs improvement in order to prevent errors of the type observed in this study. The group made the following recommendations to correct the deficiencies in this area:

1. Continue to develop the Power Operator training program, stressing the Administrative Procedures and controls.
2. Continue review of these topics in Person In Charge (PIC) Training.
3. Develop such a program for the crafts.
4. Evaluate adopting a form of the INPO Good Practice OP-203 qualification program for participating in tagging evolutions.

WORK DISTRACTIONS AND PLANNING

As has been previously discussed, there were some relationships seen among the causal factors that required them to be considered together to prevent the solution for one problem from aggravating another. Particular attention was given to the high incidence of events where management direction was lacking. Specifically this was in the planning and scheduling areas. At the same time it was noted that many events were contributed to by distracting influences. After discussing these factors, the group determined that the times that extra management direction was appropriate were before the job starts and after the job finishes. By starting work with clear direction, expectations, and the proper equipment to do the job, its chances of success are heightened. At the completion of the work it is appropriate for supervision to check that all went as was planned, that any lessons learned would be included in the next performance, and that all completion actions had been performed. During the job such things as excessive requests for status, changes in direction, and other distractions should be minimized.

In addition, the pace of activities was seen as a significant cause of errors. Current work planning practices call for the majority of the work to be conducted on dayshift and therefore the activity level is greatest during this eight hour portion of the day and significantly less during the remaining sixteen hours. Some leveling of the workload was seen as a possible solution. The pace is also much higher during plant outages than during operating periods, but little could be found to correct this. The briefings which have been conducted in the past by plant management was determined to be an effective method for addressing the need for error-free work in preference to rapid, but flawed activities. The group provided the following recommendations in this area:

1. Evaluate having the Plan Of The Day (POD) Meeting prior to 0730 to limit the change of directions due to priority shifts that now occur at 0900 or at 1030 on Friday.
2. Increase the supervisor's use of pre-job briefings by:
 - a. Put a "Pre-job Brief Required (Yes/No)" on W-2's, SC/FS/etc Cover Sheets, PMP/ICRS sheets.
 - b. Include the use of pre-job briefings in PIC Training.
3. Evaluate the "work load leveling" idea of placing crafts and engineers on shift to spread the work load over the 24 hour period as compared with putting a vast majority in the 8 hour dayshift.
4. Continue to place emphasis on controlling the work pace using meetings led by senior managers. Some of this currently occurs and Plant Manager participation is recommended. The dissemination of the results of this task group would be an excellent tool for the Plant Manager to use.

MANAGEMENT DIRECTION AND WORK PRACTICES

Another area under Management Direction needing emphasis was that of Work Practices LTA. A wide variety of events and participating organizations were included under this heading. The events ranged from repeated failures of a fire pump to failure to update load test records for lifting equipment. Many of the events could have been prevented by a more professional, dedicated approach to work performance. Others required follow through with actions which had been assigned from a previous event or which had been determined to be necessary from a near miss. These are difficult issues to address, but the group provided the following recommendations:

1. Continue the Plant Manager's goal of a culture change in which commitment dates are consistently met.
2. Evaluate creating a commitment tracking system.
3. Consider the development of a Professional Code in all organizations.

DESIGN

The nature of the work done at FFTF causes design to be a significant portion of the Plant Engineering work load. While not every event where design errors were noted involved obvious oversights, many could have been caught with the proper second check of the design. Typically, the difficult and major design jobs receive a great deal of oversight, but the "simple" jobs do not. The solution is not in requiring additional signatures on modifications and procedure changes, but in the increased use of the synergy developed in a team review. The Bettis experiences related by Bill Schuck involved this dimension. An additional factor is the incorporation of lessons learned from previous design

efforts into the ongoing designs. The use of teams reviewing designs in a particular discipline would build a knowledge and experience base and provide the forum for incorporating these lessons. This is a complex problem requiring further study, hence the recommendations in this area are ones involving evaluation of our current practices.

1. Critically evaluate the current procedure review process.
2. Further study is required to better understand the dynamics of our change causing a need for procedure changes and training.
3. Evaluate the INPO Good Practices in this area to develop further recommendations.

HUMAN PERFORMANCE EVALUATION

Finally, the INPO suggested method for correcting event causing factors is the use of a Human Performance Evaluation System (HPES). The committee highly recommends establishing a system of this kind at FFTF. We also saw improvements which could be made to the EFS itself which would improve the quality of the report and aid in determining the root cause(s) to allow appropriate corrective action to be defined. The recommendations in this area follow:

1. Establish a Human Performance Evaluation System complete with a designated coordinator.
2. Improve Event Reporting through:
 - a. Use of the Root Cause fault tree in determining the event cause at the time of the event.
 - b. Development of a two part Event Fact Sheet.
 - i. Part one would be submitted within 24 hours to meet the event reporting criteria.
 - * ii. Part two would contain a detailed analysis (without being of the level of a Critique) including lessons learned from the event.
 - c. Including the discovery time and the initiation time of the event when they are different.
 - * d. Strengthening the lessons learned and the publication of the lessons.

* Denotes participation by the HPES Coordinator.

In addition to the recommendations above, other ideas were generated by the group which did not directly relate to error prevention, but instead contribute to the general improvement of work quality.

SUMMARY AND CONCLUSIONS

In general, the distributions of the causal factors were found to closely follow the industry averages. The impacts data indicated that we generally report events of a level of severity below that of the INPO studies. Therefore it is concluded that the recommendations for corrective action are ones to improve the overall quality of operations and not to correct significant operational deficiencies. Any questions or comments concerning the content of this report should be directed to the author.

ACKNOWLEDGEMENTS

Mr. Emil Leitz of the Defense Reactors Division of Westinghouse Hanford Company provided the Root Cause Checklist which was used by the group. This is an excellent tool and his help was very much appreciated.

The task force conducting the review consisted of the author of this report as the chairman and the following members of various organizations at the FFTF Plant:

M. P. Baka	Operations Crew D
J. E. Baker	Operations Support
R. L. Dugwyler	Operations Crew C
J. M. LeMarr	Operations Crew E
A. E. Niehaus	Operations Crew B
W. J. Schuck	FFTF Engineering
W. H. Taylor	EDS Operations
J. R. Vincent	Refueling and Maintenance Planning

Their efforts in conducting the reviews, developing the recommendations, and delivering the presentation to the Plant Manager were very instrumental to the success of this project.

Appendix A: Root Cause Analysis Checklist

In each Causal Factor area, there are a maximum of three levels below a given major cause. Each successive level becomes more specific and is indented further to the right of the page for distinguishing the level separations.

The following are the Causal Factors for: PERSONNEL ERROR:

Training LTA

- Task Analysis LTA
- Task Infrequently Performed
- Incomplete Training
- Facilities LTA
- Repetition LTA
- Testing LTA
- Continuing Training LTA

Procedure Not Followed

- Because An Uncontrolled Procedure Was Used
- Because A Checklist Was Misused
- Because A Wrong Version Was Used
- The Procedure Was Intentionally Not Used

Lack Of Attention Or Concentration

- Preoccupation Of The Mind With Another Task
- Because Of Being Tired
- Because Of Being Distracted
- Because Of A Differing Attitude

Misunderstood Communication

- Standard Terminology Not Used
- Repeat Back Not Performed
- Message Too Long For Verbal
- Noisy Environment
- Message Not Complete

No Communication Or Not Timely

- No Means Of Communication Available
- Events Happened Too Fast
- Time Constraints Inhibiting Taking Time To Communicate
- Shift Turnover Incomplete

Management Programs LTA

- Drawings Not Controlled
- Drawings Not Updated
- Personnel Accountability Was Not Defined
- Corrective Actions Not Implemented
- Work Practices LTA
- Planning LTA Or None
- Scheduling LTA Or None
- Planning And Scheduling LTA
- Lack Of Management Direction

Appendix A: Root Cause Analysis Checklist

The following are the Causal Factors for: PROCEDURAL FAILURE:

- Procedure Nonexistent
 - Not Thought To Be Required
 - Not Available
 - Not Convenient To Use
- Procedure Incomplete/LTA
 - Format Confusing
 - More Than One Action Per Step
 - No Checkoff Space Provided
 - Did Not Cover Situation
 - Graphics LTA
 - Equipment Identification LTA
 - Instructions Ambiguous
 - Limits LTA
 - Multiple Area References
- Procedure Incorrect
 - Data/Computations Wrong
 - Typographical Error
 - Sequence Of Steps Was Wrong
 - Facts/Information Was Incorrect

The following are the Causal Factors for: EQUIPMENT FAILURE:

- Design LTA
 - Specifications LTA
 - Design Did Not Meet Specifications
 - Problem Was Not Anticipated
 - Design Review Process Failed To Test Design Error
 - Labeling LTA
 - Ergonomics Poor
 - Instrument Displays Or Controls LTA
 - Loss Of Monitoring Alertness
 - Different Units At Multiple Reactor Sites
 - Bad Lighting
 - Noisy Environment
- Installation Error
 - Not Installed Per Design
 - Temporary Device Not Removed
- Manufacturing Error
 - Equipment Not Made Per Design
- Maintenance Deficiency
 - PM Did Not Exist
 - PM Was Inadequate
- Material

Appendix A: Root Cause Analysis Checklist

The following are the Causal Factors for: OTHER

- Natural Phenomenon
- Sabotage
- External
- Technical Error

There are no Causal Factors under: UNKNOWN

Appendix B: Listing Of The Event Causes

85-001: TV-4 OXYGEN GREATER THAN 5%		01/05/85
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Other	Technical Error	
85-002: DHX DAMPERS CLOSED /E-12		01/05/84
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-003: DHX DAMPERS CLOSED /E-5		01/09/85
Equipment Failure	Material	
85-004: PIN SLIPPED OFF RAIL		01-09-85
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-005: CTMT INTEGRITY LOST DURING SC-27-6		01/09/85
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
85-006: CAPS COMPRESSOR RUN WITH DISCHARGE SHUT		01/14/85
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Personnel Error	Management Programs LTA	Work Practices LTA
Procedural Failure	Procedure Incomplete/LTA	Equipment Identification LTA
85-007: WORK PACKAGE NOT RELEASED		01-18-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-008: LOSS OF COOLING TO THE LIQUID RHEOSTATS		01/18/85
Personnel Error	Management Programs LTA	Planning LTA Or None
Procedural Failure	Procedure Incorrect	Facts/Information Was Incorrect
85-009: 4 TON CRANE SNAGGED MSM		01-24-85
Equipment Failure	Material	
85-010: DECAY HEAT VERIFICATION ON CLEM		01/26/85
Personnel Error	Training LTA	Task Analysis LTA
Personnel Error	Management Programs LTA	Planning LTA Or None
Procedural Failure	Procedure Nonexistent	Not Thought To Be Required
85-011: TAGOUT VIOLATED		01/31/85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
85-012: PIECES OF TUBING FOUND IN P-98		01/30/85
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Material	
85-013: CTMT INTEGRITY LOST DURING SC-27-6		02/01/85
Procedural Failure	Procedure Incomplete/LTA	Format Confusing
Procedural Failure	Procedure Incorrect	Sequence Of Steps Was Wrong
85-014: WATER LEAKS IN FSF ROOM 918		02/05/85
Personnel Error	Management Programs LTA	Scheduling LTA Or None
Other	Natural Phenomenon	
85-015: WATER LINE IN G-3 FROZE		02/08/85
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-016: IVHM EXCESSIVE FORCE ON INSERTION		02/12/85
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	

Appendix B: Listing Of The Event Causes

85-017: T-3 CASK BINDERS DAMAGED		02/18/85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
85-018: EQAL SEISMIC RESTRAINTS NOT SET		02/21/85
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-019: BROKEN FORCE BOOM		02-19-85
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
85-020: HIGH RADIATION AT CLS		02/26/85
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Personnel Error	No Communication Or Not Timely	Time Constraint Inhibit Taking Time To Communicate
85-021: ARCING OF BLTC CABLE (EVENT 1)		03/02/85
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-022: HIGHER THAN NORMAL RADIOACTIVE GAS LEVELS		03-01-85
Unknown		
85-023: ID-69 INTERFERENCE BETWEEN CCP		03-01-85
Equipment Failure	Design LTA	Design Review Process Failed To Test Design Error
85-024: 4 TON SNAGGING MSM		03-04-85
Equipment Failure	Installation Error	Not Installed Per Design
85-025: IDS PLUG O-RING MISSING		03/07/85
Unknown		
85-026: FTP PLUG O-RINGS MISSING		03/08/85
Unknown		
85-027: 1 TON CRANE CONNECTOR BENT		03-11-85
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
85-028: CLEM STRUCK POLAR CRANE		03/17/85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-029: MISSED SURVEILLANCE FOLLOWING SC-27-4 ON EQAL		03/20/85
Personnel Error	Management Programs LTA	Scheduling LTA Or None
Personnel Error	Management Programs LTA	Lack Of Management Direction
85-030: RX SCRAM DURING CM ON CRDM CONTROLLER		03/26/85
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
85-031: OVERHEATING RTCB-7		04-03-85
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
85-032: DRAIN VALVE NOT SEATED PER SC-51-10		04/08/85
Personnel Error	Training LTA	Incomplete Training
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
Equipment Failure	Design LTA	Labeling LTA
Equipment Failure	Design LTA	Ergonomics Poor
85-033: ARCING OF BLTC CABLE (EVENT 2)		04/08/85
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Problem Was Not Anticipated

Appendix B: Listing Of The Event Causes

85-034: LOSS OF DC TO D-15		04/09/85
Equipment Failure	Design LTA	Design Did Not Meet Specifications
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	
85-035: CLEM VEIWPOR WINDOW DROPPED		04-18-85
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-036: WMM BRAKE ACTUATOR ROD SEPARATED		04-19-85
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-037: TRANSFORMER GROUNDED		04/20/85
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Maintenance Deficiency	PM Did Not Exist
85-038: MANUAL RX SCRAM DUE TO DNM COUNTS		04/22/85
Equipment Failure	Material	
85-039: TRITIUM IN E-208		04/24/85
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-040: GASKET MATERIAL FOUND ON RTCB-7		04-26-85
Procedural Failure	Procedure Incomplete/LTA	Equipment Identification LTA
85-041: LOW O2 IN CELL 209		05/02/85
Personnel Error	Management Programs LTA	Planning LTA Or None
85-041: LOW O2 IN CELL 209		05/02/85
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	
85-042: PERSONNEL INJURY DUE TO ACID SPRAY		05/05/85
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Material	
85-043: C. I. TECH SPEC WITH POLAR CRANE		05/07/85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Lack Of Management Direction
85-044: OVER PRESSURIZATION OF CELL 569		5-14-85
Personnel Error	Training LTA	Task Infrequently Performed
Procedural Failure	Procedure Incomplete/LTA	Equipment Identification LTA
Equipment Failure	Design LTA	Labeling LTA
Other	Natural Phenomenon	
Other	External	
Other	Technical Error	
85-045: MASF 60 TON CRANE CONTACTED SSMC		05-17-85
Personnel Error	Training LTA	Task Analysis LTA
85-046: PERSONAL CONTAMINATION /CLEM		05/22/85
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-047: FSF DEPRESSURIZATION		05/28/85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Personnel Error	Management Programs LTA	Personnel Accountability Was Not Defined
85-048: BAD TAG-OUT ON E-143		5-29-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Tired

Appendix B: Listing Of The Event Causes

85-049: RX SCRAM DUE TO LOEP		6-5-85
Personnel Error	Training LTA	Task Infrequently Performed
Personnel Error	Training LTA	Incomplete Training
85-050: TRIP OF RSS COMPARITORS		06/09/85
Equipment Failure	Material	
85-051: CLEM CATCHES CABLE MATING TO IEM CELL		6-13-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Equipment Failure	Maintenance Deficiency	PM Was Inadequate
85-052: BLTC RUNS OVER CABLE		6-13-85
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Tired
Equipment Failure	Design LTA	Ergonomics Poor
85-053: CELL 548 CRANE FOULED		06-18-85
Equipment Failure	Material	
85-054: HIGH GASEOUS ACTIVITY IN CELL 481		6-21-85
Equipment Failure	Material	
85-056: SERF CASK CLOSURE VALVE DRIFTS CLOSED		6-25-85
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Design LTA	Design Did Not Meet Specifications
85-057: IVHM PAWL BREAKS		7-1-85
Personnel Error	Management Programs LTA	Lack Of Management Direction
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Design LTA	Design Did Not Meet Specifications
Equipment Failure	Material	
85-058: CLEM CABLE CATCHES DURING MOVE		7-3-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Equipment Failure	Design LTA	Design Review Process Failed To Test Design Error
Equipment Failure	Design LTA	Ergonomics Poor
85-059: CLEM LADDER DAMAGED DURING MOVE		7-6-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Equipment Failure	Design LTA	Design Review Process Failed To Test Design Error
85-060: WORK PACKAGE NOT RELEASED		07-11-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-061: BEARING REPLACEMENT		07/12-85
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Personnel Error	Management Programs LTA	Work Practices LTA
85-062: SODIUM SPILL AT THE CLEM DURING FILTER CHANGE		7-17-85
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Planning LTA Or None
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
85-063: PERSONNEL CONTAMINATION DURING REFUELING		7-30-85
Personnel Error	Management Programs LTA	Work Practices LTA
85-064: IMPROPER MELT-OUT OF P-930		8-3-85
Personnel Error	Management Programs LTA	Drawings Not Controlled
Personnel Error	Management Programs LTA	Drawings Not Updated
Personnel Error	Management Programs LTA	Work Practices LTA

Appendix B: Listing Of The Event Causes

85-065: RX COVER GAS PRESSURE GOES NEGATIVE DURING DRILL		8-4-85
Personnel Error	Training LTA	Task Analysis LTA
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Training LTA	Continuing Training LTA
85-066: IMPROPER ADJUSTMENT OF LLM'S		8-5-85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Training LTA	Continuing Training LTA
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
85-067: NEGATIVE RX COVER GAS PRESSURE EXCEEDS LIMITS		8-7-85
Personnel Error	Training LTA	Task Analysis LTA
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Training LTA	Continuing Training LTA
85-068: RACKING-IN PRI PUMP BKR. IN MODE 4		7-12-85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Planning LTA Or None
Personnel Error	Management Programs LTA	Scheduling LTA Or None
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
85-070: FAILED TACHOMETER GENERATOR ON D-15		08/27/85
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
Equipment Failure	Maintenance Deficiency	PM Was Inadequate
85-071: TAGOUT HUNG WRONG		08-30-85
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
85-072: IMPROPER TAG-OUT OF SAN WATER SYSTEM		8-30-85
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Design LTA	Ergonomics Poor
85-073: DROP OF T-3 SHIELD PLUG		9-6-85
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
85-074: LOSS OF DHX CONTROL VARIABLES		9-9-85
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Planning LTA Or None
Equipment Failure	Design LTA	Problem Was Not Anticipated
85-075: ID 41 LENGTH ARM BENT		09-11-85
Equipment Failure	Design LTA	Design Review Process Failed To Test Design Error
85-076: ELECTRICAL SHOCK / FSF		09/13/85
Personnel Error	Training LTA	Task Analysis LTA
85-076: ELECTRICAL SHOCK / FSF		09/13/85
Personnel Error	Management Programs LTA	Planning And Scheduling LTA
85-077: UNRELEASED WORK /HALON		09/18/85
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Misunderstood Communication	Message Not Complete
Personnel Error	Management Programs LTA	Planning LTA Or None

Appendix B: Listing Of The Event Causes

85-078: RX POWER INCREASE >3% IN 15 MIN. Personnel Error Personnel Error Personnel Error Personnel Error	Training LTA Lack Of Attention Or Concentration Lack Of Attention Or Concentration Management Programs LTA	10-2-85 Incomplete Training Preoccupation Of The Mind With Another Task Because Of Being Distracted Lack Of Management Direction
85-079: E-7 FAN OVER SPEED Equipment Failure Equipment Failure	Design LTA Material	10-11-85 Problem Was Not Anticipated
85-080: MOTA OVERTEMP Personnel Error Personnel Error Equipment Failure Equipment Failure Equipment Failure	Lack Of Attention Or Concentration Management Programs LTA Design LTA Design LTA Design LTA	10-25-85 Preoccupation Of The Mind With Another Task Lack Of Management Direction Problem Was Not Anticipated Design Review Process Failed To Test Design Error Labeling LTA
85-081: CHEMICAL BURNS Personnel Error	Management Programs LTA	10/30/85 Work Practices LTA
85-083: HIGH RAD IN HEAD COMPT. DUE TO MOTA MANIFOLD Personnel Error Personnel Error Personnel Error Equipment Failure	No Communication Or Not Timely Management Programs LTA Management Programs LTA Design LTA	11-3-85 Shift Turnover Incomplete Planning LTA Or None Scheduling LTA Or None Problem Was Not Anticipated
85-084: RAIL TRANSPORTER PENDANT DAMAGED BY BLTC Personnel Error Personnel Error	Procedure Not Followed Lack Of Attention Or Concentration	11-4-85 The Procedure Was Intentionally Not Used Preoccupation Of The Mind With Another Task
85-085: RX SCRAM DUE TO LOOP#3 FANS COAST DOWN Equipment Failure	Material	11-12-85
85-086: CONTAMINATION ON CRAFTSMAN'S CLOTHING Personnel Error Personnel Error	Procedure Not Followed Management Programs LTA	11/13/85 The Procedure Was Intentionally Not Used Work Practices LTA
85-087: E-7 FAN SPEED CONTROL FAILURE Equipment Failure	Material	11-21-85
85-088: LOEP SCRAM DUE TO S-7 Equipment Failure Equipment Failure Equipment Failure Equipment Failure	Design LTA Maintenance Deficiency Maintenance Deficiency Material	11-22-85 Problem Was Not Anticipated PM Did Not Exist PM Was Inadequate
85-089: ELECTRICAL SHORT ON TRANSFORMER C5804P Equipment Failure	Design LTA	11/27/85 Design Review Process Failed To Test Design Error
85-091: FORCE BOOM CLAMP DROPPED Personnel Error Equipment Failure	Management Programs LTA Design LTA	12-09-85 Work Practices LTA Design Review Process Failed To Test Design Error
85-092: ID 41 FAILURE Equipment Failure	Design LTA	12-11-85 Design Review Process Failed To Test Design Error
85-093: IMPROPER INSTALLATION OF F.V. AT FSF Personnel Error Personnel Error Procedural Failure	Procedure Not Followed No Communication Or Not Timely Procedure Incomplete/LTA	12-20-85 The Procedure Was Intentionally Not Used Shift Turnover Incomplete Did Not Cover Situation

Appendix B: Listing Of The Event Causes

86-001: IVHM #3 PAWL MISPOSITIONED		01-06-86
Personnel Error	Management Programs LTA	Lack Of Management Direction
Equipment Failure	Installation Error	Not Installed Per Design
86-002: CONTROL RODS IMPROPERLY RECONNECTED		01-19-86
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	
86-003: N-23 CARRIER GAS CONTAMINATED WITH AIR		02-06-86
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Other	External	
86-004: OPERATIONAL HEATUP RATE EXCEEDED		02/21/86
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
86-005: HIGH O2 IN TV-4 DUE TO BREACH OF TV BOUNDARY		03/04/86
Personnel Error	Training LTA	Continuing Training LTA
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Procedural Failure	Procedure Incorrect	Facts/Information Was Incorrect
Equipment Failure	Design LTA	Labeling LTA
86-006: FLOOR VALVE SEAL ROLLED		03-05-86
Personnel Error	Training LTA	Task Infrequently Performed
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
Equipment Failure	Manufacturing Error	Equipment Not Made Per Design
86-007: EXTENDED ALT PREF POWER OUTAGE		03-13-86
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Personnel Error	Management Programs LTA	Personnel Accountability Was Not Defined
Personnel Error	Management Programs LTA	Work Practices LTA
86-008: BLTC TRANSPORTER CABLE DAMAGED		03-13-86
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Management Programs LTA	Drawings Not Updated
Equipment Failure	Installation Error	Not Installed Per Design
86-009: G-3 INOPERABLE DUE TO CM ON ANNUNCIATOR SYSTEM		03/17/86
Personnel Error	Management Programs LTA	Planning LTA Or None
86-010: CONTAMINATION ON SHOE FROM RCB		03/25/86
Unknown		
86-011: SURFACE CONTAMINATION FOUND AFTER BLTC UNMATE		04-05-86
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Equipment Failure	Design LTA	Problem Was Not Anticipated
86-012: BENT FORCE BOOM CLAMP		04-10-86
Equipment Failure	Design LTA	Problem Was Not Anticipated
86-013: FIRE IN B-41		04-14-86
Personnel Error	Training LTA	Incomplete Training
Equipment Failure	Design LTA	Ergonomics Poor
Equipment Failure	Material	
86-014: RX SCRAM DUE TO LOW LOOP PRI FLOW LOOP 2		04/25/86
Procedural Failure	Procedure Incorrect	Facts/Information Was Incorrect
86-015: INCORRECT VALUES RECORDED FOR P-3 DISCH PRESS		04/26/86
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Tired
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Procedural Failure	Procedure Incorrect	Typographical Error

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86-016: INAPPROPRIATE USE OF A DANGER TAG		05/06/86
Personnel Error	Training LTA	Task Infrequently Performed
Personnel Error	Training LTA	Incomplete Training
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
86-017: B-190 FAULT		05-08-86
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Personnel Error	Management Programs LTA	Lack Of Management Direction
86-018: CHILLER PRESSURIZED PRIOR TO BEGINNING WORK		05/05/86
Procedural Failure	Procedure Incomplete/LTA	Multiple Area References
Equipment Failure	Material	
86-019: TWO OF THREE LLFM DETECTORS INOPERABLE		05/16/86
Equipment Failure	Design LTA	Problem Was Not Anticipated
86-020: INCORRECT F-FACTOR USED FOR LLFM CALIBRATION		05/20/86
Unknown		
86-021: ALL 3 DNM PREAMPS FOUND DE-ENERGIZED		6-5-86
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
86-022: RX SCRAM DUE TO LOSS OF LOOP 3 DHX FANS		06/07/86
Equipment Failure	Maintenance Deficiency	PM Was Inadequate
Unknown		
86-023: LLFM "C" FAILURE TO WITHDRAW		06-07-86
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Problem Was Not Anticipated
86-024: SCRAM BKR MALFUNCTION		06-20-86
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Maintenance Deficiency	PM Did Not Exist
86-025: ELECTRICAL SHORT		07-16-86
Equipment Failure	Material	
86-026: SHACKLE CLEVIS PIN DROPPED IN C.I.		7-20-86
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
86-027: DROPPED MINI TV		07-21-86
Equipment Failure	Design LTA	Specifications LTA
86-028: P-1 SKID BKR TAGGED OFF BUT STILL ON		7-21-86
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Equipment Failure	Design LTA	Ergonomics Poor
Equipment Failure	Material	
86-029: NA SPILL /CS TRAP		07/23/86
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Nonexistent	Not Thought To Be Required
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
86-030: ID 116 FELL OFF WMM		07-25-86
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
86-031: SERF CASK SEAL PLATE BOLTS OVERTORQUED		8-1-86
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task

Appendix B: Listing Of The Event Causes

86-032: GLYCOL LEAK FROM E-24 INTO ALCP-1354		8-2-86
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
86-033: POTENTIAL DAMAGE TO ICCW CHILLER		08-04-86
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
86-034: INSTRUMENT LEFT IN C-120		07/31/86
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Lack Of Management Direction
86-035: MOTA SPECIMEN SEPARATED		08/07/86
Equipment Failure	Installation Error	Not Installed Per Design
86-036: FIRE IN DIESEL GENERATOR G-2		08-11-86
Equipment Failure	Material	
86-037: UNAUTHORIZED ENTRY INTO RESTRICTED RAD ZONE		8-11-86
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Nonexistent	Not Available
Procedural Failure	Procedure Incomplete/LTA	Instructions Ambiguous
86-038: UNABLE TO INSERT MOTA-1E INTO CORE		08-14-86
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
86-039: CRACKS FOUND IN WELDS		08-07-86
Equipment Failure	Installation Error	Not Installed Per Design
86-040: INCONSISTENCY IN TECH SPEC. TABLE		08-21-86
Procedural Failure	Procedure Incorrect	Data/Computations Wrong
86-041: PERSONAL CLOTHING CONTAMINATION		8-21-86
Personnel Error	Management Programs LTA	Work Practices LTA
86-042: LOSS OF BREATHING AIR TO PERSONNEL		8-21-86
Personnel Error	Management Programs LTA	Planning LTA Or None
Personnel Error	Management Programs LTA	Scheduling LTA Or None
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
86-043: MISSING O-RING		08-17-86
Equipment Failure	Design LTA	Specifications LTA
86-044: PULL CELL PLUG		09/02/86
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Incorrect	Data/Computations Wrong
Equipment Failure	Design LTA	Labeling LTA
86-045: NO RPT COVERAGE		09-03-86
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
86-046: EVFM CABLES NOT PER DRAWINGS		09/05/86
Equipment Failure	Installation Error	Not Installed Per Design
86-047: P-61 DAMAGED BY OVERSPEED		07/31/86
Equipment Failure	Material	
86-048: NAK TANK T-920 OVERFLOW		09/05/86
Unknown		
86-049: BAD PHYSICS DATA DUE TO LLMF DEADTIME		9-9-86
Procedural Failure	Procedure Incorrect	Facts/Information Was Incorrect

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86-050: MISSED SURVEILLANCE Personnel Error Management Programs LTA	09-16-86 Scheduling LTA Or None
86-051: EQUIPMENT FAILURE/ C5-S04 Equipment Failure Design LTA Equipment Failure Material	09/15/86 Problem Was Not Anticipated
86-052: MISCALCULATION OF FLOW VALUES Procedural Failure Procedure Incomplete/LTA	09-20-86 Format Confusing
86-053: ELECTRICAL POWER TO C727B INCORRECTLY WIRED Equipment Failure Material	09-29-86
86-054: POLAR CRANE OP. W/ PEOPLE ON BRIDGE Personnel Error Management Programs LTA Personnel Error Management Programs LTA	10/03/86 Personnel Accountability Was Not Defined Lack Of Management Direction
86-055: EXPANSION TANK OVERFLOW/ DG-1 Personnel Error Management Programs LTA Procedural Failure Procedure Incorrect	10/03/86 Lack Of Management Direction Sequence Of Steps Was Wrong
86-056: POSSIBLE FIRE, E-PRI-59 Procedural Failure Procedure Incomplete/LTA	09/27/86 Did Not Cover Situation
86-057: MISSORIENTED ASSEMBLY Personnel Error Management Programs LTA	10-13-86 Planning LTA Or None
86-059: LOSS OF COOLING H2O TO LIQUID RHEO. Personnel Error Lack Of Attention Or Concentration Equipment Failure Design LTA	10/27/86 Preoccupation Of The Mind With Another Task Specifications LTA
86-060: MISSED ENVIRONMENTAL SURVEILLANCE Personnel Error Lack Of Attention Or Concentration	10-29-86 Preoccupation Of The Mind With Another Task
86-061: HIGH LEVEL RADIATION IN SRS Equipment Failure Design LTA	11-05-86 Problem Was Not Anticipated
86-062: TRANSFORMER C5545P C PHASE BUSHING LEAKED Equipment Failure Design LTA	11-10-86 Problem Was Not Anticipated
86-063: IMPROPER CTMT PENETRATION CLOSURE Personnel Error Management Programs LTA	11/12/86 Work Practices LTA
86-064: DRIVER FUEL MANAGEMENT TECHNIQUES NOT ADEQUATE Procedural Failure Procedure Incomplete/LTA Procedural Failure Procedure Incorrect	11-19-86 Did Not Cover Situation Facts/Information Was Incorrect
86-065: 9 FT. 6 IN. INFLATABLE SEAL FAILED Personnel Error Procedure Not Followed	11-20-86 Because A Checklist Was Misused
86-066: MISSED SCRAM BREAKER TESTING SURVEILLANCE Personnel Error Management Programs LTA	11/24/86 Scheduling LTA Or None
86-067: SOFTWARE ERROR IN RICS Equipment Failure Material	12/10/86
86-068: SMOKE DETECTOR CALS PAST DUE Personnel Error Management Programs LTA	12/11/86 Planning And Scheduling LTA
86-069: WMM DRAPE CABLE DAMAGE Personnel Error Lack Of Attention Or Concentration Equipment Failure Design LTA	12-12-86 Preoccupation Of The Mind With Another Task Problem Was Not Anticipated

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86-070: GLYCOL LEAK IN CELL 497 FROM E-86		12-16-86
Personnel Error	Management Programs LTA	Drawings Not Controlled
Procedural Failure	Procedure Incorrect	Facts/Information Was Incorrect
87-001: CLEM 1/2 TON HOIST DAMAGED		01-02-87
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Design Did Not Meet Specifications
87-002: ACO-1 VERTICAL CUTTING DIFFICULTIES		01-09-87
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	
87-003: ROD DROP TEST NOT PERFORMED (SURV MISSED)		01-08-87
Personnel Error	Management Programs LTA	Planning And Scheduling LTA
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
87-004: ZTO D-15 AUTO XFER CIRCUIT MALFUNCTION		01-18-87
Equipment Failure	Material	
87-005: TAGOUT ERROR DAMAGES IEMC IODINE PUMP		01-22-87
Personnel Error	Procedure Not Followed	Because An Uncontrolled Procedure Was Used
87-006: HAZARDOUS WASTE SPILL (FLOOR WAX)		01-26-87
Personnel Error	Training LTA	Continuing Training LTA
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-007: ARGON CART RELIEF VALVE INCORRECTLY SIZED		08-31-86
Personnel Error	Management Programs LTA	Drawings Not Updated
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Specifications LTA
87-008: T-3 LINER DROPPED		01-27-87
Equipment Failure	Design LTA	Design Did Not Meet Specifications
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Design LTA	Ergonomics Poor
Equipment Failure	Maintenance Deficiency	PM Did Not Exist
87-009: VIOLATION OF A CAUTION TAG		01-26-87
Personnel Error	No Communication Or Not Timely	Time Constraint Inhibit Taking Time To Communicate
Personnel Error	Management Programs LTA	Drawings Not Updated
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-010: LOSS OF FUEL PIN END FITTING		01/28/87
Equipment Failure	Maintenance Deficiency	PM Did Not Exist
87-011: ACO-12 SN'S OUT OF SEQUENCE		01/29/87
Personnel Error	Management Programs LTA	Drawings Not Updated
87-012: BREACH OF CTMT INTEGRITY (SC-27-6)		02-10-87
Procedural Failure	Procedure Incorrect	Sequence Of Steps Was Wrong
87-013: SKIN CONTAMINATION		02/12/87
Unknown		
87-014: SPILL OF CONTAMINATED WATER DURING SC-27-6		02-16-86
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Misunderstood Communication	Message Not Complete
Personnel Error	Management Programs LTA	Work Practices LTA
Procedural Failure	Procedure Nonexistent	Not Thought To Be Required

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87-015: E-215 OPERATED WITH SUCTION VALVE CLOSED Personnel Error Lack Of Attention Or Concentration Equipment Failure Material	02-22-87 Preoccupation Of The Mind With Another Task
87-016: RESIDUAL Na OXIDATION IN CELL 567 Personnel Error Lack Of Attention Or Concentration	02-23-87 Because Of Being Tired
87-017: DG-2 AUTO-START FAILURE Unknown	03-01-87
87-018: LOSS OF POWER TO BUILDING 4790 Personnel Error Management Programs LTA Equipment Failure Design LTA Equipment Failure Design LTA Equipment Failure Material	02-28-87 Corrective Actions Not Implemented Specifications LTA Problem Was Not Anticipated
87-019: INADVERTENT HEATUP OF FROZEN Na VALVE Personnel Error Training LTA Procedural Failure Procedure Incorrect	03-02-87 Continuing Training LTA Facts/Information Was Incorrect
87-020: HEATUP OF PTI N-130 WITHOUT A FREE SURFACE Personnel Error Procedure Not Followed Procedural Failure Procedure Incomplete/LTA	03-07-87 The Procedure Was Intentionally Not Used Format Confusing
87-021: MASF FAN INSPECTION COVER PROBLEM Personnel Error Procedure Not Followed Personnel Error Misunderstood Communication	03/09/87 The Procedure Was Intentionally Not Used Message Not Complete
87-022: B-119 GROUND BUS ENERGIZED Personnel Error Management Programs LTA Personnel Error Management Programs LTA Equipment Failure Design LTA	03-09-87 Drawings Not Updated Work Practices LTA Design Did Not Meet Specifications
87-023: AFFF FLOW SWITCH INOPERABLE Personnel Error Management Programs LTA Equipment Failure Material	03-25-87 Corrective Actions Not Implemented
87-024: O2 LOW OUT OF SPEC, TV-13 Equipment Failure Maintenance Deficiency Equipment Failure Material	04-02-87 PM Did Not Exist
87-025: TELEPHONE CABLE INADVERTENTLY CUT Personnel Error Lack Of Attention Or Concentration	04-06-87 Preoccupation Of The Mind With Another Task
87-027: P-61 AUTO-STARTED AND WOULD NOT SHUT DOWN Personnel Error Management Programs LTA Equipment Failure Design LTA Equipment Failure Design LTA Equipment Failure Maintenance Deficiency Equipment Failure Material	04-09-87 Corrective Actions Not Implemented Specifications LTA Problem Was Not Anticipated PM Did Not Exist
87-028: E-7 CCD'S CLOSED MOMENTARILY Personnel Error Lack Of Attention Or Concentration Equipment Failure Material	04-11-87 Because Of A Differing Attitude
87-029: Na FREEZE PLUG TEMP INCREASE IN CELL 492E Procedural Failure Procedure Nonexistent Procedural Failure Procedure Incomplete/LTA	04-15-87 Not Available Did Not Cover Situation
87-030: FIRE SPRINKLER SYSTEM INADVERTENTLY ACTUATED Personnel Error Lack Of Attention Or Concentration Personnel Error Management Programs LTA	04-28-87 Because Of A Differing Attitude Lack Of Management Direction
87-031: BLTC CABLES DAMAGED DURING MACHINE MOVEMENT Equipment Failure Design LTA	04-29-87 Specifications LTA

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87-032: TOLERANCE TOO LOW ON CIS H & V SETPOINTS		05/04/87
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
Procedural Failure	Procedure Incorrect	Data/Computations Wrong
Other	Technical Error	
87-033: DROPPED SOURCE DURING SC-99-7		05/07/87
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Material	
87-034: SC-99-7 DID NOT REQUIRE FOLDOVER CHECKS		05/07/87
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
Other	Technical Error	
87-035: FGM DRIFT		05-13-87
Equipment Failure	Design LTA	Design Did Not Meet Specifications
Equipment Failure	Design LTA	Problem Was Not Anticipated
87-036: CDMF HOIST FAIL		05/20/87
Equipment Failure	Design LTA	Problem Was Not Anticipated
87-037: TAGOUT VIOLATED BY CONTRACTOR		05-28-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-038: 18B GRAPPLE NOT FULLY ENGAGED TO MFF-1A		06/03/87
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Equipment Failure	Design LTA	Problem Was Not Anticipated
87-039: DANGER TAG REMOVED PRIOR TO AUTHORIZED CLEARANCE		06-15-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
87-040: UNCONTROLLED ENTRY INTO A RAZ		06-22-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Misunderstood Communication	Standard Terminology Not Used
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-041: INADVERTENT SHUTDOWN OF PRI PUMP PONY MOTOR		06-25-87
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Tired
Equipment Failure	Design LTA	Ergonomics Poor
Equipment Failure	Design LTA	Instrument Displays Or Controls LTA
87-042: CERS OPERATED AT POSITIVE PRESSURE		06/02/87
Other	Technical Error	
87-043: IDS DECAY HEAT VERIFICATION INCORRECT		06-25-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Nonexistent	Not Available
87-044: CO-60 END CAP SEPARATED		06/30/87
Equipment Failure	Design LTA	Specifications LTA
87-045: TAGOUT ERROR ON DIESEL FIRE PUMP P-61		07-02-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Work Practices LTA
87-046: 120VAC ELEC LINE INADVERTENTLY SEVERED		07-10-87
Personnel Error	Management Programs LTA	Drawings Not Updated
87-047: ELECTRICAL SHOCK DURING FIRE DETECTOR REMOVAL		07-13-87
Equipment Failure	Maintenance Deficiency	PM Did Not Exist
Equipment Failure	Material	

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87-048: FAILURE TO TIMELY EFFECT REPAIRS ON INOP FSD		08-04-87
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Incomplete/LTA	Equipment Identification LTA
87-049: UNAUTHORIZED REMOVAL OF TAGS FROM P-14		08-11-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-050: LOSS OF MASF H/V --LOSS OF WATER		08/12/87
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
87-051: ROD HEIGHT READINGS IMPROPERLY RECORDED		08-15-87
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Equipment Failure	Design LTA	Instrument Displays Or Controls LTA
87-052: CONTAMINATION FOUND ON EMPLOYEE'S SHOE & IN CTMT		08-17-87
Personnel Error	Management Programs LTA	Work Practices LTA
87-053: CONTROLLED JUMPERS LIFTED WITHOUT AUTHORIZATION		08-18-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Personnel Error	Management Programs LTA	Work Practices LTA
87-054: EMPLOYEE INJURY (LACERATED ELBOW)		09-04-87
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Material	
87-055: DATR SUPPORT ASSEMBLY DAMAGED DURING TRAINING		09-05-87
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Personnel Error	No Communication Or Not Timely	Events Happened Too Fast
Personnel Error	Management Programs LTA	Personnel Accountability Was Not Defined
87-056: PULL FORCE LIMITS EXCEEDED DURING PLUG REMOVAL		09-08-87
Personnel Error	Training LTA	Task Analysis LTA
Personnel Error	Management Programs LTA	Planning LTA Or None
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-057: CRANE LIFT EXCEEDED EQUIPMENT RATINGS		09-30-87
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Personnel Error	Management Programs LTA	Work Practices LTA
87-058: DROPPED MOTA SPECIMEN		10/18/87
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
Equipment Failure	Material	
87-059: INCORRECT ELEC TAGOUT FOR MAINTENANCE		10-20-87
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Personnel Error	Lack Of Attention Or Concentration	Because Of A Differing Attitude
87-060: HEATUP OF SODIUM SYSTEM WITHOUT A FREE SURFACE		10-25-87
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Design LTA	Labeling LTA
Equipment Failure	Design LTA	Instrument Displays Or Controls LTA
87-061: CONTROL VALVE FAILED		10/30/87
Equipment Failure	Material	
87-062: LIMITS FOR SAFETY RODS NOT CONSERVATIVE		11-3-87
Equipment Failure	Design LTA	Problem Was Not Anticipated
Other	Technical Error	

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87-065: SISI TROLLEY CAMERA ENCOUNTERS OBSTRUCTION		11-10-87
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
Equipment Failure	Design LTA	Problem Was Not Anticipated
Equipment Failure	Manufacturing Error	Equipment Not Made Per Design
87-066: MASF LOW BAY CONTAMINATION		11/12/87
Unknown		
87-067: SISI TROLLEY BAFFLE HUNG UP DURING REMOVAL		11/10/87
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Design LTA	Problem Was Not Anticipated
87-068: FTP-2 PLUG STUCK		10/21/87
Unknown		
87-069: MPS SAMPLE TRAIN COOLING FINS BROKEN OFF		11-17-87
Equipment Failure	Design LTA	Problem Was Not Anticipated
Unknown		
87-070: IMPROPERLY CERTIFIED RIGGING ITEM USED IN PLANT		11-17-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Lack Of Management Direction
87-071: EMPLOYEE INJURY (LACERATION)		11-20-87
Personnel Error	Management Programs LTA	Work Practices LTA
87-072: MINI-TV DROPPED FROM 4-TON HOOK		11/30/87
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
87-073: SWIPE DEBRIS ON D9-2		12/08/87
Procedural Failure	Procedure Incomplete/LTA	Equipment Identification LTA
Equipment Failure	Installation Error	Not Installed Per Design
87-074: 5 YEAR CRANE LOAD TEST MISSED		12-10-85
Personnel Error	Management Programs LTA	Planning LTA Or None
87-075: WELDING CONNECTOR SHORTED TO GROUND		12-14-87
Unknown		
87-076: T/S SURV MISSED ON LOOP 2 PLUGGING TEMP		12-18-87
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
87-077: INSPECTION REQ'MENTS NOT MET ON HOISTING EQUIP		12-16-87
Personnel Error	Management Programs LTA	Scheduling LTA Or None
Procedural Failure	Procedure Nonexistent	Not Thought To Be Required
87-078: MISSED PM ON M-137		12-30-87
Personnel Error	Management Programs LTA	Planning And Scheduling LTA
88-001: EMPLOYEE SLIPS ON ICE		1-4-88
Other	Natural Phenomenon	
88-002: NON-SEISMIC PRINTER INSTALLED IN SRM		1-8-88
Personnel Error	Management Programs LTA	Lack Of Management Direction
88-003: IMPROPER STORAGE OF A PROPANE GAS BOTTLE		01-12-88
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Management Programs LTA	Work Practices LTA
88-004: SCREEN FILTER DISCOVERED IN G-2 INTAKE SILENCER		1-15-88
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Installation Error	Not Installed Per Design

Appendix B: Listing Of The Event Causes

88-005: PROCEDURE VIOLATION DURING PM'S		01-19-88
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Management Programs LTA	Lack Of Management Direction
88-006: INJURY DURING ANNUAL N2 FLOODING CHECK		1-20-88
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Design Did Not Meet Specifications
88-007: ID 35 COOLING SHROUD DROPPED		01/22/88
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
88-008: RX SCRAM DUE TO HIGH PRI FLOW		01-26-88
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Design LTA	Instrument Displays Or Controls LTA
88-009: CIS VALVE FOUND OPEN		1-27-88
Personnel Error	Management Programs LTA	Work Practices LTA
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
88-010: PERSONNEL INJURY		01-30-88
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Design LTA	Ergonomics Poor
88-011: T/S SURV MISSED FOR LOOP 2 PLUG TEMP (EVENT 2)		01-31-88
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
88-012: EMPLOYEE INJURY (DEGREASER IN EYE)		02-12-88
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
Personnel Error	Management Programs LTA	Work Practices LTA
88-013: NON-CONFORMANCE WITH IEMC DECAY HEAT TECH SPEC		01/25/88
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Incomplete/LTA	Format Confusing
88-014: FAILURE TO FOLLOW O2 MONITOR PROCEDURES		02-11-88
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Lack Of Management Direction
88-015: ELEC SHOCK DURING SC-96-2		02-24-88
Personnel Error	Management Programs LTA	Work Practices LTA
Equipment Failure	Design LTA	Problem Was Not Anticipated
88-016: EMAL DOORS BOTH OPEN		2-25-88
Equipment Failure	Design LTA	Problem Was Not Anticipated
Unknown		
88-017: MISSED SURVEILLANCE ON FIRE SPECS.		3-3-88
Personnel Error	Management Programs LTA	Drawings Not Updated
Personnel Error	Management Programs LTA	Scheduling LTA Or None
88-018: GAS TAG LEAK RATE TEST INADEQUATE		3-3-88
Personnel Error	Management Programs LTA	Lack Of Management Direction
Other	Technical Error	
88-019: CONTROL ROOM T/S SURV'S MISSED		03-07-88
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
88-020: EMAL DOORS OPEN AGAIN		3-11-88
Personnel Error	Management Programs LTA	Corrective Actions Not Implemented
Equipment Failure	Material	

Appendix B: Listing Of The Event Causes

88-021: T-3 PHF DROPPED		ation	Preoccupation Of The Mind With Another Ta
88-025: RARZ LEFT UNLOCKED AND UNGUARDED			04/01/88
Personnel Error	Procedure Not Followed		The Procedure Was Intentionally Not Used
88-026: PERFORATED TUBING FOUND IN P-97			4-4-88
Equipment Failure	Design LTA		Specifications LTA
Equipment Failure	Material		
88-027: RRSC LIFTED WITH WRONG LOAD CELL	Procedural Failure		Procedure Incomplete/LTA
			Graphics L
88-023: EMPLOYEE INJURY (CUT HAND ON MANIPULATOR)			03-18-88
Personnel Error	Lack Of Attention Or Concentration		Preoccupation Of The Mind With Another Task
Personnel Error	Management Programs LTA		Work Practices LTA
88-024: MISSED T/S SURV (CAPS EXHAUST MONITORS)			03-31-88
Personnel Error	Lack Of Attention Or Concentration		Preoccupation Of The Mind With Another Task
88-025: RARZ LEFT UNLOCKED AND UNGUARDED			04/01/88
Personnel Error	Procedure Not Followed		The Procedure Was Intentionally Not Used
88-026: PERFORATED TUBING FOUND IN P-97			4-4-88
Equipment Failure	Design LTA		Specifications LTA
Equipment Failure	Material		
88-027: RRSC LIFTED WITH WRONG LOAD CELL			04-15-88
Personnel Error	Procedure Not Followed		The Procedure Was Intentionally Not Used
Personnel Error	Lack Of Attention Or Concentration		Because Of A Differing Attitude
Personnel Error	Management Programs LTA		Work Practices LTA
Personnel Error	Management Programs LTA		Lack Of Management Direction
88-028: MPRT POWER SUPPLY CABLE DAMAGED			04-15-88
Personnel Error	Lack Of Attention Or Concentration		Preoccupation Of The Mind With Another Task
Personnel Error	Management Programs LTA		Work Practices LTA
88-029: TRUCK ACCIDENT AT DEWAR PAD			04-26-88
Personnel Error	Management Programs LTA		Work Practices LTA
Equipment Failure	Design LTA		Labeling LTA
88-030: OVERLOAD OF RSB CRANE			04-28-88
Personnel Error	Training LTA		Task Analysis LTA
Personnel Error	Management Programs LTA		Work Practices LTA
Personnel Error	Management Programs LTA		Lack Of Management Direction
88-031: SMALL SODIUM SPILL			05/02/88
Equipment Failure	Maintenance Deficiency		PM Did Not Exist
88-032: FAILURE OF CIS BKR			5-10-88
Equipment Failure	Design LTA		Specifications LTA
Equipment Failure	Design LTA		Problem Was Not Anticipated
Equipment Failure	Maintenance Deficiency		PM Did Not Exist
Equipment Failure	Material		
Other	External		
88-033: WORK PROCEDURE VIOLATION, LIQUID RHEOSTATS			05-09-88
Personnel Error	Procedure Not Followed		The Procedure Was Intentionally Not Used
Personnel Error	Management Programs LTA		Work Practices LTA
88-034: LOEP TO FMEF			05/11/88
Personnel Error	Lack Of Attention Or Concentration		Preoccupation Of The Mind With Another Task
88-035: IMPROPER TAGOUT			05-11-88
Personnel Error	Lack Of Attention Or Concentration		Preoccupation Of The Mind With Another Task
88-036: FTP#2 STUCK PLUG REMOVAL SWIVEL EYE HANGUP			5-13-88
Other	Technical Error		

Appendix B: Listing Of The Event Causes

88-037: IMPROPER CLEARANCE OF TAGS		05-17-88
Personnel Error	Lack Of Attention Or Concentration	Because Of Being Distracted
88-038: OVERPRESSURIZATION OF CELL 495B		06-07-88
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
88-039: LOOP#3 SEC. DRAIN LINE CONFIGURATION		6-9-88
Personnel Error	Management Programs LTA	Drawings Not Controlled
Personnel Error	Management Programs LTA	Work Practices LTA
88-040: INOP. C.I. TEMP. ALARM		6-15-88
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
88-041: CTMT PENETRATION TEST VALVE LEFT OPEN		6-17-88
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
Personnel Error	Management Programs LTA	Lack Of Management Direction
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
88-042: NA SAMPLING SYS. BOUNDARY OPEN IN DEINERT CELL		6-20-88
Personnel Error	Training LTA	Task Infrequently Performed
Personnel Error	Management Programs LTA	Planning LTA Or None
Procedural Failure	Procedure Incomplete/LTA	Limits LTA
88-043: Na VALVE (85-V-90504) WAS OPERATED COLD		07-05-88
Personnel Error	Procedure Not Followed	The Procedure Was Intentionally Not Used
Personnel Error	No Communication Or Not Timely	Shift Turnover Incomplete
88-044: CTMT PRESSURE XMITTER FOUND ISOLATED		07-08-88
Unknown		
88-045: PERSONNEL INJURY (PORTABLE MAN LIFT)		07-28-88
Personnel Error	Training LTA	Incomplete Training
Personnel Error	Management Programs LTA	Work Practices LTA
Personnel Error	Management Programs LTA	Lack Of Management Direction
88-046: SRI MOTOR DROPPED		08/08/88
Personnel Error	Lack Of Attention Or Concentration	Preoccupation Of The Mind With Another Task
Procedural Failure	Procedure Incomplete/LTA	Did Not Cover Situation
88-047: LIQUID RAD. SPILL		8-11-88
Equipment Failure	Design LTA	Specifications LTA
Equipment Failure	Material	

Appendix C: Listing Of The Event Impacts

85-001:	TV-4 OXYGEN GREATER THAN 5% Loss Of Safety Function	01/05/85 Actual Loss, Potential Demand
85-002:	DHX DAMPERS CLOSED /E-12 Severe Plant Transient	01/05/84 Actual Problem, Potential Transient
85-003:	DHX DAMPERS CLOSED /E-5 Severe Plant Transient	01/09/85 Actual Problem, Potential Transient
85-005:	CTMT INTEGRITY LOST DURING SC-27-6 Loss Of Safety Function	01/09/85 Actual Loss, Potential Demand
85-006:	CAPS COMPRESSOR RUN WITH DISCHARGE SHUT Major Economic Damage	01/14/85 Actual Problem, Potential Impact
85-008:	LOSS OF COOLING TO THE LIQUID RHEOSTATS Major Economic Damage	01/18/85 Actual Problem, Potential Impact
85-009:	4 TON CRANE SNAGGED MSM Major Economic Damage	01-24-85 Actual Problem, Actual Impact
85-010:	DECAY HEAT VERIFICATION ON CLEM Loss Of Safety Function	01/26/85 Actual Loss, Potential Demand
85-011:	TAGOUT VIOLATED Loss Of Safety Function	01/31/85 Potential Loss
85-012:	PIECES OF TUBING FOUND IN P-98 Major Economic Damage	01/30/85 Actual Problem, Actual Impact
85-013:	CTMT INTEGRITY LOST DURING SC-27-6 Loss Of Safety Function	02/01/85 Actual Loss, Potential Demand
85-014:	WATER LEAKS IN FSF ROOM 918 Loss Of Safety Function Major Economic Damage	02/05/85 Potential Loss Actual Problem, Actual Impact
85-015:	WATER LINE IN G-3 FROZE Major Economic Damage	02/08/85 Actual Problem, Actual Impact
85-016:	IVHM EXCESSIVE FORCE ON INSERTION Major Economic Damage	02/12/85 Actual Problem, Actual Impact
85-017:	T-3 CASK BINDERS DAMAGED Major Economic Damage	02/18/85 Actual Problem, Actual Impact
85-018:	EQAL SEISMIC RESTRAINTS NOT SET Loss Of Safety Function	02/21/85 Potential Loss
85-019:	BROKEN FORCE BOOM Major Economic Damage	02-19-85 Actual Problem, Actual Impact

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85-020:	HIGH RADIATION AT CLS Personnel Radiation Exposure	Actual Hazard, Actual Exposure	02/26/85
85-021:	ARCING OF BLTC CABLE (EVENT 1) Loss Of Safety Function Major Economic Damage	Actual Loss, Actual Demand Actual Problem, Potential Impact	03/02/85
85-023:	ID-69 INTERFERENCE BETWEEN CCP Major Economic Damage	Actual Problem, Actual Impact	03-01-85
85-024:	4 TON SNAGGING MSM Major Economic Damage	Actual Problem, Actual Impact	03-04-85
85-025:	IDS PLUG O-RING MISSING Loss Of Safety Function Radiation Release	Potential Loss Potential Hazard, Potential Release	03/07/85
85-026:	FTP PLUG O-RINGS MISSING Loss Of Safety Function Radiation Release	Potential Loss Potential Hazard, Potential Release	03/08/85
85-028:	CLEM STRUCK POLAR CRANE Major Economic Damage	Actual Problem, Actual Impact	03/17/85
85-029:	MISSED SURVEILLANCE FOLLOWING SC-27-4 ON EQAL Loss Of Safety Function	Potential Loss	03/20/85
85-030:	RX SCRAM DURING CM ON CRDM CONTROLLER Severe Plant Transient	Actual Problem, Potential Transient	03/26/85
85-031:	OVERHEATING RTCB-7 Major Economic Damage	Actual Problem, Actual Impact	04-03-85
85-032:	DRAIN VALVE NOT SEATED PER SC-51-10 Loss Of Safety Function	Potential Loss	04/08/85
85-033:	ARCING OF BLTC CABLE (EVENT 2) Loss Of Safety Function Major Economic Damage	Actual Loss, Actual Demand Actual Problem, Potential Impact	04/08/85
85-034:	LOSS OF DC TO D-15 Loss Of Safety Function	Potential Loss	04/09/85
85-035:	CLEM VEIWPOR T WINDOW DROPPED Major Economic Damage	Actual Problem, Actual Impact	04-18-85
85-036:	WMM BRAKE ACTUATOR ROD SEPARATED Major Economic Damage	Actual Problem, Actual Impact	04-19-85

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85-037:	TRANSFORMER GROUNDED Severe Plant Transient	Actual Problem, Potential Transient	04/20/85
85-038:	MANUAL RX SCRAM DUE TO DNM COUNTS Severe Plant Transient	Actual Problem, Actual Transient	04/22/85
85-039:	TRITIUM IN E-208 Personnel Radiation Exposure	Actual Hazard, Potential Exposure	04/24/85
85-041:	LOW O2 IN CELL 209 Loss Of Safety Function	Potential Loss	05/02/85
85-042:	PERSONNEL INJURY DUE TO ACID SPRAY Loss Of Safety Function	Potential Loss	05/05/85
85-043:	C. I. TECH SPEC WITH POLAR CRANE Loss Of Safety Function	Potential Loss	05/07/85
85-044:	OVER PRESSURIZATION OF CELL 569 Major Economic Damage	Actual Problem, Potential Impact	5-14-85
85-045:	MASF 60 TON CRANE CONTACTED SSMC Major Economic Damage	Actual Problem, Actual Impact	05-17-85
85-046:	PERSONAL CONTAMINATION /CLEM Personnel Radiation Exposure	Actual Hazard, Actual Exposure	05/22/85
85-047:	FSF DEPRESSURIZATION Severe Plant Transient	Actual Problem, Potential Transient	05/28/85
85-048:	BAD TAG-OUT ON E-143 Loss Of Safety Function	Potential Loss	5-29-85
85-049:	RX SCRAM DUE TO LOEP Severe Plant Transient	Actual Problem, Actual Transient	6-5-85
85-050:	TRIP OF RSS COMPARITORS Loss Of Safety Function	Actual Loss, Potential Demand	06/09/85
85-051:	CLEM CATCHES CABLE MATING TO IEM CELL Major Economic Damage	Actual Problem, Actual Impact	6-13-85
85-052:	BLTC RUNS OVER CABLE Major Economic Damage	Actual Problem, Actual Impact	6-13-85
85-053:	CELL 548 CRANE FOULED Major Economic Damage	Actual Problem, Actual Impact	06-18-85
85-054:	HIGH GASEOUS ACTIVITY IN CELL 481 Radiation Release	Actual Hazard, Potential Release	6-21-85

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85-055:	PERSONNEL CLOTHING CONTAMINATION	6-27-85
	Personnel Radiation Exposure Potential Hazard, Potential Exposure	
85-056:	SERF CASK CLOSURE VALVE DRIFTS CLOSED	6-25-85
	Major Economic Damage Actual Problem, Potential Impact	
85-057:	IVHM PAWL BREAKS	7-1-85
	Major Economic Damage Actual Problem, Actual Impact	
85-058:	CLEM CABLE CATCHES DURING MOVE	7-3-85
	Major Economic Damage Actual Problem, Potential Impact	
85-059:	CLEM LADDER DAMAGED DURING MOVE	7-6-85
	Major Economic Damage Actual Problem, Actual Impact	
85-060:	WORK PACKAGE NOT RELEASED	07-11-85
	Loss Of Safety Function Potential Loss	
85-061:	BEARING REPLACEMENT	07/12-85
	Loss Of Safety Function Actual Loss, Potential Demand	
85-062:	SODIUM SPILL AT THE CLEM DURING FILTER CHANGE	7-17-85
	Personnel Radiation Exposure Actual Hazard, Potential Exposure	
85-063:	PERSONNEL CONTAMINATION DURING REFUELING	7-30-85
	Personnel Radiation Exposure Actual Hazard, Actual Exposure	
85-064:	IMPROPER MELT-OUT OF P-930	8-3-85
	Major Economic Damage Actual Problem, Actual Impact	
85-065:	RX COVER GAS PRESSURE GOES NEGATIVE DURING DRILL	8-4-85
	Loss Of Safety Function Potential Loss	
85-066:	IMPROPER ADJUSTMENT OF LLFM'S	8-5-85
	Loss Of Safety Function Potential Loss	
85-067:	NEGATIVE RX COVER GAS PRESSURE EXCEEDS LIMITS	8-7-85
	Loss Of Safety Function Potential Loss	
85-068:	RACKING-IN PRI PUMP BKR. IN MODE 4	7-12-85
	Loss Of Safety Function Potential Loss	
85-069:	LIGHTENING STRIKE CAUSES SCRAM	8-28-85
	Severe Plant Transient Actual Problem, Actual Transient	
85-070:	FAILED TACHOMETER GENERATOR ON D-15	08/27/85
	Loss Of Safety Function Potential Loss	
85-071:	TAGOUT HUNG WRONG	08-30-85
	Loss Of Safety Function Potential Loss	

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85-072:	IMPROPER TAG-OUT OF SAN WATER SYS	8-30-85
	Loss Of Safety Function Potential Loss	
85-073:	DROP OF T-3 SHIELD PLUG	9-6-85
	Major Economic Damage Actual Problem, Actual Impact	
85-074:	LOSS OF DHX CONTROL VARIABLES	9-9-85
	Major Economic Damage Actual Problem, Actual Impact	
85-075:	ID 41 LENGTH ARM BENT	09-11-85
	Major Economic Damage Actual Problem, Actual Impact	
85-076:	ELECTRICAL SHOCK / FSF	09/13/85
	Loss Of Safety Function Actual Loss, Actual Demand	
85-077:	UNRELEASED WORK /HALON	09/18/85
	Major Economic Damage Actual Problem, Potential Impact	
85-078:	RX POWER INCREASE >3% IN 15 MIN.	10-2-85
	Severe Plant Transient Actual Problem, Actual Transient	
85-079:	E-7 FAN OVER SPEED	10-11-85
	Major Economic Damage Actual Problem, Actual Impact	
85-080:	MOTA OVERTEMP	10-25-85
	Major Economic Damage Actual Problem, Actual Impact	
85-081:	CHEMICAL BURNS	10/30/85
	Loss Of Safety Function Actual Loss, Actual Demand	
85-083:	HIGH RAD IN HEAD COMPT. DUE TO MOTA MANIFOLD	11-3-85
	Personnel Radiation Exposure Actual Hazard, Actual Exposure	
85-084:	RAIL TRANSPORTER PENDANT DAMAGED BY BLTC	11-4-85
	Major Economic Damage Actual Problem, Actual Impact	
85-085:	RX SCRAM DUE TO LOOP#3 FANS COAST DOWN	11-12-85
	Severe Plant Transient Actual Problem, Actual Transient	
85-086:	CONTAMINATION ON CRAFTSMAN'S CLOTHING	11/13/85
	Personnel Radiation Exposure Actual Hazard, Potential Exposure	
85-087:	E-7 FAN SPEED CONTROL FAILURE	11-21-85
	Severe Plant Transient Actual Problem, Potential Transient	
85-088:	LOEP SCRAM DUE TO S-7	11-22-85
	Severe Plant Transient Actual Problem, Actual Transient	
85-089:	ELECTRICAL SHORT ON TRANSFORMER C5804P	11/27/85
	Major Economic Damage Actual Problem, Actual Impact	

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85-090:	RX SCRAM DUE TO VOLTAGE FLUCTUATION	12-7-85
	Severe Plant Transient	Actual Problem, Actual Transient
85-091:	FORCE BOOM CLAMP DROPPED	12-09-85
	Major Economic Damage	Actual Problem, Actual Impact
85-093:	IMPROPER INSTALLATION OF F.V. AT FSF	12-20-85
	Loss Of Safety Function	Potential Loss
86-001:	IVHM #3 PAWL MISPOSITIONED	01-06-86
	Major Economic Damage	Actual Problem, Potential Impact
86-002:	CONTROL RODS IMPROPERLY RECONNECTED	01-19-86
	Major Economic Damage	Actual Problem, Actual Impact
86-003:	N-23 CARRIER GAS CONTAMINATED WITH AIR	02-06-86
	Loss Of Safety Function	Potential Loss
86-004:	OPERATIONAL HEATUP RATE EXCEEDED	02/21/86
	Severe Plant Transient	Actual Problem, Potential Transient
86-005:	HIGH O2 IN TV-4 DUE TO BREACH OF TV BOUNDARY	03/04/86
	Loss Of Safety Function	Actual Loss, Potential Demand
86-006:	FLOOR VALVE SEAL ROLLED	03-05-86
	Major Economic Damage	Actual Problem, Actual Impact
86-007:	EXTENDED ALT PREF POWER OUTAGE	03-13-86
	Loss Of Safety Function	Potential Loss
86-008:	BLTC TRANSPORTER CABLE DAMAGED	03-13-86
	Major Economic Damage	Actual Problem, Actual Impact
86-009:	G-3 INOPERABLE DUE TO CM ON ANNUNCIATOR SYSTEM	03/17/86
	Loss Of Safety Function	Actual Loss, Potential Demand
86-010:	CONTAMINATION ON SHOE FROM RCB	03/25/86
	Personnel Radiation Exposure	Actual Hazard, Potential Exposure
86-011:	SURFACE CONTAMINATION FOUND AFTER BLTC UNMATE	04-05-86
	Radiation Release	Actual Hazard, Potential Release
86-012:	BENT FORCE BOOM CLAMP	04-10-86
	Major Economic Damage	Actual Problem, Actual Impact
	Personnel Radiation Exposure	Actual Hazard, Actual Exposure
86-013:	FIRE IN B-41	04-14-86
	Severe Plant Transient	Actual Problem, Actual Transient
	Major Economic Damage	Actual Problem, Actual Impact

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86-014:	RX SCRAM DUE TO LOW LOOP PRI FLOW LOOP 2 Severe Plant Transient	04/25/86 Actual Problem, Potential Transient
86-015:	INCORRECT VALUES RECORDED FOR P-3 DISCH PRESS Loss Of Safety Function	04/26/86 Potential Loss
86-016:	INAPPROPRIATE USE OF A DANGER TAG Loss Of Safety Function	05/06/86 Potential Loss
86-017:	B-190 FAULT Major Economic Damage	05-08-86 Actual Problem, Actual Impact
86-018:	CHILLER PRESSURIZED PRIOR TO BEGINNING WORK Loss Of Safety Function	05/05/86 Potential Loss
86-019:	TWO OF THREE LLFM DETECTORS INOPERABLE Loss Of Safety Function	05/16/86 Actual Loss, Potential Demand
86-020:	INCORRECT F-FACTOR USED FOR LLFM CALIBRATION Loss Of Safety Function	05/20/86 Actual Loss, Potential Demand
86-021:	ALL 3 DNM PREAMPS FOUND DE-ENERGIZED Loss Of Safety Function	6-5-86 Potential Loss
86-022:	RX SCRAM DUE TO LOSS OF LOOP 3 DHX FANS Severe Plant Transient	06/07/86 Actual Problem, Actual Transient
86-023:	LLFM "C" FAILURE TO WITHDRAW Major Economic Damage	06-07-86 Actual Problem, Actual Impact
86-024:	SCRAM BKR MALFUNCTION Loss Of Safety Function	06-20-86 Actual Loss, Test Demand
86-025:	ELECTRICAL SHORT Major Economic Damage	07-16-86 Actual Problem, Actual Impact
86-026:	SHACKLE CLEVIS PIN DROPPED IN C.I. Major Economic Damage	7/20/86 Actual Problem, Potential Impact
86-027:	DROPPED MINI TV Major Economic Damage	07-21-86 Actual Problem, Actual Impact
86-028:	P-1 SKID BKR TAGGED OFF BUT STILL ON Loss Of Safety Function	7-21-86 Potential Loss
86-029:	NA SPILL /CS TRAP Loss Of Safety Function	07/23/86 Actual Loss, Actual Demand
86-030:	ID 116 FELL OFF WMM Major Economic Damage	07-25-86 Actual Problem, Actual Impact

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86-031:	SERF CASK SEAL PLATE BOLTS OVERTORQUED	8-1-86
	Major Economic Damage Actual Problem, Potential Impact	
86-032:	GLYCOL LEAK FROM E-24 INTO ALCP-1354	8-2-86
	Loss Of Safety Function Potential Loss	
86-033:	POTENTIAL DAMAGE TO ICCW CHILLER	08-04-86
	Major Economic Damage Actual Problem, Potential Impact	
86-034:	INSTRUMENT LEFT IN C-120	07/31/86
	Loss Of Safety Function Potential Loss	
86-035:	MOTA SPECIMEN SEPARATED	08/07/86
	Major Economic Damage Actual Problem, Actual Impact	
86-036:	FIRE IN DIESEL GENERATOR G-2	08-11-86
	Major Economic Damage Actual Problem, Actual Impact	
86-037:	UNAUTHORIZED ENTRY INTO RESTRICTED RAD ZONE	8-11-86
	Personnel Radiation Exposure Potential Hazard, Potential Exposure	
86-038:	UNABLE TO INSERT MOTA-1E INTO CORE	08-14-86
	Loss Of Safety Function Actual Loss, Potential Demand	
	Major Economic Damage Actual Problem, Actual Impact	
86-039:	CRACKS FOUND IN WELDS	08-07-86
	Major Economic Damage Actual Problem, Actual Impact	
86-041:	PERSONAL CLOTHING CONTAMINATION	8-21-86
	Personnel Radiation Exposure Actual Hazard, Potential Exposure	
86-042:	LOSS OF BREATHING AIR TO PERSONNEL	8-21-86
	Loss Of Safety Function Potential Loss	
86-043:	MISSING O-RING	08-17-86
	Major Economic Damage Actual Problem, Potential Impact	
86-044:	PULL CELL PLUG	09/02/86
	Loss Of Safety Function Potential Loss	
86-045:	NO RPT COVERAGE	09-03-86
	Radiation Release Potential Hazard, Potential Release	
86-046:	EVFM CABLES NOT PER DRAWINGS	09/05/86
	Loss Of Safety Function Potential Loss	
86-047:	P-61 DAMAGED BY OVERSPEED	07/31/86
	Major Economic Damage Actual Problem, Actual Impact	
86-048:	NAK TANK T-920 OVERFLOW	09/05/86
	Major Economic Damage Actual Problem, Actual Impact	

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86-049:	BAD PHYSICS DATA DUE TO LLFM DEADTIME	9-9-86
	Loss Of Safety Function Potential Loss	
86-050:	MISSED SURVEILLANCE	09-16-86
	Loss Of Safety Function Potential Loss	
86-051:	EQUIPMENT FAILURE/ C5-S04	09/15/86
	Major Economic Damage Actual Problem, Actual Impact	
86-052:	MISCALCULATION OF FLOW VALUES	09-20-86
	Loss Of Safety Function Potential Loss	
	Major Economic Damage Actual Problem, Actual Impact	
86-053:	ELECTRICAL POWER TO C727B INCORRECTLY WIRED	09-29-86
	Loss Of Safety Function Potential Loss	
	Major Economic Damage Actual Problem, Actual Impact	
86-054:	POLAR CRANE OP. W/ PEOPLE ON BRIDGE	10/03/86
	Loss Of Safety Function Potential Loss	
86-055:	EXPANSION TANK OVERFLOW/ DG-1	10/03/86
	Major Economic Damage Actual Problem, Potential Impact	
86-056:	POSSIBLE FIRE, E-PRI-59	09/27/86
	Major Economic Damage Actual Problem, Actual Impact	
86-057:	MISSORIENTED ASSEMBLY	10-13-86
	Major Economic Damage Actual Problem, Actual Impact	
86-059:	LOSS OF COOLING H2O TO LIQUID RHEO.	10=27-86
	Major Economic Damage Actual Problem, Actual Impact	
86-060:	MISSED ENVIRONMENTAL SURVEILLANCE	10-29-86
	Major Economic Damage Actual Problem, Actual Impact	
86-061:	HIGH LEVEL RADIATION IN SRS	11-05-86
	Major Economic Damage Actual Problem, Actual Impact	
86-062:	TRANSFORMER C5545P C PHASE BUSHING LEAKED	11-10-86
	Major Economic Damage Actual Problem, Actual Impact	
86-063:	IMPROPER CTMT PENETRATION CLOSURE	11/12/86
	Loss Of Safety Function Potential Loss	
86-064:	DRIVER FUEL MANAGEMENT TECHNIQUES NOT ADEQUATE	11-19-86
	Loss Of Safety Function Actual Loss, Potential Demand	
86-066:	MISSED SCRAM BREAKER TESTING SURVEILLANCE	11/24/86
	Loss Of Safety Function Potential Loss	
86-067:	SOFTWARE ERROR IN RICS	12/10/86
	Loss Of Safety Function Potential Loss	

Appendix C: Listing Of The Event Impacts

86-068:	SMOKE DETECTOR CALS PAST DUE	12/11/86
	Loss Of Safety Function Potential Loss	
86-069:	WMM DRAPE CABLE DAMAGE	12-12-86
	Major Economic Damage Actual Problem, Actual Impact	
86-070:	GLYCOL LEAK IN CELL 497 FROM E-86	12-16-86
	Major Economic Damage Actual Problem, Actual Impact	
87-001:	CLEM 1/2 TON HOIST DAMAGED	01-02-87
	Major Economic Damage Actual Problem, Actual Impact	
87-002:	ACO-1 VERTICAL CUTTING DIFFICULTIES	01-09-87
	Major Economic Damage Actual Problem, Actual Impact	
87-003:	ROD DROP TEST NOT PERFORMED (SURV MISSED)	01-08-87
	Loss Of Safety Function Potential Loss	
87-004:	ZTO D-15 AUTO XFER CIRCUIT MALFUNCTION	01-18-87
	Loss Of Safety Function Actual Loss, Potential Demand	
87-005:	TAGOUT ERROR DAMAGES IEMC IODINE PUMP	01-22-87
	Loss Of Safety Function Actual Loss, Potential Demand	
	Major Economic Damage Actual Problem, Actual Impact	
87-006:	HAZARDOUS WASTE SPILL (FLOOR WAX)	01-26-87
	Major Economic Damage Actual Problem, Actual Impact	
87-007:	ARGON CART RELIEF VALVE INCORRECTLY SIZED	08-31-86
	Loss Of Safety Function Potential Loss	
87-008:	T-3 LINER DROPPED	01-27-87
	Major Economic Damage Actual Problem, Potential Impact	
87-009:	VIOLATION OF A CAUTION TAG	01-26-87
	Loss Of Safety Function Potential Loss	
87-012:	BREACH OF CTMT INTEGRITY (SC-27-6)	02-10-87
	Radiation Release Potential Hazard, Potential Release	
87-013:	SKIN CONTAMINATION	02/12/87
	Personnel Radiation Exposure Actual Hazard, Actual Exposure	
87-014:	SPILL OF CONTAMINATED WATER DURING SC-27-6	02-16-86
	Radiation Release Actual Hazard, Potential Release	
87-015:	E-215 OPERATED WITH SUCTION VALVE CLOSED	02-22-87
	Major Economic Damage Actual Problem, Actual Impact	
87-016:	RESIDUAL Na OXIDATION IN CELL 567	02-23-87
	Radiation Release Actual Hazard, Potential Release	

Appendix C: Listing Of The Event Impacts

87-017:	DG-2 AUTO-START FAILURE Loss Of Safety Function	Actual Loss, Test Demand	03-01-87
87-018:	LOSS OF POWER TO BUILDING 4790 Loss Of Safety Function	Potential Loss	02-28-87
87-019:	INADVERTENT HEATUP OF FROZEN Na VALVE Major Economic Damage	Actual Problem, Potential Impact	03-02-87
87-020:	HEATUP OF PTI N-130 WITHOUT A FREE SURFACE Major Economic Damage	Actual Problem, Potential Impact	03-07-87
87-021:	MASF FAN INSPECTION COVER PROBLEM Loss Of Safety Function	Potential Loss	03/09/87
87-022:	B-119 GROUND BUS ENERGIZED Loss Of Safety Function	Potential Loss	03-09-87
87-023:	AFFF FLOW SWITCH INOPERABLE Loss Of Safety Function	Actual Loss, Actual Demand	03-25-87
87-024:	O2 LOW OUT OF SPEC, TV-13 Loss Of Safety Function	Potential Loss	04-02-87
87-025:	TELEPHONE CABLE INADVERTENTLY CUT Major Economic Damage	Actual Problem, Actual Impact	04-06-87
87-027:	P-61 AUTO-STARTED AND WOULD NOT SHUT DOWN Major Economic Damage	Actual Problem, Actual Impact	04-09-87
87-028:	E-7 CCD'S CLOSED MOMENTARILY Severe Plant Transient	Actual Problem, Potential Transient	04-11-87
87-029:	Na FREEZE PLUG TEMP INCREASE IN CELL 492E Loss Of Safety Function	Potential Loss	04-15-87
87-030:	FIRE SPRINKLER SYSTEM INADVERTENTLY ACTUATED Major Economic Damage	Actual Problem, Actual Impact	04-28-87
87-031:	BLTC CABLES DAMAGED DURING MACHINE MOVEMENT Major Economic Damage	Actual Problem, Actual Impact	04-29-87
87-032:	TOLERANCE TOO LOW ON CIS H & V SETPOINTS Radiation Release	Potential Hazard, Potential Release	05/04/87
87-033:	DROPPED SOURCE DURING SC-99-7 Personnel Radiation Exposure	Actual Hazard, Potential Exposure	05/07/87
87-034:	SC-99-7 DID NOT REQUIRE FOLDOVER CHECKS Radiation Release	Potential Hazard, Potential Release	05/07/87

Appendix C: Listing Of The Event Impacts

87-035:	FGM DRIFT		05-13-87
	Loss Of Safety Function	Potential Loss	
87-036:	CDMF HOIST FAIL		05/20/87
	Loss Of Safety Function	Potential Loss	
87-037:	TAGOUT VIOLATED BY CONTRACTOR		05-28-87
	Loss Of Safety Function	Potential Loss	
87-038:	18B GRAPPLE NOT FULLY ENGAGED TO MFF-1A		06/03/87
	Major Economic Damage	Actual Problem, Potential Impact	
87-039:	DANGER TAG REMOVED PRIOR TO AUTHORIZED CLEARANCE		06-15-87
	Loss Of Safety Function	Potential Loss	
87-040:	UNCONTROLLED ENTRY INTO A RARZ		06-22-87
	Personnel Radiation Exposure	Potential Hazard, Potential Exposure	
87-041:	INADVERTENT SHUTDOWN OF PRI PUMP PONY MOTOR		06-25-87
	Major Economic Damage	Actual Problem, Potential Impact	
87-043:	IDS DECAY HEAT VERIFICATION INCORRECT		06-25-87
	Loss Of Safety Function	Potential Loss	
87-045:	TAGOUT ERROR ON DIESEL FIRE PUMP P-61		07-02-87
	Loss Of Safety Function	Potential Loss	
87-046:	120VAC ELEC LINE INADVERTENTLY SEVERED		07-10-87
	Major Economic Damage	Actual Problem, Potential Impact	
87-047:	ELECTRICAL SHOCK DURING FIRE DETECTOR REMOVAL		07-13-87
	Loss Of Safety Function	Potential Loss	
87-048:	FAILURE TO TIMELY EFFECT REPAIRS ON INOP FSD		08-04-87
	Loss Of Safety Function	Actual Loss, Potential Demand	
87-049:	UNAUTHORIZED REMOVAL OF TAGS FROM P-14		08-11-87
	Loss Of Safety Function	Potential Loss	
87-050:	LOSS OF MASF H/V --LOSS OF WATER		08/12/87
	Loss Of Safety Function	Potential Loss	
87-051:	ROD HEIGHT READINGS IMPROPERLY RECORDED		08-15-87
	Loss Of Safety Function	Potential Loss	
87-052:	CONTAMINATION FOUND ON EMPLOYEE'S SHOE & IN CTMT		08-17-87
	Personnel Radiation Exposure	Actual Hazard, Potential Exposure	
87-053:	CONTROLLED JUMPERS LIFTED WITHOUT AUTHORIZATION		08-18-87
	Major Economic Damage	Actual Problem, Potential Impact	

Appendix C: Listing Of The Event Impacts

87-054:	EMPLOYEE INJURY (LACERATED ELBOW)	09-04-87
	Major Economic Damage	Actual Problem, Potential Impact
87-055:	DATR SUPPORT ASSEMBLY DAMAGED DURING TRAINING	09-05-87
	Major Economic Damage	Actual Problem, Actual Impact
87-056:	PULL FORCE LIMITS EXCEEDED DURING PLUG REMOVAL	09-08-87
	Major Economic Damage	Actual Problem, Potential Impact
87-057:	CRANE LIFT EXCEEDED EQUIPMENT RATINGS	09-30-87
	Major Economic Damage	Actual Problem, Actual Impact
87-058:	DROPPED MOTA SPECIMEN	10/18/87
	Major Economic Damage	Actual Problem, Actual Impact
87-059:	INCORRECT ELEC TAGOUT FOR MAINTENANCE	10-20-87
	Loss Of Safety Function	Potential Loss
87-060:	HEATUP OF SODIUM SYSTEM WITHOUT A FREE SURFACE	10-25-87
	Major Economic Damage	Actual Problem, Potential Impact
87-061:	CONTROL VALVE FAILED	10/30/87
	Major Economic Damage	Actual Problem, Actual Impact
87-062:	LIMITS FOR SAFETY RODS NOT CONSERVATIVE	11-3-87
	Loss Of Safety Function	Potential Loss
87-065:	SISI TROLLEY CAMERA ENCOUNTERS OBSTRUCTION	11-10-87
	Loss Of Safety Function	Potential Loss
87-066:	MASF LOW BAY CONTAMINATION	11/12/87
	Personnel Radiation Exposure	Potential Hazard, Potential Exposure
87-067:	SISI TROLLEY BAFFLE HUNG UP DURING REMOVAL	11/10/87
	Loss Of Safety Function	Potential Loss
87-068:	FTP-2 PLUG STUCK	10/21/87
	Major Economic Damage	Actual Problem, Actual Impact
87-069:	MPS SAMPLE TRAIN COOLING FINS BROKEN OFF	11-17-87
	Major Economic Damage	Actual Problem, Actual Impact
87-070:	IMPROPERLY CERTIFIED RIGGING ITEM USED IN PLANT	11-17-87
	Major Economic Damage	Actual Problem, Potential Impact
87-071:	EMPLOYEE INJURY (LACERATION)	11-20-87
	Major Economic Damage	Actual Problem, Potential Impact
87-072:	MINI-TV DROPPED FROM 4-TON HOOK	11/30/87
	Major Economic Damage	Actual Problem, Actual Impact

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87-073:	SWIPE DEBRIS ON D9-2	12/08/87
	Major Economic Damage	Actual Problem, Actual Impact
87-074:	5 YEAR CRANE LOAD TEST MISSED	12-10-85
	Loss Of Safety Function	Potential Loss
87-075:	WELDING CONNECTOR SHORTED TO GROUND	12-14-87
	Major Economic Damage	Actual Problem, Actual Impact
87-076:	T/S SURV MISSED ON LOOP 2 PLUGGING TEMP	12-18-87
	Loss Of Safety Function	Potential Loss
87-077:	INSPECTION REQ'MENTS NOT MET ON HOISTING EQUIP	12-16-87
	Major Economic Damage	Actual Problem, Potential Impact
87-078:	MISSED PM ON M-137	12-30-87
	Loss Of Safety Function	Potential Loss
88-001:	EMPLOYEE SLIPS ON ICE	1-4-88
	Loss Of Safety Function	Actual Loss, Actual Demand
88-002:	NON-SEISMIC PRINTER INSTALLED IN SRM	1-8-88
	Loss Of Safety Function	Potential Loss
88-003:	IMPROPER STORAGE OF A PROPANE GAS BOTTLE	01-12-88
	Loss Of Safety Function	Potential Loss
88-004:	SCREEN FILTER DISCOVERED IN G-2 INTAKE SILENCER	1-15-88
	Major Economic Damage	Actual Problem, Potential Impact
88-005:	PROCEDURE VIOLATION DURING PM'S	01-19-88
	Loss Of Safety Function	Actual Loss, Potential Demand
88-006:	INJURY DURING ANNUAL N2 FLOODING CHECK	1-20-88
	Loss Of Safety Function	Actual Loss, Actual Demand
88-007:	ID 35 COOLING SHROUD DROPPED	01/22/88
	Major Economic Damage	Actual Problem, Actual Impact
88-008:	RX SCRAM DUE TO HIGH PRI FLOW	01-26-88
	Severe Plant Transient	Actual Problem, Potential Transient
88-009:	CIS VALVE FOUND OPEN	1-27-88
	Radiation Release	Potential Hazard, Potential Release
88-010:	PERSONNEL INJURY	01-30-88
	Loss Of Safety Function	Actual Loss, Actual Demand
88-011:	T/S SURV MISSED FOR LOOP 2 PLUG TEMP (EVENT 2)	01-31-88
	Loss Of Safety Function	Potential Loss

Appendix C: Listing Of The Event Impacts

88-012:	EMPLOYEE INJURY (DEGREASER IN EYE)	02-12-88
	Loss Of Safety Function Potential Loss	
88-014:	FAILURE TO FOLLOW O2 MONITOR PROCEDURES	02-11-88
	Loss Of Safety Function Potential Loss	
88-015:	ELEC SHOCK DURING SC-96-2	02-24-88
	Loss Of Safety Function Actual Loss, Actual Demand	
88-016:	EMAL DOORS BOTH OPEN	2-25-88
	Radiation Release Actual Hazard, Potential Release	
88-017:	MISSED SURVEILLANCE ON FIRE SPECS.	3-3-88
	Loss Of Safety Function Potential Loss	
88-018:	GAS TAG LEAK RATE TEST INADEQUATE	3-3-88
	Radiation Release Potential Hazard, Potential Release	
88-019:	CONTROL ROOM T/S SURV'S MISSED	03-07-88
	Loss Of Safety Function Potential Loss	
88-020:	EMAL DOORS OPEN AGAIN	3-11-88
	Radiation Release Actual Hazard, Potential Release	
88-021:	T-3 PHF DROPPED	03-14-88
	Major Economic Damage Actual Problem, Actual Impact	
88-022:	PIN WEIGHING SHROUD DAMAGED	03/18/88
	Major Economic Damage Actual Problem, Actual Impact	
88-023:	EMPLOYEE INJURY (CUT HAND ON MANIPULATOR)	03-18-88
	Major Economic Damage Actual Problem, Actual Impact	
88-024:	MISSED T/S SURV (CAPS EXHAUST MONITORS)	03-31-88
	Loss Of Safety Function Potential Loss	
88-025:	RARZ LEFT UNLOCKED AND UNGUARDED	04/01/88
	Personnel Radiation Exposure Actual Hazard, Potential Exposure	
88-026:	PERFORATED TUBING FOUND IN P-97	4-4-88
	Major Economic Damage Actual Problem, Potential Impact	
88-027:	RRSC LIFTED WITH WRONG LOAD CELL	04-15-88
	Major Economic Damage Actual Problem, Potential Impact	
88-028:	MPRT POWER SUPPLY CABLE DAMAGED	04-15-88
	Major Economic Damage Actual Problem, Actual Impact	
88-029:	TRUCK ACCIDENT AT DEWAR PAD	04-26-88
	Major Economic Damage Actual Problem, Actual Impact	

Appendix C: Listing Of The Event Impacts

88-030:	OVERLOAD OF RSB CRANE Major Economic Damage	Actual Problem, Actual Impact	04-28-88
88-032:	FAILURE OF CIS BKR Loss Of Safety Function	Actual Loss, Test Demand	5-10-88
88-033:	WORK PROCEDURE VIOLATION, Loss Of Safety Function	LIQUID RHEOSTATS Actual Loss, Potential Demand	05-09-88
88-035:	IMPROPER TAGOUT Major Economic Damage	Actual Problem, Potential Impact	05-11-88
88-036:	FTP#2 STUCK PLUG REMOVAL Major Economic Damage	SWIVEL EYE HANGUP Actual Problem, Actual Impact	5-13-88
88-037:	IMPROPER CLEARANCE OF TAGS Loss Of Safety Function	Potential Loss	05-17-88
88-038:	OVERPRESSURIZATION OF CELL 495B Major Economic Damage	Actual Problem, Actual Impact	06-07-88
88-039:	LOOP#3 SEC. DRAIN LINE CONFIGURATION Loss Of Safety Function	Potential Loss	6-9-88
88-040:	INOP. C.I. TEMP. ALARM Loss Of Safety Function	Potential Loss	6-15-88
88-041:	CTMT PENETRATION TEST VALVE LEFT OPEN Radiation Release	Potential Hazard, Potential Release	6-17-88
88-042:	NA SAMPLING SYS. BOUNDARY OPEN IN DEINERT CELL Radiation Release	Potential Hazard, Potential Release	6-20-88
88-043:	Na VALVE (85-V-90504) WAS OPERATED COLD Major Economic Damage	Actual Problem, Potential Impact	07-05-88
88-044:	CTMT PRESSURE XMITTER FOUND ISOLATED Loss Of Safety Function	Potential Loss	07-08-88
88-045:	PERSONNEL INJURY (PORTABLE MAN LIFT) Loss Of Safety Function	Actual Loss, Actual Demand	07-28-88
88-047:	LIQUID RAD. SPILL Radiation Release	Actual Hazard, Potential Release	8-11-88

Appendix D: Description Of The Software Used

Choice Of Software

The software was developed by the author of this report using the data base program VP-INFOTM and the spreadsheet program VP-PLANNERTM. These are marketed by Paperback Software International.

VP-INFO was chosen for the following reasons:

1. It reads and writes DBASE⁵ files.
2. It is capable of handling six (6) open files at one time which is three times that of DBASE III PLUS and allowed setting up a more flexible data structure.
3. It allows significantly more fields per record which was a necessity if the level three causal factors were to be in a single data file.
4. It has more powerful menu building routines such as moving bar menus which could be used to make the program more user friendly.

VP-PLANNER was chosen for the following reasons:

1. It reads and writes LOTUS⁶ files.
2. It directly reads DBASE files into its spreadsheet and can write DBASE files directly from the spreadsheet.
3. It allows the printing of graphs directly from the spreadsheet and prints them very rapidly.

General Description Of The Programs

A data base application was developed to handle the input of event information. This information was organized into eight (8) files:

1. The main file containing the Event Title, Number, and Date.
2. A data file for the first level causes for each Event.
3. A data file for the second level causes for each Event.
4. A data file for the third level causes for each Event.
5. A data file for the first level impacts for each Event.
6. A data file for the second level impacts for each Event.
7. A data file listing the Event Title, Number, Date, and all of the causes for all three levels.
8. A data file listing the Event Title, Number, Date, and all of the impacts for all three levels.

⁵ Trademark of Ashton-Tate Company.

⁶ Trademark of Lotus Development Company.

Description Of The Software Used

The strategy employed was to use a relational structure for files 1 through 6 in which the files were related by the Event Number. Files 2 through 6 contained numerical data which represented the number of times a given cause had been attributed to the specific event. In other words, these files were arrays of numbers whose position in the array represented a causal factor, and whose value represented the number of times that factor was relevant to the event. The use of an array made programming easier in that the causal factors could be referred to as {FILENAME}(X) where {FILENAME} represents the name of the file and (X) represents the array position of the desired factor in the file. This saved a great deal of typing of distinct variable names and greatly reduced the length of the program since each level only required one line of code to update the factor total instead of having a large selection structure to assign the value to the correct variable name. In addition, this provided for a great deal of speed improvement over the other method.

The input of information to the program was done by entering the Event Title, EFS Number, and Date of Event into a form on the screen. After this, a series of moving bar menus allowed choosing the various causes and impacts. Since menus were used, typing the causal factor or impact category was not required; the selection was made by moving the cursor to the desired choice and pressing the ENTER key (the option remained to also type the number of the desired choice). The menus followed the logic of the flow charts such that when a given first level cause was selected only those second level causes relevant to that cause were shown on the next menu. Provision for editing mistakes was provided, but the data files became irreversibly corrupted by a resident program running on the borrowed PC. A work-around was available with manual manipulation of the files.

Once the information was input to the program, file 1 contained the textual information about each event, and files 2 through 6 contained the numerical representation of the cause and impact data. After all events were entered, two additional programs were used to convert the numerical information into the text files that are listed in Appendices B and C. The advantage of this process was that the entire causal factor description did not have to be typed each time it was assigned to an event, and that the text form of each causal factor was always exactly the same to allow sorting the data or finding all records of a given type at a later time.

Files 2 through 4 were read into a spreadsheet which had been previously set up with the proper column headings and preset column summation formulas. Similarly, Files 5 and 6 were read into a second spreadsheet. The first spreadsheet contained all the cause information at each of the three levels. Each level occupied a separate section of the spreadsheet which allowed examining the data at each level. These values provided the inputs for the

Description Of The Software Used

graphs used in this report. The graphs were printed and converted to overhead slides for the presentation. While VP-PLANNER graphics print very rapidly, their quality is inferior to LOTUS graphics, so after the presentation, when additional time was available, the two spreadsheets were stripped of their VP-PLANNER specific codes and read into LOTUS and the graphs regenerated. WORDPERFECT 5.0⁷ was used to develop this report since it reads the various file formats created by the programs used, can integrate text and graphics, and supports both dot matrix and laser printers.

⁷ Trademark of Wordperfect Corporation.

Internal Distribution

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SV Doebler	N2-34
RL Dugwyler	N2-34
RH Davis	N2-34
JR Ewalt	N2-04
EF Gray	N2-35
GL Greene	N2-40
GB Griffin	N2-34
ML Grygiel	S6-65
DG Hamrick	N2-34
LE Harville	N2-34
DB Klos	R2-79
EE Leitz	R2-42
JM LeMarr	N2-34
DM Lucoff	N2-34
PC Miller	N2-04
T. Morton	N2-40
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JL Rathbun	N1-72
RD Redekopp	N2-33
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