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R.M. Kacich

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TO: E. J. Mroczka

September 19, 1991  
NED-91-MVB-049

FROM:

*M. V. Bonaca*

M. V. Bonaca

Chairman

NE&O Performance Task Group

Ext. 5927

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SEP 23 1991

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SUBJECT:

NE&O Performance Task Group Report

R. M. KACICH

SEP 23 1991

Attached please find the subject report.

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On behalf of the Performance Task Group, I want to thank you for the opportunity you gave us to participate in such an important endeavor. Such participation allowed each one of us to personally grow and to develop a broad sense of how our company operates and interacts. In this process, the Group learned a lot.

As a measure of the importance that we attached to this endeavor, we collectively expended over 2,000 manhours in Task-related activities.

The Group suggests that this report be distributed to NE&O Director level personnel and above.

We stand ready to support you in the implementation of those recommendations you will endorse. Please let us know if we can be of further assistance.

MVB:tds  
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cc: P. A. Blasioli  
F. K. Dacimo  
J. J. Festa  
M. S. Kai  
M. Kupinski  
R. A. Place  
D. J. Ray

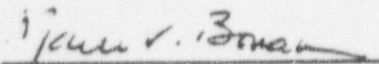
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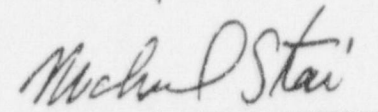
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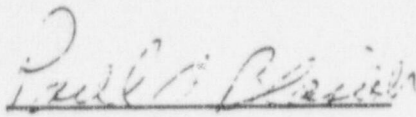
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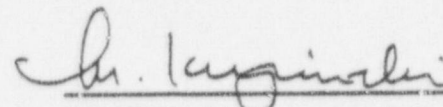
NE&O PERFORMANCE TASK GROUP REPORT

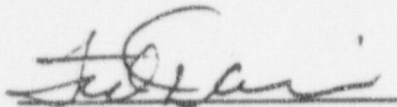
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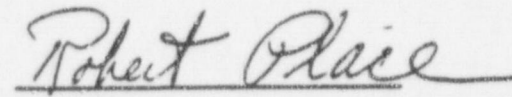
  
M. V. Bonaca, Chairman

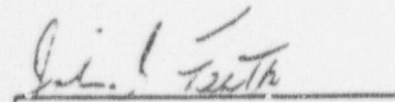
  
M. S. Kai


  
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NEO PERFORMANCE TASK GROUP REPORTFOREWORD

By the nature of the charge to analyze instances of poor performance, a report such as this focuses only on the negative aspects of performance, while the positive ones are not recognized. Notwithstanding these considerations, the NE&O Performance Task Group undertook this task of a critical and candid self-assessment in the spirit of seeking opportunities for improvement. But, in writing the results of our work, the unbalanced perspective this report provides of NE&O's performance became apparent.

Therefore, the Task Group felt compelled to write this foreword in order to emphasize that this report only speaks of NE&O activities that could and should have been better. Ironically, many of the past problems discussed in this report were identified because of the very quality, acuity and insight of the NE&O people, characteristics which are a recognized strength of NE&O, and because of the unqualified charge NE&O management has given its people to identify and resolve safety and performance issues.

The Task Group hopes that the insights and recommendations of this report will be received in the same spirit in which they were developed: solely as a means of making our good organization even better.

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## 1. INTRODUCTION

On May 14, 1991, the NE&O Performance Task Group was charged with the responsibility of evaluating NE&O performance from January 1, 1980 to the present in order to identify causes of performance issues and to recommend corrective actions.

Since the key motivating factor behind this charge was a concern by management with an increasing number of performance issues, the Task Group first considered assessing if NE&O performance over the past 18 months had degraded. This undertaking was soon abandoned, as it was believed that it would represent an almost impossible task against an elusive reference point of performance. A performance trend during the period to be analyzed is difficult to establish because internal and external performance criteria are rapidly changing: industry standards and internal expectations have steadily increased, the NE&O threshold for raising and reporting safety issues has been lowered, and the ability of the NE&O staff to understand issues and identify problems has significantly increased. Also, sensitivity to safety/performance issues has been heightened by NE&O management openly and repeatedly encouraging NE&O personnel to raise safety and technical issues. This increased sensitivity, combined with the increased engineering capabilities of the NE&O staff, has uncovered problems in areas that have been unquestioned for a number of years. Furthermore, the Task Group believes that external concerns with NE&O performance are amplified by the allegations and related issues.

Nevertheless, the Task Group recognizes that performance issues do exist, and that there is, at least, a perception of degrading performance. The enforcement actions against our nuclear units over the past 18 months, in many cases, involve issues of substance, and their frequency over the same period has significantly increased. These performance issues are visible and need to be addressed now. The search for performance issues was undertaken by the Task Group in the awareness of the recent NE&O reorganization and of the opportunity it offers for significant improvements in the engineering area. Recent changes in the focus of the Configuration Management Program in the direction of integrating safety requirements with procedures, design bases and engineering programs also offers significant opportunities for improvement. Finally, the initiatives underway at the Millstone Station as part of the Millstone Station Performance Enhancement Program are recognized as addressing areas of poor performance.

In our search for root causes of instances of poor performance, the Task Group attempted to go beyond a simple analysis of performance events, in order to search for those causative factors which may be traceable to the NE&O organization and its culture. In other words, an attempt was made to go beyond the



commonly identifier root causes which typically identify problems and corrective actions at the personnel or first and second level management only, in order to find the causative factors traceable to our culture, to the NE&O and NU program and to its evolution in recent years. It is recognized that as we moved farther away from quantitative performance data, this search became more judgmental and qualitative. Nevertheless, this search was supported and validated by many individual and group interviews with individuals who, because of their current/past association with NU, were considered by the Task Group as capable of providing significant insights on NE&O current and historical traits, culture and characteristics. Although more difficult to identify than immediate root causes, these causative factors, deep-seated in the culture of the organization, constitute major components of the true underlying causes of poor performance issues as presented by the quantitative analysis.

The Task Group believes that NE&O is a strong nuclear organization, is staffed with highly qualified and motivated personnel, has the potential for being an excellent nuclear organization, and that some of the changes and programs already underway, combined with action on the insights and recommendations provided by this group, will help further improve this organization. The Task Group believes that part of the weaknesses we have identified in this report have existed for some time but have become more visible to us because we have become better at identifying them, and less tolerant of accepting them. These are essential traits of a strong organization and provide the foundation for the improvements recommended in this report.

It should be remembered that any effort, like the one undertaken by this Task Group, can not generate a blueprint for success. Rather, the insights and examples identified should be expanded and considered in a broad sense to generate true solutions. This kind of thinking we call programmatic. We have developed broad recommendations that speak to culture, organization and approaches. Certainly, we have also identified specific recommendations where we saw them. However, we are relying upon NU and the NEO organization to identify the full spectrum of changes needed to address the performance issues we have identified.

## 2. APPROACH USED TO EVALUATE NE&O PERFORMANCE

The charter of the NE&O Performance Task Group was to critique NE&O performance since January 1990, and to propose measures to enhance performance. The group was charged with reviewing past events resulting from instances of poor performance in order to identify underlying causes and to evaluate existing programs and their adequacy when instances of poor performance could be traced back to weaknesses in such programs. Since these programs are the expression of the plan implemented by management to support operations of the NU nuclear units, their critique ultimately speaks of the overall NE&O nuclear program, its strengths and weaknesses, culture, historical traits and current characteristics. Therefore, in order to identify the true underlying causes of performance issues, a detailed analysis of performance data needs to be complemented by an understanding of current and historical traits, culture and characteristics of NE&O which may constitute underlying themes on performance issues.

This understanding cannot be developed from an analysis of performance data alone, because the analysis of data often points to potentially different and multiple contributors and it is difficult, from this analysis alone, to understand what the true underlying cause may be. In addition, analysis of instances of poor performance typically traces back the causes to local program implementation, procedural deficiencies or personnel error. Therefore, corrective actions typically only affect working level personnel or local management, because links to the higher level corporate culture, if they exist, are more difficult to identify.

And yet, corporate characteristics heavily influence performance. An understanding of the culture is important to help identify underlying themes on performance issues.



Therefore, the Task Group analysis was performed in three steps:

1. Individual performance issues were evaluated in order to identify common causes and recurrent themes (quantitative analysis).
2. A perspective of current and historical NE&O traits, culture and characteristics which may constitute underlying themes on performance issues was developed (qualitative analysis).
3. An attempt was made to detect links between (1) and (2) wherever (2) appeared to provide the underlying causes to performance issues identified in (1) (integration of qualitative and quantitative insights).

The "quantitative" analysis first involved the identification of performance data, records of events and results of evaluations identifying instances of poor performance, which have occurred since January 1, 1990. Documents reviewed included: Trends of Enforcement Actions, Emergency License Amendments, Enforcement Conference Packages, NEB Annual Evaluations, Licensee Event Reports, Quality Services Department (QSD) audits, INPO evaluations, SALP reports, INPO and NRC indicators, Reportability evaluations, Justifications for Continued Operation/Operability Determinations (JCOs/ODs), Independent Safety Evaluation Group (ISEG) and Human Performance Evaluation System (HPES) reports, and reports from focus groups.

Given the amount of data to be reviewed and investigated, two subgroups were formed, each charged with reviewing and evaluating approximately one half of the performance data. Group A was charged with reviewing Emergency License Amendments, Enforcement Conference Packages, LERs, JCOs, and ODs, specifically evaluating performance events. Group B was charged with reviewing observations of performance as documented in QSD audits, INPO evaluations, SALP reports, ISEG and HPES reports. All members were tasked with reviewing NRC trends, trends in enforcement actions, NRB annual evaluations, INPO indicators, and results of other Task Groups. Each group of reviewers was selected to ensure that cross-sectional representatives of the NE&O organization would review the performance information in as informed and unbiased manner as possible.



During this review process, underlying reasons or causes of events were grouped, and recurrent themes were noted.

For each "event" in question, it was first determined if a performance issue was involved, i.e., if the event could have been avoided by better performance. When a performance problem was identified, the root cause or causes of the event were noted. Given the large amount of data being reviewed, an independent investigation of every event could not be performed. Therefore, the Task Group often started from previously performed evaluations, such as those documented in LERs, to reach conclusions on underlying causes of events, although an effort was made to go beyond the existing documented assessment.

On the positive side, the Task Group members have first hand knowledge of many of the events being reviewed, such that personal insights were offered, discussed and shared with the other members of the Task Group. There may be isolated instances where the specific root cause was not correctly identified by the Task Group. But given the large number of data and events being reviewed and the collective knowledge of the Group, we believe that the significant recurrent causes of poor performance were properly identified.

The qualitative evaluation was performed by collecting, discussing and interpreting the individual perspectives of Task Group members and selected interviewees on underlying issues affecting NE&O performance. Individual perspectives of Task Group members were integrated through the nominal group technique. Interviews were held with individuals who were believed to be capable of providing insightful or more objective perspectives of NE&O performance issues. This overall subjective evaluation paralleled the analysis of the events previously described. The evolving analysis of actual performance data affected and modified some of the individual Task Group members original perspectives and beliefs; therefore, the integration of the efforts described as quantitative and qualitative evaluations began to take place during the analysis of performance data, and was completed at the end of the analysis effort, when the "links" discussed above were sought by the group.

The Task Group took full advantage of its diverse expertise and experience and its first-hand knowledge of performance events. Each member participated in the three-week intensive effort of reviewing and categorizing documents where performance issues were identified. The Task Group felt an obligation to test and validate each conclusion of the sub-groups. Many hours were spent in meetings and interviews in developing the qualitative analysis. Finally, considerable thought and review has gone into putting the insights and conclusions on paper. While this report was developed in only four months, it is estimated that over 2,000 man-hours of effort were contributed by the combined group. The Task Group believes that the effort and commitment made by each member has resulted in a valid assessment of the performance issues.

### 3. QUANTITATIVE EVALUATION: ANALYSIS OF DATA

Common causes of performance issues identified by the analyses of performance events and observations completed by Groups A and B (See Attachments 1 and 2) were combined by the Task Group. The analyses performed by Groups A and B had clearly identified dominant categories of common causes: discussion by the combined group of significant examples from each subgroup "bin" or category allowed us to merge dominant categories (high numerical score) from the two subgroups into common Task Group categories. Group A and B categories with low numerical scores were discussed and incorporated into the major Task Group categories, where one existed, or dropped altogether as they represented isolated instances of low significance.

Four major categories of performance issues were thus developed. The four major categories where opportunities for improvement were identified from the data analysis and combined review process are:

- o Programs and processes
- o Program focus and prioritization of resources
- o Disposition of hardware limitations
- o Individual performance

The next four sections will describe, in detail, the specifics associated with each performance category.

#### 3.1 PROGRAMS AND PROCESSES

Some of the events and observations analyzed are at least in part attributable to inadequacies in NE&O engineering and operation support programs, processes, and weaknesses in programmatic thinking.

In discussing engineering and operation support programs, we should see them not as isolated programs, as they occasionally appear to be, but integrated, such that all competencies, jurisdictions and uses are reflected and satisfied, and lapses and errors are prevented. In this sense, Equipment Qualification (EQ), Fire Protection, High Energy Line Break (HELB), Post-Accident Monitoring (i.e., Regulatory Guide 1.97), Material and Equipment Parts List (MEPL), Emergency Operating Procedures and Setpoint Control should be better integrated with the



Design Basis and the Safety Analysis and procedures under the larger umbrella of Configuration Management (CM). Therefore, breakdowns among EEQ and EOPs, Design Basis, and Safety Analysis, can be appropriately recognized as breakdowns in CM.

In discussing engineering and operations support processes, we speak of those processes established to assure that plant changes, maintenance, surveillance, and operations activities are executed in such a way as not to cause any breakdown in CM: if the design basis of the plant configuration is maintained during the execution of these activities, then the plant is modified, maintained and operated consistently with all commitments and expectations. CM programs assure fulfillment of all of our design commitments; processes are the checks and balances and good practices we have established to control our activities, such that the integrity of the CM can be maintained.

An example of weaknesses in engineering process and support programs, coupled with weak programmatic thinking, can be seen in the Millstone Unit #2 LER 90-10 regarding the modification of a door without considering the HELB requirements. The key process weakness that can be identified is the absence of a written functional plan identifying all the expected door requirements, including those imposed by HELB. Such a plan could and should have been evaluated by a reviewer to assess the consequences of the door modification. In this case, a weak engineering/modification process caused a CM breakdown.

Similarly, although the Millstone Unit #1 traveling screen collapse event appears dominated by the operator failure to follow procedures, the other programmatic failures that contributed to this event cannot be overlooked:

- a. NE&O did not take a standard approach among the units in deleting the trip. This is an example of a programmatic weakness.
- b. The removal of the trip, not considering critical aspects of nuclear safety, failed to recognize weaknesses imbedded in the new configuration. This is an engineering process weakness.

Weaknesses in the engineering process and CMP deficiencies are recurrent root causes in other significant events analyzed. For example, the discovery that house heating steam line breaks had not been adequately accounted for as a basis of Environmental Qualification (EQ) at three of our units identified weakness in the engineering process developed to implement the environmental qualification program, in the CM, and lack of focus (discussed in Section 3.2) that lead to the 1990 "fire drill", when the 1988-89 Millstone Unit 2 SSFI had already identified concerns with High Energy Line Break (HELB). Granted, in part, this overall problem was attributable to over relying on NRC direction to use the 1975 HELB work as a basis for EQ but, ultimately, we ended up with the problem.

The engineering weakness is highlighted by the lack of a functional specification clearly interpreting and identifying the requirements and the bases for EQ; a program is underway to correct some of these problems through a common effort between the Safety Integration Section and EQ. The CM weakness is highlighted by the modifications of some piping supports which were performed without evaluating the effects of such modifications on the HELB program. Another past example of these weaknesses is provided by the clean-up system isolation valves issue at Millstone Unit #1. Other examples are provided by the Millstone Unit #1 issues raised during the recent startup, which highlighted weaknesses in HELB, EQ, Regulatory Guide 1.97 compliance, and cable separation.

Similar examples of CMP and engineering process weakness are the overloading of the gas turbine at Millstone Unit #1: the engineering process did not integrate the Safety Analysis requirements with equipment limitations and procedures. Corrective action on this weakness is being taken. Similar examples are provided by the overloading of the diesel generators at CY, by the design weaknesses in the automatic initiation of auxiliary feedwater at CY, and by the LPCI heat exchangers problem at Millstone Unit #1. The detailed analysis identified more similar problems, but those discussed clearly suffice, and are sufficiently significant, to demonstrate a clear link between a significant category of events of poor performance and weaknesses in the CMP and in the engineering process.



Some of the events classified in this category are a demonstration of lack of cross-standardization among the NE&O operated nuclear plants. The NE&O nuclear program occasionally emphasizes the diversity of our nuclear units, rather than take advantage of the similarities; and so the units are not only supported by different support programs, but also do not take sufficient advantage from lessons learned from the experience of the other NU plants.

Further, as pointed out in Attachment 2, weak or cumbersome administrative programs, or weak procedures that implement such programs, contribute to personnel error. The root causes and contributing causes of the example of the 55 gallon drum of contaminated water-oil mixture described in Attachment 2 did include personnel error, but also included programmatic weaknesses. This example clearly pointed to weaknesses in the Chemistry labeling system and in verification. More importantly, the fact that control of waste oil is spread over several groups, some of which have no particular expertise in disposing of hazardous waste, identifies the inherent vulnerability of this program. The solution recommended by the HPES report was to assign responsibility to one group only.

The INPO evaluation of the hazardous chemicals program confirms the same problem, i.e., weak or cumbersome administrative programs, and provides analogous observations. INPO also noted similar problems in the following station programs:

1. Safety Tagging
2. Foreign Material Exclusion
3. Contamination Control
4. In-house Operating Experience Review (PIRs)
5. Industrial Safety
6. Automated Work Order Process

A more significant general observation is that the problem areas are visible, and thus may contribute to the perception that station management does not view them as important. The INPO evaluator's observation of one inch of standing water in the hazardous chemicals storage building, causing significant corrosion to the bottom of the cylindrical containers, may give the perception that compliance with station requirements for storage of cylinders is unimportant. This shows how program weaknesses can contribute to procedure non-compliance.



As we identify process weaknesses to be corrected, we feel compelled to recognize the strengths already active at the working levels. Our people are recognizing the need for operating through correct interfaces, and it is the insight they have developed, in the way of interpreting the plant support programs, that makes NE&O so effective in identifying weaknesses and in resolving them, thus compensating for program weakness. The Task Group believes that the problems we are identifying in our units are not unique to our plants, but we have become more adept at finding them and, in this, we may lead the rest of the industry.

### 3.2 PROGRAM FOCUS AND PRIORITIZATION OF RESOURCES

Many performance events could have been avoided by better planning, better management focus, better coordination and better priority setting at all levels. The recurrent theme behind these events is lack of sufficient resources being applied with the proper level of priority and attention. While there may be some cases where this can be viewed as an excuse to justify poor performance, in other cases, it is a reality. Lack of resources at the local level may mean that resources have not been appropriately allocated on a priority basis, or that, in the aggregate, NE&O doesn't have enough resources to accomplish everything the way it should be done, or a combination of both. The conclusion is that the line organization cannot cope with this resource issue on its own. This issue must be addressed at the highest level of NE&O to ensure that expectations are balanced with resources. Sending ever-increasing, top-down commitments with decreased resources, as is usually the case, results in an unmanageable situation.

Types of events falling in this category are failed surveillances where the equipment had consistently shown little margin over the surveillance acceptance criterion, and all that was necessary was recalculating a more realistic acceptance criterion. An example of this type of problem is the Millstone Unit #3 Supplemental Leak Collection and Release System (SLCRS) which had consistently shown little margin over the Technical Specification (T.S.) surveillance acceptance criterion. In early 1990, the surveillance was failed and an emergency T.S. waiver was required: the acceptance criterion was recalculated, and the new value allowed plenty of margin to the existing system. Other similar situations required T.S. waivers over the past eighteen months.

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Another group of similar events centers on known inadequate Technical Specification action statements that if not modified, may cause unnecessary plant shutdowns -- may unnecessarily prevent startup. Two times, this situation required waivers of Technical Specification action statements for Millstone Unit #3. In one instance, an NRC generic letter (87-09), issued in 1987, recommended to all licensees improvements to Technical Specification action statements that would allow more flexibility in changing modes and in startup with selected inoperable equipment. A Technical Specification review was initiated that was still ongoing in 1990 when Millstone Unit #3 could have taken advantage of this improvement; instead, plant restart required another waiver of Technical Specifications.

More significant performance events that fall in this category include the Millstone Unit #1 non-conservative high steam flow setpoint, which took from the April, 1987 G.E. information letter to March, 1990 to reach closure. The CY concerns related to loss of control air and its impact on the AFW system were raised by the PDCR Task Force in 1985, and were not validated until 1990; validation of concerns required a JCO that would allow CY operation in a state of reduced margin one full cycle.

Other examples include the PRA identified concern with separation between high and low pressure safety injection piping at Millstone Unit #2, which was identified in the fall of 1990 and was closed only in July, 1991 in spite of significant pressure to close the issue; the Design Basis Reconstruction Program identification of the heat exchanger limitation at Millstone Unit #1, which required over one year before it was realized how significant it was, and was not identified through the normal process for resolution of discrepancies; the HELB concerns identified by the 1988-1989 Millstone Unit #2 SSFI, which were not timely addressed to recognize the heating steam line break concerns; the Design Basis Reconstruction documents, which stay for indefinite periods of time in Engineering waiting for review, and which, in turn, Engineering does not use completely because they have not been reviewed.

The conclusion is that some important tasks do not get completed in a timely fashion. This situation is exacerbated by two factors: on the one hand, decreased resources; on the other hand, raising external expectations and an increasingly questioning attitude encouraged by NE&O management at the very time when resources necessary to address identified problems are



ever less available. The in-house SSFIs stand out as an example of a strong commitment to identify problems, followed by a weak effort to disposition, if significant resources are required (i.e., MP#1: FSAR upgrade, setpoint control, MP#2:HELB).

### 3.3 DISPOSITION OF HARDWARE LIMITATIONS

A significant set of events seem to exhibit the recurrent theme, that the hardware limitations or technical problems leading to the performance event were previously known but were not thoroughly resolved, or were inadequately dispositioned, thus leading to the subsequent failure or performance event noted now.

For many of these situations, compliance with the letter of the regulation may have been established or it was believed to be established, but the lack of sound technical dispositioning caused these technical problems or hardware limitations to surface again and again. Examples of events in this category are the Millstone Unit #3 condensate piping rupture, where a 1983 surveillance program, chosen over the hardware solution, was later inadvertently dropped, thus leading to the piping failure. Although the surveillance commitment was inadvertently dropped, the process assigned to track and implement the surveillance was weak.

Of a similar nature are the recurrent concerns with the CY auxiliary feedwater system, surfacing since 1980 and leading to a "fire-drill" in 1990; the Millstone Unit #1 LPCI heat exchanger issue that has had repeated flare-ups over the past six years; and the service water issues at CY and Millstone Unit #3. Other similar events were identified by the analysis. A common thread in all of these events was that these issues, or marginality, or potential problems, some of which were known by cognizant individuals, were defended "as is", and became issues for action, or reaction, only when an LER or a reportability evaluation exposed a new aspect of the problem, which made it again unacceptable, often resulting in a new series of limited corrective actions to remedy underlying inadequacies. This situation is especially true for the two older units in our system.



A recurrent theme behind these events is the resource prioritization issue. Inadequate resource prioritization appears to foster an environment and a culture where ----- strives to "make do" with known equipment limitations. There are times when defending the status quo is entirely appropriate, but there should be no pressure to do so without exploring the technical merit. Our current circumstances may promote a culture where this may become the accepted approach even when it should not be; and the acceptance of these limitations makes it likely that the same problem, or some related problem, will surface again.

### 3.4 INSTANCES OF POOR INDIVIDUAL PERFORMANCE

Categories identified by Groups A and B as inadequate technical review, procedure non-compliance, lack of attention to detail, communication problems and mind-set were combined into the overall category of poor individual performance. All these events are typically classified in the source document as personnel error. For those events, it is often difficult to separate true personnel error contribution from the degree to which an inadequate program or weak procedures may have set the individual up for failure. However, the Human Performance Enhancement System Reports (HPESRs), the INPO and SALP evaluation, and the Quality Service audits, combined with individual Task Group members first-hand knowledge of some of these events resulted in a reasonable apportionment of responsibility for performance events between personnel error and program/procedure weakness.

The Task Group believes that there are several underlying causes of these problems. A significant fraction is due to weak procedures, or procedures that do not have adequate human factors considerations. Additionally, a significant fraction is due to overly-cumbersome administrative programs that make performing work very inefficient, for which non-compliance to the program is tolerated by some managers and supervisors. Finally, a small fraction is personnel error, even given adequate procedures, training and clear delineation of expectations. All of these elements contribute to personnel error and, thus, must be corrected if poor personnel performance is to be improved. The example of the task of repacking a 3/4" valve provided in Attachment 2 illustrates the complexity of this issue. So does the review of the disposal of the 55 gallon drum of contaminated water-oil mixture also described in Attachment 2.

-15-

The Group B analysis of Attachment 2 provides insights in the contribution of a cumbersome program to individual error, but also concludes that the largest number of occurrences from all events reviewed fall into the poor performance category.

A number of instances were noted where some plant supervisors observed, but did not correct, errors by personnel. Granted, in most cases, those were minor errors. However, this gives the impression that first line supervisors and management silently tolerate this situation. This is apparent also in NUSCO where QSD audits have identified failures to comply with NE&O procedures. This is indicative of a process breakdown but also is a failure of some supervisors and managers to enforce standards. Some supervisors approved calculations that did not comply with the procedures.

The Task Group believes that there are four contributing causes to this problem. First, some supervisors may be reluctant to correct errors because of the potential for confrontation that results in the destruction of their working relationship: these supervisors may not be adequately trained in providing feedback in a non-confrontational way and in applying discipline. This has been made increasingly difficult as a result of the allegations issue. Second, first-line supervisors need training in observation techniques which are not natural attributes but it is a skill that requires development and training. Third, some of the administrative programs and procedures are viewed as being cumbersome and a significant obstacle to accomplishing work. With selective non-compliance going uncorrected, the perception develops that full compliance is not important, and evidence shows that this may be a cultural problem within NE&O. Fourth, first-line supervisor presence on the floor is minimized by the overload of administrative duties imposed on most first-line supervisors.



4. QUALITATIVE EVALUATION:  
ANALYSIS OF ORGANIZATION AND CULTURE

In addition to the quantitative analysis described above, the NE&O Performance Task Group performed a qualitative analysis of NU's performance. This analysis consisted of three main parts: (1) the opinions and beliefs of the individual Task Group members collectively determined using the Nominal Group Technique (NGT), (2) input received from selected guest speakers who presented their views directly to the full Task Group, and (3) feedback solicited from interviewing several NE&O personnel by individual Task Group members. Although these three approaches involved different individuals at various levels in the NE&O organizational structure, as well as some individuals external to NU, the general conclusions of these three distinct approaches were very similar. Therefore, the Task Group believes that, although this part of our efforts was subjective in nature, the insights gained by this analysis represent an accurate assessment of some of the underlying causes of NU's performance issues.

4.1 NOMINAL GROUP TECHNIQUE (NGT)

Given the diverse and broad backgrounds and experience of the individual Task Group members, NGT was utilized to ascertain potential underlying causes of NU's performance issue. This technique resulted in a listing of broad-based causes. This listing became instrumental in all future efforts of the Task Group, and was continually referred to and refined as new data were developed. For example, this listing was augmented and revised based upon input and perceptions received from the guest speakers and interviewees.

4.2 INTERVIEWS WITH NE&O PERSONNEL

Task Force members individually conducted discussions with various NE&O personnel throughout the course of deliberations. Insights gained from these discussions were brought back to the full Task Group at subsequent meetings and used during the process of reaching qualitative analysis conclusions.



#### 4.3 GUEST SPEAKERS

It was considered that it would be extremely beneficial to have selected guest speakers present their viewpoints. To use this was deemed particularly beneficial to assure no significant underlying cause was missed, but also to test and validate the Group's findings. The informal and frank discussions with key individuals was much appreciated and greatly assisted the Task Force in reaching (and providing a high level of assurance of the accuracy of) the insights delineated below.

#### 4.4 RESULTS

##### 4.4.1 NU'S IMPACT ON NE&O.

The qualitative analysis paints the picture of an NU organization concerned with the financial aspects of the business, geographical expansion, cost containment and allegations. The dependence on a dominant nuclear program is naturally worrisome for the expenditures it imposes and the potential liabilities it represents. One conclusion of the Task Group is that, because of these reasons, NU's concerns with the liabilities and cost of NE&O override the interest in maintaining and supporting an excellent nuclear organization. Running an excellent nuclear organization is viewed as a "cost" issue. This is perceived throughout NE&O. The result of all this is that the top of the house seems more concerned about our nuclear program than interested in it, and the Task Group believes that this demoralizing perspective is felt, to varying degrees, at all levels of NE&O.

##### 4.4.2 NE&O'S DISTINCTIVE REQUIREMENTS

The Task Group believes there is a perception within NE&O that the present organization at NU does not fully recognize the long-term distinctive requirements and changing environment/regulations that makes a nuclear program dynamic, demanding special needs, and is unequatable to other sections of the company. Lower ratings from the NRC can result in costly, inefficient improvement programs that can have a significant financial impact on NU. Even a perception of degrading performance is harmful and should be corrected. Thus, maintaining excellence in performance is cost beneficial in light of risks to the general public and the financial risks to NU.

Because of the changing environment/regulations, maintaining excellence is a dynamic process. Industry and regulatory standards are improving and a long term commitment is needed to maintain excellence. The Task Group perceives that the emphasis on short term financial objectives has led to a culture where the special long term requirement for excellence in the nuclear programs is not recognized and a lower standard is, inadvertently, being allowed.

#### 4.4.3 NU's MICROMANAGEMENT STYLE

NE&O is being micromanaged in a manner which hinders local management and makes it appear powerless in the eyes of personnel. This results in senior management being involved in issues and decisions that should be left to lower level management in lieu of resolving more global and programmatic issues. Cost containment is exacerbating this situation. While our people understand and support the need to contain the cost of NE&O, top down micromanagement steps, not tempered by the judgment of local supervision, affect individuals in a personal way, and undermine morale and trust.

#### 4.4.4 NE&O NEEDS TO REDEFINE ITS VISION.

Vision should speak to where we are headed and where we want to be. The Task Group believes that NE&O personnel have been confused and demoralized by lack of an "excellence in performance" goal. All too often, excellence has been equated with cost: therefore, cost containment has been communicated and received as an acceptance of lower, though adequate, level of performance. The only consistent message forcefully received over the past four years is cost containment, and this has become the goal. Cost containment should be the way of life, not the goal of NE&O.

#### 4.4.5 NE&O NEEDS TO BE MORE PROGRAMMATIC.

The Task Group has reached the conclusion that NE&O has not been sufficiently programmatic. There has been a tendency to address individual events in isolation, rather than to look at these events collectively in terms of the process. Band-aid fixes to identified problems have been applied without regard to the global impact on the process. An example of a non-programmatic approach



is the large growth of NUSCO engineering without a plan that would focus and articulate this growth around the design change process required to adequately support the NU nuclear units. A design engineering group requires the establishment of formal processes centered around design control documents, in order to facilitate and control the design process. The problem resulting from this situation has been identified by the quantitative analysis and is discussed in Attachment 3.

The quantitative analysis also shows that this relative absence of formality has contributed to the weaknesses in the engineering programs, such as EEQ and HELB: A more detailed discussion of the examples presented by the engineering process deficiencies and, in particular, the HELB/EEQ program, is provided in Attachment 4. What may not be sufficiently understood is the actual waste of resources caused by an inefficient process which causes the same problem to surface again and again, with the resulting reactive environment and need for more resources. In addition, in some cases, weak programs and processes have led to a lack of clearly defined responsibilities and associated accountabilities. When individual expectations and accountabilities are not clearly delineated and understood, instances of weak performance will continue to occur.

In recent years, when resource reductions in the face of increasing industry expectations would have required a programmatic approach, based on a blueprint strategizing the NE&O future and allocating resources accordingly, NE&O was not sufficiently programmatic. The result is that cost reductions may not have been optimally allocated; efficiencies resulting from programmatic improvements have not been captured; and the workforce has not been rallied behind a program to improve NE&O in spite of cost reductions, but has been demoralized by the message that cost containment was trimming fat, fat that nobody could see because fat may be in the process, not in the individual workloads. The recent reorganization is a positive step, but the Task Group believes that it did not fully address all the engineering/programmatic factors and organize accordingly to that blueprint.



#### 4.4.6 NE&O NEEDS IMPROVED PLANNING.

Through the years, and often because of increasing demands and weak programs, processes and weak NE&O programmatic thinking, NE&O has become a reactive organization that does not effectively plan. This situation has been aggravated by reduced resources matched by increasing expectations at all levels. The focus of management should be to match expectations and resources: conversely, resources have been reduced but expectations have increased, as demonstrated by the fact that many new dictates from external organizations, such as NUMARC (the comprehensive procurement issue) and INPO (zero fuel defect goal) are committed at the higher level before full consideration is given to the reasonability of the dictate and to the resource issue. Execution of new tasks is then assigned through top-down commitments, generally without due consideration of the required resources, or what other work they will displace. Lower management is left to struggle with an overcrowding of commitments, and prioritization occurs at the local level only. The result is a top-of-the-house convinced that a new requirement has been properly addressed, and unaware of the consequences of the new assignment on previous commitments. The overall consequences of the overloading caused by this management approach are not appreciated. The results are that lower level management spends too much time managing and re-managing priorities instead of completing and closing issues.

The result of this situation is that NE&O management struggles to make do with available resources and meet schedules. The most natural way is to demonstrate that things don't need to be done, or to delay action, voluntarily or involuntarily. Compliance with the regulation is one way to demonstrate that something doesn't need to be done, even when good engineering solutions suggest that we go beyond compliance. Although compliance with regulations is necessary, it should not be construed as being sufficient to address all technical issues. This develops a culture where this may become the accepted approach even when it should not be. Therefore, internally-raised issues occasionally get little priority in resolution unless a regulatory issue is involved.

Ironically, the reportability process is then used to get questions answered, but the reportability process can only render a conclusion on regulatory compliance, subject to NRC review. This process delays resolution of internally-identified issues and gives the impression that regulatory compliance, or cost and schedule, are more important than sound engineering solutions to safety issues. NE&O planning should allow for improved handling of internally-raised technical issues.

To illustrate the complexity of this issue, the example is provided of the CY automatic initiation of auxiliary feedwater issue, which started in 1979, is still open, and has required a license amendment for this cycle, pending modifications of that system during next refueling. This is a good example of how we have postponed resolution. The details of this example are provided in Attachment 5.

The Task Group believes that improved planning, management focus and adequate coordination, supported by a better balance between resources and expectations, will be required to effect the necessary NE&O culture change required to improve performance in this area. In some areas, additional resources may be needed, in the short term, for improving programs in a timely manner.

#### 4.4.7 INSIGHTS ON INSTANCES OF INADEQUATE PERFORMANCE BY PERSONNEL.

The quantitative analysis has shown that, on the surface, personnel error is dominated by lack of attention to detail and failure to comply with procedures. However, there is a widespread recognition that current programs are illogical, cumbersome, and viewed as an obstacle to getting the job done; many procedures are weak and are not respected because they are there to interpret a cumbersome program; and some supervisors and managers silently tolerate this disregard for programs. Furthermore, it is noted that the NE&O procedures, in general, tend to place the burden of responsibility on individuals without adequate support programs.

Clearly, failure to follow procedures cannot be tolerated and must be corrected. But, first of all, respect for the overall program must be developed. The impression derived from many observations is one of cumbersome, inefficient and illogical programs, which are the result of growing expectations being addressed through a band-aid approach, without revisiting the overall program in order to make it more efficient and effective, and thus credible. Growing NE&O requirements have rarely been addressed programmatically, but one at a time, until the support programs have become close to unworkable.

Those programs which are not regarded with respect by personnel, combined with insufficient management presence on the floor and with morale problems, combine to create occurrences of disregard for procedures, apathy, lack of attention to detail, and lack of self-checking that ultimately may lead to personnel error.



Management attention to making programs and procedures more effective and efficient will be necessary for enhancing respect for the overall program. Top management presence to demonstrate interest in day-to-day work activities is necessary to build morale and eliminate apathy. Management belief in the programs being created will assure their effectiveness. Personnel will better understand management intent to eliminate sloppiness and to enforce adherence to procedures. The Task Group believes that relying on enforcement of procedure compliance through disciplinary actions alone cannot suffice because personnel error is not the dominant factor.

#### 4.4.8 PEOPLE ISSUES ARE AFFECTING INDIVIDUAL PERFORMANCE.

In many cases, workers see no opportunities for growth. Instead, they can only look forward to twenty to thirty years of doing the same jobs. In this situation, they eventually develop a lack of interest in their jobs. This is evidenced by a lack of self-checking and increasing errors. Innovative management approaches are needed to maintain worker interest in their jobs and improve morale.

The NU Human Resources Organization has studied the proposed work habits and type of worker NE&O can expect in the year 2000. This type of person will work for us 3 to 5 years and move on to another job or company. This has the potential to impact the NE&O performance because, without good programs/processes, the year 2000 worker will not be quickly productive nor will his experience be available for future reference.

#### 4.4.9 NU POLICIES ARE AFFECTING NE&O PROFESSIONALISM AND MORALE

A recognized strength of NE&O is the experience and capabilities of its staff. In order to maintain the excellence of its staff, NU policies must reflect the importance of this expertise in its treatment of its employees. Restrictions on travel have reduced our participation in industry groups and, in some cases, affected job activities. This reduces the opportunities for NU to benefit from the experience of other utilities, to benefit from improved communications with regulators, EPRI and INPO, to stay abreast of emerging industry developments and to benefit from the recognition as an industry leader. Further, other NU practices, such as



training, use of PC computers and overtime policies, promote the impression that NU does not value the professionalism and expertise of the NE&O staff. This is affecting morale and may be one of the factors affecting performance.

## 5. CONCLUSIONS

The conclusions naturally follow from the merging of the quantitative and qualitative analyses. The quantitative analyses have identified common causes and recurrent themes of instances of poor performance; the qualitative analysis provides insights into organizational traits which the Task Group believe constitute underlying causes.

The quantitative analysis, supported by the qualitative analysis, yields the following conclusions, which have been discussed in Section 3:

### 5.1 NEO Programs and Processes Need Improvement

The presence of some weak programs and processes demonstrate that NE&O lacks sufficient programmatic thinking. It has been noted that cumbersome administrative programs and procedure inadequacies have also contributed to personnel error.

### 5.2 There is a Lack of Program Focus And Prioritization Of Resources

NE&O has become a reactive organization, responding to the most immediate concerns without providing adequate prioritization of resources. Thus, recurring problems remain unsolved.

### 5.3 Instances of Hardware Limitations Affect Performance

In some cases, hardware limitations or technical problems were previously known but were inadequately dispositioned. Often, NE&O defers known hardware limitations until they result in an issue. Consequently, problems surface again and again and put the organization in a reactive response mode.

### 5.4 Instances of Poor Individual Performance Were Noted In NE&O

The dominant causes are attributed to weak procedures, overly-cumbersome administrative programs, and poor morale. Some managers and supervisors tolerate errors. In some cases, lack of clearly identified responsibilities and accountability compounds the problem.

Because of the number of instances of poor performance and the fact that these instances are not attributable to any one group within NE&O, the Task Group has concluded that there are cultural factors that are the deep-seated causes for the general problem areas identified above. The Task Group believe that the qualitative analysis of Section 4 provides these deep-seated causes. These causes relate to NE&O leadership and can be summarized as follows:

#### 5.5 NE&O Lacks True "Vision"

Vision should speak to where we are headed, where we want to be and how we are going to get there. NE&O must strive for excellence. Cost containment has been communicated and received as a necessary acceptance of lower, though adequate, level of performance. This has led to a tolerance of weak programs and processes.

#### 5.6 NE&O Direction Does Not Remain Focused

Conflicting directions are received faster than the organization can respond. Managers can not plan in an environment of constantly changing direction. The constantly changing direction contributes to a lack of program focus.

#### 5.7 NE&O Does Not Plan Adequately

NE&O has become a reactive organization. Lower management is left to struggle with an overcrowding of commitments and reprioritization occurs at the local level only. Improvement of long-standing problems in processes, programs and hardware are deferred in response to the most immediate commitment.

The Task Group has also concluded that the NE&O problem areas have been exacerbated by cultural factors attributed to NU. These insights are as follows:

#### 5.8 NU Has Affected NE&O's Performance

NU is focused on the financial aspects of the business, geographic expansion, cost containment and allegations, thus concerned with the challenge that NE&O represents to cost containment and corporate success. Considering the impact a nuclear program



can have, not only on the company but on our neighbors, it is important that NU management be totally committed to achieving excellence in our nuclear program. Further, considering the negative messages our people are constantly receiving from outside sources, it is important for NU management to be more supportive of our nuclear program. Without this, morale has been affected and, consequently, performance may be declining.

5.9 NU Does Not Fully Recognize the Distinctive Requirements of NE&O

The present culture at NU does not fully recognize the long term distinctive requirements and changing environment/regulations that makes a nuclear program dynamic, demanding special needs and is unequatable to other sections of the company.

5.10 NU Has Developed a Micromanagement Style That Hinders Local Management

Micro-management affects individuals in a personal way, undermining morale and trust. Further, it focuses management on details rather than on programmatic issues. This contributes to a lack of planning and prioritization of resources.

## 6. RECOMMENDATIONS

It should be remembered that any effort, like the one undertaken by this Task Group, can not generate a blueprint for success. Rather, the insights and examples identified should be expanded and considered in a broad sense to generate true solutions. This kind of thinking we call programmatic. We have developed broad recommendations that speak to culture, organization and approaches. Certainly, we have also identified specific recommendations where we saw them. However, we are relying upon NUJ and the NEO organization to identify the full spectrum of changes needed to correct the performance issues we have identified. The following recommendations are not listed in any order of priority.

### GOALS

- 6.1 A change in NE&O goals is required. The over-riding NE&O goal should be excellence in performance and not cost containment. Top ratings from SALP and INPO would be the natural result. This goal must be consistently communicated to all levels of NE&O. This recommendation goes much further than written goals, but encompasses the subtle and indirect messages sent to the NE&O organization by all levels of management as day-to-day business is evaluated.

### PLANNING/PROGRAMMATIC THINKING

- 6.2 Quality planning is needed for achieving the goal of excellence in performance. Planning needs to include concrete proposals for improving programs/processes, followed by execution of the proposals. The plans should focus on the elements required to make NE&O successful. In preparing these plans, NE&O should integrate all required work efforts and achieve concurrence on work priorities. The quality of inputs to the plan should be the focus rather than schedule for completing the plan. These plans should become the blueprint of how to support the goal of excellence in performance. The plan should clearly specify the tasks, responsibilities by department, and the expected results including completion dates. Delays in implementation of these tasks should be discouraged.
- 6.3 NE&O planning should be realistic and account for resource limitations. Resources have decreased but expectations have increased and management should accept the responsibility for matching resources and expectations.
- 6.4 NE&O should develop a culture in which all levels of the organization think programmatically.

#### PROGRAMS/PROCESSES

- 6.5 NE&O management should re-assess the existing programs, or lack thereof, in Engineering, Operations, and other support services (Security, Radwaste, Fire Protection, Hazardous Waste, Chemistry, etc.) and establish effective and integrated support programs, as required, to improve the organizational efficiency and to ensure execution of tasks in a correct and consistent manner.
- 6.6 NE&O management should establish engineering programs/processes that fully integrate all facets of engineering responsibilities within NE&O to better ensure that all design changes are executed correctly and consistently. This would require the establishment of an Engineering Design Control Manual (including functional specifications and equipment specifications) and an improvement to the current NE&O procedures. The Engineering Design Control Manual idea is further developed in Attachment 3.
- 6.7 NE&O management should continue to support timely completion of the Design Basis Reconstruction Program. The Design Basis modules need to become a design document. Internal resources need to be dedicated to complete the program and to facilitate timely review. Resources should be allocated to ensure the maintenance of these documents. In addition, the key role of safety analysis in providing the link of the analysis to equipment through the functional requirements needs to be an integral part of the Configuration Management Program.

#### TECHNICAL EXCELLENCE

- 6.8 NE&O management should be consistently responsive to resolution of internally generated issues. In fact, resolution of internally generated issues may require a higher priority, based upon merit, than those driven by regulatory issues. It needs to be remembered that our staff has a much greater insight and knowledge of our plants than the NRC and is much better at identifying safety and reliability issues. In addition, delaying resolution of internally identified issues give an implied message that safety is not as important as cost and schedule.
- 6.9 NE&O management needs to emphasize good engineering/technical solutions to issues and needs to move beyond legalistic arguments and regulatory compliance.



- 6.10 NE&O management needs to apply adequate resources to perform studies and programs. Engineering studies that attempt to look at future problems or resolve known marginality of equipment or known hardware problems and limitations receive a lower priority when compared with regulatory driven issues. Yet these programs and studies need to be done in order to avoid future regulatory driven issues.

#### MANAGEMENT INITIATIVES

- 6.11 Better ways of doing business need to be identified to improve the efficiencies of the cumbersome programs. Further, the initiatives to identify new tools to improve processes, like initiatives to address the Comprehensive Procurement Issue, including upgrading MEPL and adding Bill of Materials to PMMS, development of a Reliability Centered Maintenance program, development of a Fire/Safety Department at the Millstone Station and development of an automated tagging program, will improve performance.
- 6.12 Management needs to improve standardization within NE&O to take advantage of the lessons learned and to increase efficiencies. For example, considering the fact that there are approximately 10,000 procedures and forms at the Millstone station, it is clear that a significant reduction in the number of procedures can be achieved by standardization of common processes.
- 6.13 Clear expectations and accountability by all levels of management should be established to ensure compliance with policies and procedures. The Procedure Upgrade Program should be completed in a timely fashion and expanded to include verification and validation of all procedures. A station labeling program is needed to make procedure compliance easier.
- 6.14 The workload and complement of permanent supervisors should be examined in detail to increase the amount of time the first line supervisors can interact with their people. A study should be performed to determine the training needed for the NE&O first line supervisors to carry out their responsibilities. This program should be implemented in a timely fashion.

PROFESSIONALISM AND MORALE

6.15 Management should be proactive in establishing positive employee programs/policies for NE&O to recognize the importance of people in the success of NE&O. Training, travel and personal computer policies should be reviewed in order to re-establish a culture that encourages professionalism in our people. Personnel policies (i.e., pay grades, overtime, and relocation) should be reviewed to ensure that they are consistent with restoring a reasonably high morale within an experienced and professional staff. Better communications of goals and plans is needed to enhance confidence and trust in management. Innovative management approaches are needed to maintain workers' interest in their jobs and improve morale.

6.16 NE&O management should review the progress in implementing the above recommendations. This should occur in twelve (12) months. It is suggested, for continuity's sake, that the individuals who made up the NE&O Performance Task Group should be reconvened to conduct this review. Further, we recommend that similar self-assessments of NE&O performance be undertaken by appropriate NE&O management directly involved in the major engineering and operations processes on a periodic basis.

ATTACHMENT 1GROUP A ANALYSIS OF DATA

Group A was assigned to analyze the following documents for identification of performance issues:

- o Emergency License Amendments
- o Enforcement Conference Packages
- o Licensee Event Reports
- o Justifications for Continued Operation

In reviewing the events described in this data base, it soon became clear that those events which were performance related, fell into one of two general categories. The event was caused by either a personnel performance-related issue or a programmatic issue. That is, the root cause could be categorized or "binned" as either a personnel error or a program inadequacy. In order to gain further insight into the relevant performance issues, it was concluded that a further breakdown of these two major categories was required. A second review of the events resulted in a secondary categorization of the performance related events into sub-bins.

Within the inadequate program bin, four sub-bins were determined to have significance. These were Design Process/Control, Surveillance, Lack of Priority/Excessive Review Time, and Configuration Management Program. Under the Personnel Performance category, all three sub-bins had significance. These were Inadequate Procedures, Procedure Non-compliance/Attention to Detail, and Inadequate Technical Review. A brief discussion of each of the "significant" sub-bins is provided below.

1. Design Process/Control

This particular category falls under the programmatic inadequacy bin. This category captures events wherein the design process itself or control of the design process was inadequate. In general, the result of this deficiency is the implementation of a design change which places the plant in a condition of reduced reliability or reduced safety. Several examples are provided below for purposes of illustration.



- a. As reported in Millstone Unit #2 LER 90-10, the design of a HELB door was modified without consideration for the HELB requirement.
- b. At Millstone Unit #1, the automatic circulating water pump trip on high dP across the traveling screens was eliminated in order to reduce reactor trips. The automatic function was replaced with operator manual actions.

## 2. Surveillance

A review of LER's indicated a significant number of events caused by a programmatic deficiency in the area of surveillances. Although one might make a case that a large number of these events were in fact attributable to personnel error, when taken in the aggregate they appear to be more logically classified as a programmatic deficiency. In general, these events are missed surveillances or the inadequate/incomplete conduct of surveillances. One must question whether the surveillance program is of sufficient strength and structure to allow the workers to proceed on track, unencumbered by conflicting Technical Specifications or poor scheduling tools.

## 3. Lack of Priority / Excessive Review Time

This particular programmatic issue seems to point out that ours is a reactive company that doesn't get too excited over an issue until it becomes a "fire drill". It speaks to the need for a better means of planning, management focus, and priority setting at all levels. The following examples illustrate this point.

- a. At CY, the PDC Task Force Group, convened in 1984, identified a concern related to loss of control air and its impact on the AFW System. This was not pursued with the necessary priority. In 1990, the concern was validated and a JCO was then generated (LER 90-16).

- b. At Millstone Unit #1, a non-conservative h. steam flow setpoint existed since 1976. In April, 1987, GE issued an information letter pointing out the problem. Engineering verification did not take place until March, 1990. In this case, a potential deficiency was treated as a low priority item. The potential for a Technical Specification violation should have been sufficient to expedite the review process.
- c. At Millstone Unit #3, the Supplemental Leak Collection and Release System had continuously shown little margin over the TS surveillance acceptance criteria. In early 1990, the system failed the surveillance. Known marginal equipment performance was not aggressively addressed until the crisis stage was reached.

#### 4. Configuration Management Program

This type of programmatic deficiency is viewed as inadequate synergism or connection between the Safety Analyses, procedures, equipment design, and the Technical Specifications. It shows up as a weakness in major programs (HELB, EFQ, App. R, etc.).

Several examples are provided:

- a. As a result of not having adequately verified the Gas Turbine loading requirements at Millstone Unit #1, a waiver of compliance became necessary to operate without FWCI beyond the action statement interval until the Gas Turbine loading issue was resolved. In this instance, the Safety Analysis requirements were not functionally integrated with equipment and procedures.
- b. At Millstone Unit #1, procedures called for lining up two LPCI pumps to one heat exchanger. This resulted in a higher than design flow through the heat exchanger. This problem had existed since early in plant life when the relevant procedure was revised without recognizing that equipment design limitations were being challenged.



## 5. Procedure Non-Compliance / Attention to Detail

These events attempt to capture the personnel error type events. There are many elements associated with human performance related events. These elements generally include program deficiencies, inadequate procedures, a culture that condones a sloppy approach to procedure compliance, an absence of a common understanding as to what constitutes procedure compliance, training deficiencies, mental lapses, etc. It should be recognized that in reviewing events after the fact (and with limited knowledge), it is sometimes difficult to assess to what degree was the worker "set up" by poor procedures or an inadequate program. The general feeling of the committee is that, lacking more detail and insight, we probably overcalled the significance of this category relative to programmatic issues and inadequate procedures. In fact, we, as a company, may be too quick to point toward correcting individuals for personnel error as a root cause, leaving the real underlying management/programmatic issues unaddressed.

The following examples of procedural non-compliance and attention to detail issues are provided:

- a. Millstone Unit #1 LER 91-07 describes an event in which the reactor was tripped due to high conductivity in the RCS. Personnel error was the root cause. The LER describes a number of factors which contributed to this event. One of these factors was that the operators confused 1-SL-12 with the common drain header stop valve on the floor below. Both valves were inadequately described in the surveillance procedure and this may have led to the apparent misinterpretation.
- b. Millstone Unit #1 LER 90-12 discusses an event in which the high-high trip settings on the SJAE off-gas drawers were set in the non-conservative direction. Personnel error was identified as the root cause. As it turned out, the calculated response factor had changed by greater than 20% since the previous surveillance. Within the body of the procedure, guidance was given that if the response factor changed by greater than 20%, a setpoint change was required. That same guidance was not provided in the calculation that the technician was using.

- c. CY LER 91-8 describes an inadvertent initiation of the RPS. The plant was shut down. The control operator opened the RHR suction valve from the RWST in order to raise level in the pressurizer. His attention was drawn away by another evolution and the pressurizer level increased to the high level trip setpoint.

C. Inadequate Procedures

This category is both a personnel and a program issue. These events reflect instances in which an unsuccessful outcome was more the result of a procedure inadequacy than straightforward personnel error. Again, considerable judgment had to be exercised in making these calls. The following examples are provided:

- a. Millstone Unit #1 LER 90-8 describes an event in which the fuel thermal limit exceeded the Technical Specification limit. The root cause was implied to be personnel error in that there was an "underestimation of the xenon transient which resulted from the power reduction." During the ascension to 100% power, fuel thermal limits were closely monitored and, at 100% power, they were verified to be below the TS limit by a significant margin. Approximately one hour later, one of the limits was determined to be greater than the TS allowable. Clearly, such monitoring evolutions should be controlled by a procedure. In this case, the inadequate procedure was corrected later by developing an instruction to provide the Reactor Engineer with guidelines for core monitoring during reactor power changes.
- b. Millstone Unit #1 LER 90-15 describes a reactor scram due to low water level. The root cause was given as the lack of specific procedural guidance for the calibration being performed. The technician was working from "generic guidance" for calibrating a pressure switch and had no specific instructions regarding valve lineups or precautions regarding actions to be taken for calibration of this specific instrument which was located in the common reference line for the reactor level transmitter.

7. Inadequate Technical Review

This category encompasses those events where a generally adequate program was in place but a personnel error (inadequate technical review) occurred within that program. An example of this is the MSR line break at Millstone Unit #3. The wall-thinning program was generally adequate. A data entry error, however, caused a vulnerable section of piping to be excluded from the program.



ATTACHMENT 2GROUP B ANALYSIS OF DATA

Group B was assigned to analyze the following documents for identification of performance issues:

- o Human Performance Enhancement System Reports
- o INPO Evaluations
- o SALP Evaluations
- o Quality Service Audits

SUMMARY OF DOCUMENTS REVIEWED

- o Human Performance Evaluation System Reports

As part of the Human Performance Evaluation System program, investigations are performed for events and issues identified as having some root cause involving human performance. Reports are developed by the HPES coordinator and provide a discussion of the facts, conclusions, including root causes and contributing causes, opportunities for consideration and other comments. The 38 reports for Millstone in 1990 and 15 reports for Millstone and Connecticut Yankee in 1991 were reviewed by the Task Group for potential performance issues. Based upon the root causes identified in the report and further discussion in the Task Group, Performance Issues Categories were identified. For each report, all relevant categories were identified. While in some cases, the issue could be encompassed by one category, in general, the HPES reports identify root causes that fall into two or more of the Performance Issues Categories. It is important to keep in mind that the thrust of the HPES program is human performance issues and, thus, the Category statistics would tend to be skewed to People Performance issues like inattention to detail, procedure non-compliance, and poor communications. However, these reports provide valuable insights in that they provide the details for actual events that have occurred.

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o INPO Evaluations

The draft 1991 INPO evaluation for the Millstone site and the 1990 INPO evaluation for the Connecticut Yankee site were reviewed to identify performance issues. The Summary of Performance Achievement was used as the individual items to be evaluated. For each Summary of Performance Achievement, the INPO evaluation provides examples of the problems noted. Each of the examples were reviewed for root cause. By examining the root cause for each example, Performance Issues Categories were selected. Thus, for each Summary of Performance Achievement, several Categories were identified. Including the Millstone and Connecticut Yankee INPO reports, there were 25 Summaries of Performance Achievement for which, on the average, there were 3 Categories identified. It should be noted that the Connecticut Yankee INPO evaluation took place early in 1990.

o SALP Evaluations

The 1991 Millstone SALP report and the 1990 Connecticut Yankee SALP report were used to identify performance issues. The SALP reports are different from the other documents reviewed in that they represent the judgments made by individuals at the NRC that include some factual information and some subjective evaluations. In order to apply the structured approach developed by the Task Group, 62 sentences that raise issues were selected as items for classification. In this case, since individual sentences were used as the items for classification, in general, one Performance Issue Category was identified per sentence.

o Quality Service Audits

Because of the volume of material associated with Quality Service Audits, it was decided to look at the Quarterly Summary Reports to identify performance issues rather than each individual audit. However, to gather further insights in to the audit results, one audit was selected for further review and evaluation. From the quarterly reports 29 items were identified for categorization. In addition, QSD audit QSD-89-5220 "Electrical Engineering Design Calculations" was reviewed in more detail.



SUMMARY OF CATEGORIZATIONo Inadequate Program/Process

Those events where performance issues could be, at least in part, attributable to an inadequacy in the administrative control programs or in the processes used to control work were categorized as Inadequate Program/Process. Performance issues in this category were found in all of the documents reviewed, most notably in the HPES reports and the INPO evaluations.

The HPES Report M91-006, "Inadvertent Dumping of Radioactive Water to MP-1 Tank Farm Trap Rock" provides insights into the difficulties maintenance personnel have in implementing the hazardous chemical program.

On January 21, 1991, two maintenance mechanics were assigned to remove a 55 gallon drum of a water and oil mixture from the Unit 1 turbine lube oil room. The drum is used to collect leakage from valves located in the heater bay. In the past, the contents of the drum have been contaminated. One of the mechanics took a 500 ml sample of the drum contents to the Chemistry Lab for radionuclide counting and analysis. Later in the day, communications between one of the mechanics assigned to the job and the Maintenance Supervisor indicated that the sample of the drum showed no detectable radionuclides. Neither the sample nor the sample results were picked up from the Chemistry Lab. The mechanics thought that the supervisor had the sample and the supervisor thought that the mechanics had picked up the sample. The drum was then moved to the Unit 1 Maintenance Shop and the outside of the drum was frisked and determined clean by a Health Physics technician. From previous discussions with personnel at the non-contaminated waste oil collection facility near Unit 3, the mechanics believed that the facility would not accept a water/oil mixture that was mostly water. The mechanics took the drum to the contaminated oil facility at the MRRF. Because the drum was considered non-contaminated, personnel at the MRRF would not accept it. The drum was returned to the shop to allow the contents to settle overnight.

On January 22, the water was pumped out of the drum through a funnel and filter into a pail. This method removed nearly all of the oil mixture. During this separation process, the mechanics questioned the validity of the sample results, since the drum removed the previous week was contaminated. One of the mechanics took a bucket



of the removed water and placed it in the tool counter by the HP desk. This tool counter did not detect any contamination. Therefore the mechanics felt that the results of the drum sample were correct. The water removed from the drum was not clear and the mechanics thought that it might contain a small amount of residual oil. Because the water might contain oil, the mechanics knew it could not be disposed of by dumping in the plant floor drains, which are processed by Radwaste. The mechanics did not want to dump the water in the plant storm drains, because the storm drains eventually drain to the Long Island Sound. The water was dumped into the trap rock at the tank farm. Approximately 25 gallons of water were dumped.

On January 23, results of two oil samples were returned to the supervisors office. One was labeled WASTE OIL and had an activity of  $1.5\text{E}-6$  uCi/ml. The other was labeled with the supervisors name and had an activity of  $1.69\text{E}-5$  uCi/ml. The supervisor became concerned that the water dumped may have been contaminated. The supervisor contacted his department head and another sample of the contents remaining in the drum was sent to Chemistry for analysis. This analysis confirmed that the sample originally labeled WASTE OIL was the sample of the drum and was contaminated.

The root causes and contributing causes were identified as:

1. lack of verification by Maintenance personnel
2. lack of a well defined waste oil disposal policy
3. poor communications between the mechanics and their supervisor
4. failure to verify which group would take the oil/water mixture
5. lack of an appropriate system to identify oil samples and track the sample back to the source.

This was classified by Task Group B as Inadequate Program/Process and Poor People Performance. This is an event where personnel errors were made in spite of the good intentions of the individuals involved. It clearly points to weaknesses in the Chemistry labeling system and in verification and corrective actions have been taken for

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these problems. However, more importantly, control of waste oil is spread over several groups, some of which have no particular expertise in disposing of hazardous waste. As recommended in the HPES report overall responsibility for the waste oil collection program should be given to one group. This points to the need to relook at the jobs our people are doing. In this case by assigning responsibility to one group we will reduce the number of people involved in waste oil collection and thus reduce the chance for error. By setting up a program whereby a mechanic could take waste oil to one group and that group would be responsible for all aspects of waste oil control, we would eliminate the need to train all mechanics on waste oil control and possibly simplify or even eliminate some procedures; we would allow the development of "experts" in waste oil disposal; we would eliminate one complication of the job for the mechanics. Further, this problem indicates that this may be indicative of problems in other programs. We need to find new approaches to reduce the cumbersome nature of performing simple maintenance tasks.

The INPO evaluations clearly identify weaknesses in the administrative control programs. In particular, the problems identified in the HPES report discussed above are confirmed by the findings from the Millstone INPO evaluation for the hazardous chemicals program. The INPO evaluation noted the following:

"Weaknesses exist in the station program that provides for the storage, use, and disposal of hazardous chemicals. Problems in the control of chemicals were identified in various areas of the site including the warehouse, cylinder storage areas, laboratories and in-plant areas. Contributing to the problem is the lack of direction for disposal of unused chemicals."

The examples given were as follows:

1. The warehouse contains carcinogenic chemicals that are not properly labeled or stored in a designated area for carcinogens. The warehouse also contains chemicals that have exceeded their expiration dates, and chemicals that are no longer used, some of which remain on the warehouse restock list.

2. In the cylinder storage building, cylinders are improperly secured and environmental conditions are not adequately maintained.
3. The laboratories contain unlabeled and incompatible chemicals stored in close proximity. Cylinders containing flammable gasses are unsecured and had safety caps removed. Corrosive chemicals are stored on shelves above and on top of sensitive equipment. Peroxide forming chemicals that are no longer used are stored in the laboratory.
4. Numerous unlabeled chemicals are located in plant areas.

The task group identified program deficiencies and procedural non-compliance as the root causes. This was categorized as Inadequate Programs/Process. Clearly, from the number of findings and the fact that problems were widespread, the hazardous chemicals control program is deficient and needs improvement. But, maybe more significant is that the problem areas are visible and could contribute to the perception that Station management does not view control of hazardous chemicals as important. For example, the INPO evaluator noted that the floor of the cylinder storage building contained approximately one inch of standing water and that the water was causing significant corrosion to the bottom of the cylinders which adversely affects the integrity of the cylinders. With this as an example, it is easy to see how compliance with station requirements for storage of cylinders may be viewed as unimportant. This shows how program deficiencies can contribute to procedure non-compliance. While we have highlighted the hazardous chemicals program, the INPO evaluation noted similar problems in the following station programs:

1. Safety Tagging
2. Foreign Material Exclusion
3. Contamination Control
4. In-house Operating Experience Review
5. Industrial Safety
6. Automated Work Order Process

This points to the need to relook at our Administrative Control Programs.



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o Inadequate Procedures

This category includes those events where an inadequate procedure was identified as a root cause in the performance issue. It should be noted that both Connecticut Yankee and Millstone have embarked upon programs to improve their procedures. However, completion of the Millstone program has been delayed due to lack of resources. The administrative control procedures at Millstone and Connecticut Yankee have not been improved. The Task Force Subgroup believes that a key element missing in the procedure development is input of human factors considerations. In some cases inadequate procedures is synonymous with an inadequate program. The Task Force identified the Work Order Procedure (ACP-QA-2.02C) as an example. This procedure identifies 16 major duties for the Job Supervisor, 10 major duties for the Shift Supervisor and 11 major duties for the Operations Work Coordinator as well as duties for 12 other individuals. It includes references to 43 other procedures. The procedure is riddled with Notes and Cautions. Considering this is a key procedure in performing work at the Millstone station, it is obviously a contributor to Instances of Poor People Performance.

o Lack of Design Basis  
Documentation/Configuration Management

This category includes those events where the lack of information about the design basis contributed to the performance issue. This was primarily noted in the SALP reports. The most notable example was the High Energy Line Break issues noted in the Millstone SALP report. The SALP sentence is as follows:

"The licensee identified that failure of certain house heating steam system lines would degrade areas of the unit which previously were classified as EQ mild environments."

This was categorized as Lack of Design Basis. Problems with the High Energy Line Break evaluations had been identified in late 1988-early 1989 associated with the qualification problem of the Reactor Water Cleanup Valves for Millstone Unit 1. In response to a Root Cause finding, it was recommended that a program be developed in which the compliance to HELB criteria be revisited. While

the emphasis of the proposed program was offsite doses, it was also identified that there might be some impact on the EQ program. In addition, in 1988-89 the Millstone Unit 2 SSFI also identified concerns about High Energy Line Breaks. In spite of the identification of problems in the 1988-1989 time frame, no significant actions were taken to resolve these issues until the problems with the house heating steam lines were discovered in 1990 through a totally unrelated issue.

There are several important implications to these problems. First, compliance with the HELB criteria has not been maintained due to a lack of configuration management. Some piping supports have been changed without evaluating the effect on potential locations for breaks. Secondly, the standards for compliance have significantly increased. However, the programs we have put in place do not always reflect the increasing standards for compliance. Because we are instituting more and more task forces, like SSFI, these problems will surface. In general, we do not plan for or provide the resources to respond in a timely fashion to the problems that surface. Thirdly, since a number of these issues require hardware modifications or significant amounts of resources, resolution of the issues is often deferred. These issues become a continuing source of problems that are responded to by Band-Aid. While justification can be provided for the handling of each individual issue at every stage of its evolution, taken together, it contributes to the impression that minimizing short term cost and schedule impact are the more important than full resolution of issues.

o Lack of Standardization

This category includes those events where good practices or lessons learned at one unit were not incorporated into the programs or practices of the other units. Examples were found in each category of the documents reviewed where errors could have been prevented by better communications between units. The most significant example was highlighted in the Millstone SALP report. The SALP report identified the collapse of the traveling screens at Millstone Unit 1 as a significant issue. This was categorized as Instances of Poor People Performance and Lack of Standardization.



While this clearly involved a failure to follow procedures, the design aspects that contributed to the problem should not be overlooked. Millstone Unit 1 had, previous to this event, an automatic trip of the circulating water pumps on high delta-p across the screens. This trip had been added because in the early seventies the traveling screens had collapsed due to fish migration into the intake structure. Because of a potential for a spurious actuation of this trip it was decided to remove the trip and rely upon operator action. The fact that operator action had not prevented the previous screen collapse was not factored into the design change. In addition, no thought was given to the existing trip at Millstone Unit 2. This highlights the need to develop standard approaches to problems at our plants and to apply lessons learned at one plant to all our plants. While it is recognized that we have a unique and special challenge by having three very different plants at the Millstone site, we still can capitalize upon this knowledge by improved communications between our staffs and in standardizing programs and approaches between the units. With approximately 10,000 procedures and forms at the Millstone site alone, it is obvious that not enough has been done to eliminate redundant procedures between the units.

o Lack of Resources

The lack of resources category captures those events where known inadequacies have not been corrected because resources are limited and the particular corrective action did not have a high priority. For example, the Millstone INPO evaluation identified the Counting room environmental conditions as not sufficiently controlled to accurately measure the concentration of isotopes in a reliable manner. This problem had been previously identified by Millstone personnel; however, a project to correct this problem has not been implemented because of the limitations on the capital budget and its low priority compared with regulatory required projects. Another example where lack of resources is a contributing factor is identified in the Millstone SALP report; where lack of resources contributed to findings that responses to audit findings and implementation of corrective actions identified in LERs could have been more timely.



o Training Issue

This category includes those events where inadequate training was identified as one of the root causes. There were very few identified in this category. However, it should be kept in mind that because of the processes used to develop the documents that were reviewed, indirect root causes such as training issues would not be readily identified. The Connecticut Yankee INPO evaluation did identify training of supervisors in supervisory skills and plant practices as an issue. This reflects the issue that supervisors observe non-compliance with procedures but do not correct the non-compliance. This is further discussed in the category of Instances of Poor People Performance.

o Instances of Poor People Performance

This category includes those events where non-compliance with procedure or inattention to detail was identified as a root cause. These issues were found in each category of the documents reviewed and were the largest number of occurrences. The Task Group believes that there are several underlying causes of these problems. A significant fraction is due to weak procedures, or procedures that do not have adequate human factors considerations. Additionally, a significant fraction is due to overly-cumbersome administrative programs that make performing work extremely inefficient, if not impossible, for which non-compliance to the program is tolerated and accepted by management. Finally, a small fraction is personnel error, even given adequate procedures, training and clear delineation of expectations. All of these elements contribute to personnel error, thus must be corrected if poor personnel performance is to be improved. A significant finding of the INPO evaluations is the number of instances where it was noted that supervisors observed but did not correct errors by personnel. Based upon discussions in the Task Group, it is believed that there are three contributing causes to this problem.

First, the supervisors are reluctant to correct errors because of the potential for confrontation that results in the destruction of their working relationship. The supervisors have not had adequate training in providing feedback in a non-confrontational way. Clearly, the allegations issues make this job more difficult.

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Secondly, supervisors need training in observation techniques. Observation to prevent errors is not a natural attribute but is a skill that requires development and training.

Finally, some of the administrative programs are viewed as being overly cumbersome and a significant delay to accomplishing work. With many instances of non-compliance that go uncorrected, the perception develops that compliance is not important.

As a further example, a first line supervisor reported the following scenario as an example of poor performance: A mechanic was tasked to repack a 3/4" QA valve. In order to do this, the man could remove the valve from the piping system and bring the valve into the shop. The valve bonnet would be unbolted along with the packing follower and the old packing replaced with the new packing. This job was expected to take 2 hours. To do the job, the assigned person (job supervisor) had to get the AWO from Operations, read the AWO, check with Quality Control, read the procedure, check with Health Physics and verify the tag location. After all of the above, he had to disassemble the valve, perform the work, get parts from Stores and ultimately install the valve, sign the AWO and return it to Operations. This total effort took 7 hours versus the expected 2 hours. Each point provided a built in excuse for prolonging the job. This scenario is fully consistent with the findings in the INPO evaluation.

From the INPO evaluation we can identify two factors that contribute to procedure non-compliance:

- o cumbersome and deficient administrative programs
- o tolerance of selective non-compliance by management

The Task Group identified the QSD audit of the Electrical Engineering Design Calculations as significant since it clearly indicates that problems in procedure compliance affect the engineering organization as well as the operations organization. The audit determined that there was a general failure to comply with NEO 5.06 in addition to identifying a number of technical inadequacies. These problems were not restricted to one section or even one department since similar problems were found in an audit of the Mechanical Engineering calculations. While there are some improvements to be made to the procedure (NEO 5.06), in general, it is not a difficult procedure to



follow. In spite of this, some supervisors approved calculations that did not comply with the procedure. This contributes to the perception that procedure non-compliance is tolerated. Evidence of this in the corporate engineering programs, as well as the site programs, indicates that this is a cultural problem within NE&O.

o Inadequate Design

This category includes design problems that contribute to poor performance. In some cases poor designs can contribute to Poor People Performance. For example, the INPO evaluation highlights a containment control issue due to inadequate draining of the piping at Millstone Unit #2. In this case, inadequate or poor design for drain lines makes it very difficult to drain piping. This in turn makes it difficult to maintain contamination control when the piping is taken apart with water still in the piping. The root cause of this event, in part is attributable to the poor piping drain design.

o Equipment Problem

This category includes those events where an equipment failure contributed to the root cause.

o Summary of Results

While the insights gained from each of the documents are important and should not be ignored, additional insights can be gained by looking at the occurrences of issues associated with the Performance Issue Categories. The categories can be combined into three overall categories: People Performance Issues; Program/Process Issues and Design/Equipment Issues. The largest number of occurrences are in the Instances of Poor People Performance category.



ATTACHMENT 3

ENGINEERING PROCESS INADEQUACIES

Lack of a formal, structured and integrated engineering process appears to be the source of many analyzed events.

First, engineering is performed without tools such as a Design Control Manual which should represent a road map to articulate design control. The Design Control Manual (DCM) would be built upon the existing NE&O body of knowledge but also extend to fully delineate the overall programs and responsibilities necessary to maintaining proper design control. The DCM would reside outside of the NE&O procedure manual and be invoked by a simple NE&O procedure requiring all organizations involved in the design change process to attend to its use. An existing major weakness with our present patchwork of NE&O procedures would be corrected by ensuring that the DCM reflected the overall process rather than just describing specific programs in an independent manner. Many other benefits would result such as: a reduction in the number of plant procedures, increased flexibility in changing the DCM when improvements are identified; and increased accountability.

Second, the existing NE&O procedures place design responsibility and authority on the individuals rather than formal processes.

Third, the NE&O engineering organization lacks the proper recognition of the importance of functional groups to the design process. This third issue is considered a built-in opportunity for oversights and, as such, is discussed in detail herein.

Engineering design organizations should be structured and operate around formal processes designed to assure that all requirements to be fulfilled are clearly identified up front and documented. System level requirements are contained in documents typically called "Functional Requirement Specifications" (FRS). Then, Equipment Specifications (ES) are developed that describe the detailed equipment design that fulfills the requirement identified in the FRS. The FRS's and the ES's become Design Documents around which the design organization rotates. Design organizations accordingly include functional and equipment groups, respectively responsible for FRS and ES. Checks and balances across this interface are critical to assuring that equipment is designed and

modified without missing or violating the necessary requirements. The distinction between FRS and ES is further emphasized by the differences between functional and equipment groups: for nuclear design, the functional organization typically include "plant design" type groups, which provide nuclear, thermal-hydraulics, plant operations, and licensing expertise, while the equipment engineering groups include mechanical, electrical and civil engineering expertise and perform detailed system and component design.

An excellent example is provided by the engineering work required to design and support the Reactor Protection System (RPS) of a nuclear plant. Based on static and dynamic protection requirements during accidents and transients, typically developed by nuclear engineers to fulfill protection and licensing requirements, the FRS identifies the protection philosophy, setpoints, allowables, and delay times. The RPS ES is developed by electrical engineers and describes the hardware capable of performing the required Functional Requirements Specification (FRS) functions. They are two completely different things.

The importance of the FRS to our business is that most implicit or explicit commitments in Tech. Specs., FSAR, and in all areas of engineering and operations have their bases in some system level requirement that is best documented in a FRS. Because of this, it is apparent that they should be maintained and used to support design changes. This is because:

- a. Absent a process to formally document requirements, we may miss some, and we have no history of doing that.
- b. Without a written document, we will lose memory of why we did something, and we seem to have instances of this situation.
- c. Most importantly, the nuclear business is controlled by extensive regulation which often indirectly impose requirements on our plants. Fulfillment of these requirements needs interpretation, which has varied as a function of time. Some of our problems, for example in the EEQ and HELB programs, derive from the fact that, in the late 70's or early 80's, we did not document the engineering logic behind how the



related regulations were interpreted in the implementation of such programs. The lack of a formal process to develop a FRS as a blueprint of how to implement the program, how to fulfill all requirements and how to integrate the programs to fulfill safety requirement and EOPs is the main reason why these programs are occasionally flawed, or, at times, we don't know if they are. Typically, when questions are raised regarding some issue, the question is asked: what was the requirement? The answer references old regulatory documents. The trouble is that the regulatory documents do not spell out requirements, and today's interpretation may be very different and much more demanding than the one of ten years ago.

The NE&O engineering process has not been developed along the lines described above, nor does it operate in the formal fashion described above. This is a prime cause in our problems stemming from a weak engineering process and weak engineering programs. The problem is compounded by the fact that the Engineering Design Group is effectively only an equipment group. Nuclear Engineering, which is responsible for at least the functional requirements of safety related equipment, is not part of "Engineering". This could be viewed as an oversight, which could be at the root cause of the lack of familiarity, in our design process, with the existence and importance of functional specifications. Only in the recent reorganization there has been a formal recognition that this group has this role, but how it is going to interface, and whether it has the resources to do it, has not been addressed. Furthermore, the plant engineering staff should also be formally integrated into the engineering process.

Further proof of the weaknesses imbedded in our design process are the deficiencies currently identified in the EEQ, HELB, Reg. Guide 1.97, containment isolation programs at Millstone Unit #1, which are being traced back to weaknesses in the process to develop and logically integrate these programs among themselves and with the Safety Analysis and the EOPs. This issue is further illustrated in the next section.

The current organization can be effective, as long as a formal process of doing engineering is finally accepted and implemented within NE&O.



As we identify process weaknesses to be corrected, we feel compelled to recognize the engineering strengths already active at the working levels. Our engineers are recognizing the need for operating through correct interfaces, and it is the insight they have developed, in the way of interpreting the plant support programs, that makes NE&O so effective in identifying weaknesses, such as those recently surfaced at Millstone Unit #1. The Task Group believes that the problems we are identifying in our units are not unique to our plants, but we have become more adept at finding them and, in this, we may lead the rest of the industry.

ATTACHMENT 4

HELB/EQ ENGINEERING PROGRAM INADEQUACIES

Over the past several years, a number of problems have been identified with Environmental Qualification of Electrical Equipment. To a large part, the root causes of these problems can be attributable to a lack of some part of Design Basis Documentation, a weak EEQ program, and a weak engineering process to maintain the program. To understand where these deficiencies lie, it is informative to examine how, in an ideal situation, the Master List, the list of environmentally qualified electrical equipment should be developed. First, the mechanical engineering group should determine for what systems pipe breaks must be postulated and what equipment must be postulated to be damaged by the piping interaction effects. This information would be passed to the safety analysis group that would perform an analysis of the pipe breaks taking into account the damaged failed equipment.

The safety analysis group would determine the mass and energy releases for the various pipe breaks and would determine the systems required to mitigate the pipe breaks. Spectrum studies would be performed to determine limiting assumptions for parameters such as single failures, loss of offsite power, and break size. The mass and energy releases would be passed to a Containment analysis group that would determine the limiting environmental conditions. Composite curves, taking into account the spectrum studies, would be generated. The mass and energy releases would also be sent to the Radiological group to calculate equipment doses. The information regarding the systems required to mitigate the accident would be passed to a systems group that, together with the mechanical, electrical and I&C groups, would translate the functional requirements into equipment and component requirements.

It must be kept in mind that the safety analysis would only specify the functional requirements, such as how much auxiliary feedwater or safety injection flow is needed and by when, or how much heat removal is needed from the RHR system. The individual components are not explicitly modeled. The detailed implementation of these requirements is provided by the engineering disciplines. The equipment and component identified, together with the environmental curves and dose calculations, would be used to develop the master list. At each interface, a document would be developed to maintain a record of the assumptions and requirements.

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The High Energy Line Break studies that form the basis for the EEQ program were performed in the 1970's by outside vendors. As can be seen from the above discussion, a multi-discipline effort was needed to maintain the studies. Procedures were not developed to reflect this and no responsibilities were assigned. Thus, no effective process was developed to maintain the basis for the Master Lists. Subsequent efforts to re-look at the Master Lists have relied upon comparison to other lists like the MEPL or other documents like the EOPS. The responsibility for the EQ program was given to Qualification Engineering Section, but the multi-discipline responsibilities were not assigned nor were the Master List bases revisited. As a result, mistakes were made and problems were identified. To correct this problem, a major revision was made in 1989 to NEO Procedure 2.21, Nuclear Plant Environmental Qualification Program.

This revision represents a significant improvement in that, for the first time, the multi-discipline responsibilities were enumerated. However, the new procedure still does not recognize the process discussed above. Instead, the procedure is centered around the Master List and the maintenance of the Master List. In fact, the current process works backwards. When issues arise, the Master List is reviewed and lists of affected equipment are generated. Justification and bases for the list of equipment are developed. Instead of working forward from the functional requirements, we work backwards from the equipment lists. Working backwards from the Master List is a much more difficult task as it is prone to errors of omission.

Another key factor that is missing from NEO 2.21 is the importance of the High Energy Line Break studies that form the basis of the EQ program. The NEO procedure defines NRC reports and Regulatory Guides as the basis for equipment environmental qualification. These documents only provide guidelines for developing the basis for equipment qualification. The High Energy Line Break studies and the accident analysis form the basis for the equipment qualification.

Finally, the NEO procedure does not address the need for documents that control the interfaces between the groups. The key interfaces reside in the transmittal of break identification and equipment damage information from the Mechanical group to the Safety Analysis group and the transmittal of functional requirements from the Safety Analysis group to the Engineering groups. This



information resides in the early studies and has not been translated into documents, typically specifications, that would control the interfaces. Without these documents, errors will continue to be made in attempting to maintain the EQ program.

The EQ program has been described here as an example in order to highlight the kind of problems we encounter in our programs. Other engineering and operation support programs are also in need of the same type of attention.

It is apparent that all these programs should be revisited through the process, suggested in Attachment 3, integrated through the Configuration Management Program (CMP) and maintained through an effective Engineering Process. Some activities are already underway under CMP, and this effort may not require additional resources, but will require a commitment to an integrated NE&O approach.

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ATTACHMENT 5

CONNECTICUT YANKEE AUXILIARY FEEDWATER ISSUES

Automatic initiation of AFW is a NUREG-0737 item that came from the TMI event. Our position, at the time of issuance of NUREG-0737, was that automatic initiation was not required and, in fact, was an unreviewed safety question since it made steam line break results worse. In spite of our arguments, the NRC insisted on implementation of automatic initiation of AFW and we ended up installing it in 1980 under a very tight schedule. The scheme selected was to vent the air supply of the Terry turbine steam admission valves and the feedwater bypass valves so that they would fail in the open direction. During testing of the design change, it was discovered that venting the air from the turbine admission valve resulted in tripping of the AFW pump turbine on overspeed. Since the schedule was very tight, there was little time to redesign the system. A scheme was devised in which the turbine admission valve was allowed to only partially open by maintaining some air pressure to the valve. The actual setting was determined by testing. While the impact of the lower turbine inlet pressure on AFW flow was addressed, it was not recognized that the air dependency introduced by the revised design did not meet the criteria of NUREG-0737.

In 1985, The Connecticut Yankee Plant Design Change Task Group identified the problem of the air dependency as a PDCR deficiency. Specifically, the Task Group stated, "In reviewing the failure modes for the valves, it appears that automatic initiation with loss of control air (non-safety grade system) may overspeed the turbine and result in a turbine trip and subsequent loss of AFW. A seismic event is a possible initiator for loss of FW and loss of control air." This issue remained unresolved after the Task Group was disbanded. Generation Facilities Licensing was charged with assuring resolution of the identified deficiencies. Generation Facilities Licensing was unable to reach resolution. Because resolution could not be reached, a project for resolution was added in the ISAP program. However, it was combined together with a number of issues under the umbrella of projects necessary to reduce the dependency on feed-and-bleed cooling.

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The concern was raised to NUSCO management that this was inappropriate since the air dependency issue could be resolved by a relatively inexpensive modification. On the other hand, the feed-and-bleed dependency included major modifications to resolve issues like tornado missiles. By evaluating these projects as a group, the priority would be set by the costly major modifications. As a result of this concern, NUSCO management pressed Operations to perform a test to resolve this issue. In the shutdown from Cycle 15, a test was performed and it was concluded that the AFW turbine would not overspeed. While a test report had not been completed, the NRC was informed that it was expected that the ISAP project would be closed, based upon the test results. During subsequent unrelated flow testing of the AFW pumps, it was discovered that the turbine did indeed overspeed when the admission valve was fully opened in auto-initiation and that the previous testing was flawed. As a result, the NRC was informed of the problem and we were granted a one-cycle change to the Technical Specifications that would allow credit for air until a modification could be implemented.



May 1991

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## NEO PERFORMANCE TASK GROUP

### Background

Some indicators of recent NEO performance include lower Millstone SALP ratings, over half of our INPO performance indicators being below the industry average, some lower NRC performance indicators, and more than double the number of violations during the most recent SALP period compared to the previous one.

### Charter

The charter of the NEO Performance Task Group is to critique NEO performance since January 1, 1990, and to propose to management measures to preclude recurrence and enhance performance. The Task Group is to conduct its evaluation looking at the entirety of NEO, and not any one division specifically. A broad range of issues is to be evaluated, and as work proceeds, interim findings may point to additional issues that need to be explored. At a minimum, the following areas are to be addressed with respect to identifying areas for performance enhancements and proposing new measures:

1. Recent increase in personnel-related errors.
2. Procedural compliance.
3. The increase in the frequency of escalated enforcement actions (see attached list).
4. The frequency of NU seeking emergency amendments or temporary waivers of compliance (see attached list).
5. Design basis related issues.
  - a. Is the pace of design basis reconstruction appropriate?
  - b. Should we expend resources to document the current licensing basis?
  - c. Is the integrity of the design basis being preserved during the implementation of plant changes? For example, when EOP changes are implemented, how do we assure consistency with RG 1.97 commitments, SPDS commitments, CRDR commitments, and 10CFR50.49?

6. Programmatic issues.

a. RG 1.97 implementation.

b. HELB - maintenance of these studies and appropriate incorporation into the 10CFR50.49 compliance effort.

The task involves evaluation of the above issues to discern if there are any patterns or trends which warrant management attention. Other available resources such as SALP reports and inspection reports should be utilized as appropriate. This Task Group is not to explicitly evaluate issues related to allegations or reportability/operability, as these are being addressed via other Task Groups.

Chairman

The Chairman of this Task Group is Mario V. Bonaca.

Members

The other seven members of this group are:

P. A. Blasioli  
F. R. Dacimo  
J. J. Festa  
M. S. Kai  
M. Kupinski  
R. A. Place  
D. J. Ray

Deliverable

A report summarizing the major findings and recommendations for enhancement is to be provided to the SVP - NEO by Friday, September 13, 1991.

Access to Other Resources

The Chairman is authorized to obtain additional resources from within NEO or external to NEO as necessary to fulfill the objectives of this task group.