IMPROVING PERFORMANCE IN A COMPETITIVE ENVIRONMENT

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1. ABSTRACT

Improving performance and sustaining improvement is not an option - it is mandatory if nuclear power is to be part of our future energy equation. The public, through the regulator, will not tolerate the increased risks associated with less than quality performance. Acceptable performance standards have been advocated by the nuclear industry for many years and the public believed that the standards were being met. However, observed indications of performance during the past several years suggest that this may not be the case.

The cultural change required to reverse the trend in Canada, to one where the nuclear industry is the leader, is a challenging task. Industry survival depends on taking prompt action leading to a sustained high standard of safety performance. This challenge comes at a time when the power industry is rapidly moving toward a deregulated environment.

Improving safety performance comes with added cost which is contrary to the cost cutting pressures associated with deregulation. How we deal with these competing forces is discussed in this paper.

2. INTRODUCTION

This paper is written from a Point Lepreau Generating Station perspective, but the authors believe the content, in general, to be indicative of the nuclear generating industry in Canada.

The history of CANDU reactors in Canada shows them to have been very successful (based on capacity factor) in the first ten years of operation. Subsequently performance is observed to degrade. Point Lepreau has operated successfully for greater than ten years, but current indications suggest an operational pattern consistent with the historical trend.

Successful operation in the early life of Point Lepreau has led to an assumption that we had an effective safety culture. Consequently corporate executives reduced operational resources, in response to deregulation forces, with a belief that operational safety performance would not be adversely affected.

This decision was taken at a time in the life of the plant when maintenance and technical challenges were increasing. The result was that the additional effort required to deal with these emerging issues exceeded the capability of available resources to do quality work within allocated times.

In retrospect the early successes of Point Lepreau did not challenge our programs and policies. Consequently we were left with a false sense of security. This only became evident when plant mid-life challenges emerged.

We now find ourselves in a situation where a major company asset is at risk. In parallel with required safety performance improvement initiatives we must:

- address emerging technical issues

- maximize work process efficiencies such that we remain competitive.

3. URGENCY TO ADDRESS THE ISSUES

Increased consumption of electrical energy world wide, combined with the need to replace aging

generating plants makes electrical generation a potential long term growth industry.

The nuclear option should be part of this expansion. It offers many benefits in terms of its impact on the environment, and it avoids depletion of non renewable fossil fuels which have other uses that benefit our society. An awareness of these important benefits is overshadowed by potential risks associated with the nuclear option. These concerns are amplified with any evidence that such facilities are not being operated to a sufficiently high safety standard.

If nuclear is to be part of the long term energy equation then we must demonstrate to the public that we can operate nuclear facilities such that we maintain high levels of safety performance and at the same time are cost competitive. A failure to achieve these objectives places in jeopardy:

- continued operation of existing facilities

- future nuclear development in Canada

- future offshore sales of CANDU reactors.

In effect, this could lead to the demise of the nuclear industry in Canada. The irony of this scenario is that in the not too distant future, the only viable option available to generate large quantities of power may be nuclear. It would be most unfortunate if Canadian developed technology had to be purchased offshore to supply our own future demands.

4. THE SYSTEMATIC APPROACH

It is unfortunate that the nuclear industry in Canada has gotten into a situation where the consequences of poor performance is the driving force behind performance improvement.

Ideally, initiatives undertaken to change or improve an existing situation should be based on an objective assessment or measure which can be linked to a:

- program deficiency

- station goal or objective.

We should not be in a position where the consequences of poor performance are the motivators which establish the need and set the agenda for a performance improvement program.

Given the current state of safety performance in the nuclear industry, we must take immediate steps to correct obvious problems. In parallel, we must establish a strategic planning process which is based on a systematic approach - one where we have established goals

and targets consistent with the station mission.

A failure to take this approach makes it difficult to determine whether any proposed program is appropriate to address the real problem(s). The systematic approach involves the following elements:

- a detailed analysis of observed events to determine the underlying causes (a fundamental issue)

- identification of projects required to correct the problem(s)

- a plan of action which defines the project end goal

- resourcing

- implementation

- measurement to ensure that scheduled plan milestones are being achieved, and that the end goal has been reached

- on-going assessment to ensure that achievements are being sustained, with a follow-up process to address unsatisfactory findings.

5. THE POINT LEPREAU APPROACH TO PERFORMANCE IMPROVEMENT

The Point Lepreau Generating Station operated very successfully from its commercial operational date in February 1983 to the start of an extended planned outage in 1995. Throughout this time, relations with the regulator were good, but in recent years there has been increasing evidence that they were becoming concerned with increasing station work backlogs.

We completed the extended 1995 outage on schedule and under budget. This apparent success left us with a feeling of confidence and optimism that past trend-setting capacity factors would continue into the future.

Corporate NB Power, in the background, were aggressively looking at ways to improve efficiency to better position the utility in a deregulated environment. The Point Lepreau success picture did not portray the station to be an aging plant, requiring additional resources to deal with emerging maintenance requirements and corresponding longer plant outages. Consequently, little sympathy could be garnered for any proposal involving increased resources for Point Lepreau.

Our confidence and optimism from the apparent success of the 1995 outage was short lived. On start-up, the shaft on a main Primary Heat Transport pump was sheared as the result of mistakenly leaving a wooden cover in the PHT system. The cover was shredded and spread throughout the PHT system with recovery extending the outage by approximately three months. Within the next year, additional deficiencies originating from work initiatives undertaken during the 1995 outage, were discovered. As a consequence of these failings the regulator applied a condition to the station operating Licence. The condition required semi-annual reporting to the regulator on the implementation and evaluation of measures, programs or initiatives developed for the purpose of promoting safety in work practices and processes at the facility.

We were aware of, and had commenced implementation of, safety performance initiatives at the station. However, the input from the regulator prompted us to accelerate and better formalize our improvement program plans.

Initially we took action to correct known deficiencies, identified by our own internal assessment and issues that were identified by WANO as being areas for improvement. We continued to progress initiatives in this informal way until May of 1997. In parallel, we scoped out a three phased systematic approach to deal with all issues necessary to improve safety performance at Point Lepreau. This approach is:

- phase one (Oct 96 - Aug 98) - progress initiatives to correct identified deficiencies. In parallel develop and implement a plan to address all required performance improvement initiatives and progress the development of a strategic long term planning process.

- phase two (Sept 98 - Dec 2000) - complete performance improvement initiatives to an extent that they become integrated into the way the station does business on an ongoing basis. Commence implementation of strategic planning such that at the end of this time period, necessary effective programs are in place and being monitored and acted upon, on the basis of goals, measures and targets. It is through this process (strategic planning) that the required level of safety performance will be maintained on an ongoing basis. This final step, full implementation of strategic planning, is really the commencement of phase three

- sustain a high standard of safety performance on an ongoing basis through implementation of the long term strategic plan.

In developing our overall performance improvement program we identified in excess of 40 projects. These projects were identified based on the following:

- our own internal review
- recommendations for improvement from a full peer assessment by WANO
- Regulator staff observations

Our plan involved the establishment of a performance improvement group to budget, plan, schedule, monitor, initiate corrective action as appropriate, and

report progress every two weeks. The actual work required to implement the various projects is the responsibility of the line organization. Each project has an assigned member of the line organization responsible to progress the project such that schedule milestones are achieved.

A steering committee comprising senior corporate staff members, the performance improvement group leader, and the station line managers (including the station manager) meet on a two week frequency to address any problems, establish new or reinforce existing priorities, ensure line organization's continued commitment to priority projects and to ensure continued corporate focus.

We initially attempted to address all projects, only being limited by the availability of qualified staff. We took this rigorous approach realizing that it was a commitment to the regulator.

In April of 1997 we made our first conditional presentation to the regulator. The presentation outlined our strategy, implying that it was our intent to progress most performance initiatives simultaneously.

The effort required to progress many fronts quickly became a concern. Equally, we were concerned that our program was not independently verified.

In June of 1997 we had WANO do an independent assessment of our problems to verify the adequacy and scope of our proposed improvement program. The assessment involved a review of recent unplanned events, and a series of one-on-one and group interviews with staff from all station work groups. They concluded that our proposed improvement program would address our performance problems. However, they cautioned us that success would be unlikely unless we narrowed our focus to several key initiatives.

Concurrently, a second group of external advisors (a group of three senior executives commissioned by our president to provide independent advice on our approach and the likely expectations of a regulator) also recommended that success would be greatly enhanced if we limited our focus to less than five issues.

The feedback from both of the above groups prompted us to act immediately. From an earlier assessment of unplanned events, we determined that human performance was the most common unplanned event causal factor. Greater than 50% of the events examined had some element of human failure. This is consistent with findings documented in other published reports. This finding prompted our decision to focus our program on three human performance initiatives:

- Conduct of work

- Safety awareness

- Supervisory effectiveness

Other projects were continued in the background, but not at the expense of progressing projects supporting the focal issues.

At this point, we also felt that an independent verification would be useful to confirm:

- our selected focal issues

- The effectiveness of our new systematic event investigation process (TapRooT®)

A second experienced WANO team did an independent assessment of recent station unplanned events, using a different systematic process (HPES). They confirmed that human performance failings were a significant contributor to station unplanned events, and gave us confidence that our new event investigation process was effective.

Focusing on these issues involved developing documentation, promotional campaigns, and extensive staff training followed by evaluation to assure that the desired effect was achieved.

At this point in time, we have completed the project phase for six of the seven focal projects. Significant progress has been made in the remaining area, but work continues in the development of the supervisor training program. We believe that safety performance

has improved, but we need to accelerate the pace of change.
The strategy for the next two years is to maintain our focus on human performance, while at the same time broadening our focus to include the next most important areas requiring improvement. Following the development of selection criteria, we selected 17 projects. These were then categorized into four focal areas of which 10 projects were designated Category A (the highest priority), while the remaining 7 were assigned to group B.

The focal areas for the group A projects are; Supervisory effectiveness, Work Management & Control, Plant Ageing, and Sustaining Improvement. The Work management & Control area is made up of number of separate projects. These include; introducing a forward scheduling process, improvements to the Work Permit process, reducing maintenance backlogs, reducing the backlog of outstanding corrective actions, reducing the backlog of outstanding AECB Action Items, introducing a Problem Identification and Corrective Action (PICA) process, and introducing a work management system for technical work. The focal area on sustaining performance was also subdivided into two projects. These are; complete the development of a strategic plan, and the introduction of a Self-Assessment Program.

The group B projects include; OP&P improvements to reduce non compliances, introduction of a Safety Culture refresher program, improvements to the design change and configuration management processes, Procedure improvement program, introducing a comprehensive training program for all work groups, and the development and implementation of a staffing and succession plan.

6. LESSONS LEARNED

The performance improvement program is the most important and comprehensive program undertaken at Point Lepreau. Aspects which make the program unique include:

- historically our focus had always been on technical issues, while human performance issues were viewed with a much lower priority

- the program involves a significant increase in resources (100+) over a long time period (>5 years)

- we perceive pressure from WANO and the regulator to show positive results in a timely manner

- it involves significant changes to work processes and staff practices

- it was initiated in parallel with our attempt to address a large backlog of work

We initially approached our performance improvement program much like any technical project. We did not anticipate the many non-technical problems that surfaced. These new challenges are providing us the opportunity to learn more about the human side of the business. We need to address future human problems as adeptly as we address technical problems. We have responded to this by obtaining significant assistance from Corporate Human Resources Specialists.

The more significant problems we encountered, and other observed areas which we believe to be potential problem areas are discussed below. It is our hope that this discussion will help others embarking on a similar program, to be more aware of non-technical problems during the planning stage of the program.

Line management and staff's reluctance to change - performance improvement means changes to programs, standards, and priorities, as well as staff re-assignment. Work groups felt that the additional work load was counterproductive at a time when backlogs were already at an all time high and continuing to increase. Staff were already overworked from dealing with a series of planned and unplanned outages and other issues identified by station management as high priority jobs. Overcoming this reluctance to change must be countered by senior management continually emphasizing the need for, and demonstrating their commitment to, a performance improvement program.

Staff skepticism about management's commitment to performance improvement - staff were aware of identified problems and process deficiencies that existed for years, which management had failed to address. Management saying they will fix the problems is not enough. Before they are convinced, the line organization must see change which actually affects the way in which they do their jobs.

Communication - Sending memos, or relying on middle management to communicate was not effective. Since success must be achieved through first line supervision, senior management must personally transmit the message frequently, clearly, and precisely to them. The first message to be communicated is the need for change and the urgency with which it must occur.

Limiting the focus of an improvement program - An overall improvement program may involve initiatives in many areas, but attempting to promote more than two to five issues simultaneously reduces the probability of the program being effective.

Relating issues to the workers job - different techniques can be used to promote performance initiatives, but for them to be fully effective, there is a need to show, through example, a correlation between the initiative being promoted and the workers' job responsibilities.

The application of a systematic approach - a performance improvement program should be based on a systematic approach. This will establish credibility. It will also meet the ongoing challenge of demonstrating that the program is leading to the target standard of performance. A systematic approach will also ensure that the improved performance will be sustainable.

The program content should address root problems which are determined through an analytical process. The program should then be implemented to direct the station work force toward the targets and to establish performances measures for monitoring results on an ongoing basis.

Verification of the improvement program - a second review, particularly by an external body is necessary to provide an added level of assurance that the process is correct and to increase its credibility.

Exposure of staff to facilities where other work methods are effectively employed - in many instances staff have never seen a process other then the one that is currently being employed by the station. An aging work force that has never been exposed to other methods tend to have a mind set that there is no alternative to their processes and hence are reluctant to give a new method or process a chance. Having staff visit facilities with different processes or methods is an effective way to acquire work group acceptance.

Organization structure and accountabilities - the structure of an organization or lack of clear lines of authority and accountabilities for each division may be a mitigating factor to success. Failing to address such an issue at the outset increases the risk of failure or as a minimum will delay success.

Leadership and Core Values - senior management must adopt and continually demonstrate core values of sincerity, honesty, fairness, caring, integrity etc.

Expectations and Standards - workers can only be effective if they know what is expected and the standards to which work must be done. This is one of the fundamental building blocks to success.

Performance Improvement and Line Management Meetings - where implementation of performance improvement plans are the responsibility of the line organization, it is essential that regular meetings be held to ensure that schedules and priorities are maintained. A failure to reinforce the focal project areas leaves open the possibility for emerging station issues to displace resources from the focal projects.

The Scope of Performance Improvement Programs - a substantial amount of additional work results from an improvement program. This additional work must be integrated into other necessary ongoing station activities. How all necessary station objectives can be practically met must be presented in a comprehensive plan.

Acquiring additional staff - the increased work load associated with a performance improvement program

typically involves acquiring additional resources. New resources will not be fully capable of productive work soon after arriving on site. It typically takes months or sometimes years before employees can be fully effective. An influx of new resources can represent an initial setback to progress, as existing staff are required to assist with the development of new staff.

7. COUNTER MEASURES TO PROMOTE MAINTAINING A COMPETITIVE EDGE

Taking the initiative to deal with safety performance problems is not a one time effort. Established goals must be achieved and gains realized must be sustained on an ongoing basis if we are to maintain public confidence in the industry. We must also realize that there are significant costs associated with achieving and sustaining a high safety performance standard. Recent trends suggest that rising safety performance standards will tend to increase costs.

At Point Lepreau the estimated cost for the next 2 years to achieve our target performance level is expected to increase the station OM&A budget by greater than 20%. An ongoing incremental cost of 10% is expected to sustain the required level of performance.

Known added costs and uncertainty for potential future costs of rising safety performance standards are gradually making alternate energy sources an attractive option. The intangible benefits of electrical energy from nuclear generating facilities are not being effectively communicated to society at large. Examples of such benefits include:

i) minimal impact on the environment

ii) alternate fuel sources are non-renewable and have other applications which benefit society

iii) fuel transportation costs are low and indirect costs are lower than for alternate fuels.

If we do not take measures to counter the increasing cost of operating nuclear power facilities, there is a real risk that our industry will be displaced with other alternatives which have a significant negative environmental impact.

We must meet high levels of safety performance but we must do it in a cost effective manner. In fact we need to look at all aspects of our operation to eliminate unnecessary cost. Furthermore we need to examine all future suggestions or recommendations promoting the increase of a safety performance standard. We must be prepared to challenge when it can be demonstrated that the costs do not justify a marginal gain in safety performance, if the risk is already extremely low.

Some of the areas that need to be examined to ensure that costs are controlled on an ongoing basis, are discussed below.

Organizational Structure - establish station goals and objectives; then assess each level within the organization and make necessary changes such that business can be conducted efficiently. The organization should be restructured to remove redundant layers and, where appropriate, sub-divide work groups to remove bottlenecks within the organization.

Work Processes - Examine all work processes to ensure that each is streamlined, and remove unnecessary steps. In parallel, look at other organizations to see if there are more cost-effective processes that could be useful to your organization.

Staff Training - in addition to the safety performance concerns, identify staff training deficiencies which are resulting in higher resource cost and poor quality of work. Such deficiencies increase rework, and reduce overall station reliability. We must be assured on an ongoing basis that staff possess the required competencies to meet high standards with respect to safety, quality and efficiency.

Managing the work force - as a first step in managing workers, management and supervision need to document and make known worker expectations and standards. They then need to observe compliance, and reinforce expectations through ongoing communication. These basic steps are necessary to

ensure that quality standards are being met and that acceptable levels of productivity are achieved.

Maintenance - look for opportunities to perform more on-line maintenance, to reduce both planned and unplanned unit outages and, for possible opportunities to reduce the frequency of preventive maintenance.

The development and implementation of an aging program which recognizes ongoing equipment degradation provides the opportunity to properly plan for the repair or replacement of equipment before it results in an unplanned outage.

Performance measures - look for ways to measure the effectiveness of all programs and processes. Such information is necessary for control of the process and to provide management with the information necessary to set goals and make informed decisions.

Work place Self Assessment - implement a station self assessment program, one where people at the working level participate in the assessment of their work group practices, and where they have the opportunity to provide input to any corrective action decision. Worker involvement provides a higher degree of assurance that change will be accepted without undue challenges.

Inform the public - implement programs to better inform the public about the positive benefits of nuclear power. Appreciation of the real facts should promote a higher level of acceptance and less pressure to increase the standards when the risk are negligible.

Challenge unnecessarily restrictive standards - take the initiative to challenge suggestions of increased standards when the cost versus the benefits are unreasonable.

8. CONCLUSION

As operators of nuclear facilities we must be responsible and take initiative to address all issues which are not in accordance with high safety performance standards. At the same time we have to be prepared to defend against pressures to initiate improvement when safety margins are already high, and significant costs would be required for marginal improvement.

We need to continually advocate the benefits of nuclear power versus alternate sources of energy. Currently the nuclear option offers a significant cost benefit over the alternatives. This advantage is gradually decreasing due to the emergence of new technical problems consistent with the aging process, and the trend to continually increase safety performance standards. To prepare for the deregulated environment, and to counter other issues we are unable to control, we need to be vigilant in looking for and implementing new initiatives which will improve efficiency within any part of our organization.