TO: **All PSEG Nuclear Employees**

FROM: Harry Keiser -President & Chief Nuclear Officer- PSEG Nuclear

SUBJECT: **PSEG *NUCLEAR* MANAGEMENT EXPECTATIONS MEMORANDUM PROGRAM**

DATE: April 16, 2001

The PSEG Nuclear senior management team to establish expectations, reinforce existing expectations, or to provide emphasis on topics warranting further communication to achieve high performance standards for the PSEG Nuclear issues management Expectation Letters (MELs).

Management Expectation Letters will be prepared in memorandum as follows:

1. Not conflict with procedural requirements within the PSEG Nuclear. If at any time a non-conservative conflict arises, the procedures will govern.
2. Be effective the date the memorandum was approved. Be numbered by the order of issuance (e.g., second letter issued would be numbered "NC.NA-ME.ZZ-0002"). Revisions to existing MELs should be given a new revision numbers for each revision.
3. Be approved and signed by the appropriate PSEG Nuclear Senior Management member.
4. Be initialed by the author at the bottom left hand corner of the last page of the letter.
5. Be controlled within the records / document management system.
6. Be reviewed on an annual basis to determine current applicability. The letter will either be kept or deleted.

Where additional correspondence guidance is needed, use the PSEG Nuclear Correspondence Style Guide (NC.NA-WG.ZZ-0003 (Z)) as a reference.

JC: jc

B-192

Corrective Action Program provides the mechanism to document, evaluate, and resolve conditions adverse to quality. The Employee Concerns Program (ECP), which provides the ability to raise concerns anonymously, is available as an alternative if the primary paths were not effective. ECP personnel are available at extensions X3654, and X7937. The NRC remains available as well, and can be contacted on site or at their Region I offices in King of Prussia, Pa.

Every individual working in support of *PSEG Nuclear* is expected to foster and embrace an environment where every employee feels free to raise nuclear quality/safety concerns. Your concerns are to be promptly reviewed and prioritized based on their potential safety significance, and appropriately resolved with timely feedback.

For your part, we expect if you are aware of quality/safety concerns that you raise the issue so that it can be addressed. **An employee who raises such a concern is a valued nuclear professional who has provided us with an opportunity to improve.** Those individuals will be rewarded by the organization. Harassment, intimidation, or retaliation against any individual for raising a concern is a violation of NRC regulations and is unacceptable. This includes inappropriate actions by any individual, group, or organization. Inappropriate actions may include remarks, cartoons, adverse employment actions, or other conduct aimed at a person for raising a concern. There is zero tolerance for such activities, and anyone choosing to engage in them, directly or indirectly, formally or informally, will be subject to disciplinary action up to and including discharge.

JC: jc

TO: All PSEG *Nuclear* Employees

FROM: Harry Keiser -President & Chief Nuclear Officer-PSEG Nuclear

SUBJECT: NUCLEAR SAFETY

DATE: April 16, 2001

As part of the strategy for winning in the nuclear industry, high safety standards-both nuclear and industrial-are the first critical elements for measuring our success. I have also shared with you the correlation for our industry that shows that those who focus on achieving top safety performance also achieve top performance in reliability and cost. I would like to take this opportunity to share my beliefs about nuclear safety to emphasize its importance.

Nuclear safety comes first. It is the foundation for everything we do and is everyone's job. Each person's individual work performance is the first level of defense in operating Salem and Hope Creek safely. When we take an action or make a decision, each one of us must:

- Maintain a safety consciousness;
- Make decisions that are conservative for nuclear safety;
- Adhere to procedures; and
- Raise safety issues when they are experienced or observed.

It is important for our success that the atmosphere within the *PSEG Nuclear* is highly conducive to safety. Each employee should feel free to raise safety issues. It is your responsibility as a *PSEG Nuclear Nuclear* employee to identify and promptly resolve all conditions adverse to nuclear safety. This policy on Nuclear Safety for nuclear facilities is clear and simple:

- Safety is my job
- Safety is your job
- Safety concerns will be treated with respect, and resolved promptly.

Identifying safety and quality concerns is the right of every individual working in support of our nuclear facilities. The observations of employees are a critical first level of defense in maintaining our safety conscious focus. You are the eyes and ears of the organization, you know where the problems are and you know where the opportunities for improvement are. Therefore, it is important to our success that the atmosphere within *PSEG Nuclear* remains conducive to identifying issues and raising nuclear safety concerns.

Management has the primary responsibility for resolving issues beginning with your supervisor, and the

To: All *PSEG Nuclear* Managers and Supervisors

FROM: Harry Keiser -President & Chief Nuclear Officer-PSEG Nuclear

SUBJECT: PERSON-TO-PERSON COMMUNICATION

DATE: April 16, 2001

Effective communication skills are an important part of being a leader. Managers and supervisors are responsible for communicating to their associates, what we're doing and why, in plain English. Moreover, effective communication is a two-way process. Managers and supervisors need to be good listeners in order to become truly effective communicators. Both effective listening and information sharing are critical to our success. Effective communication causes strong team and individual relationships to be created. Effective communication causes our commitments to excellence to be realized with velocity. I expect effective communication at all levels including acknowledgment of jobs well done and sharing of each other's disappointment when we do not live up to our commitments to excellence. Effective communication is an essential part of strong supervisory worker environment.

It is my immediate and ongoing expectation that members of the Senior Management Team and Cost Center managers will conduct routine meetings with direct reports. I also expect supervisors to conduct routine meetings with bargaining and non-bargaining unit employees. This is not a new expectation.

It is my expectation that supervisors spend an adequate amount of time in the field assessing and monitoring work that they are responsible for. I expect supervisors to give instant feedback and constant reinforcement to their personnel to ensure high standards for performance are met. Contact time between support groups and the stations is critical to the success our company. I also expect that support group management and supervisory personnel will spend sufficient time in the plants with their customers to communicate what they are doing and ensuring that their actions are supporting the needs of the stations. Times have changed. Never before has interpersonal communication played such an important role. All of us need to become better communicators. This is a responsibility each of us owns, rather than a function of a particular department or group.

We will provide you with the tools you need to become a better communicator. I am confident that you will provide the other equally important ingredients -- your cooperation, support, and leadership.

JC: jc

TO: **All PSEG Nuclear Employees**

FROM: Harry Keiser -President & Chief Nuclear Officer-PSEG Nuclear

SUBJECT: **PERSONAL ACTIONS AND ACCOUNTABILITY**

DATE: April 16, 2001

In the past, there have been some very serious incidents, which served to undermine the confidence of our regulators and draw into question the dedication and competence of our employees. In several incidents, employees were found to be sleeping or attempting to sleep while at work. By their actions, these employees compromised themselves and PSEG Nuclear's focus on achieving top quartile performance through high performing individuals and teams.

Employees within the Protected Area or on Company time are not permitted to take a nap, rest their eyes by closing them for an extended period of time, or in any other way place themselves in a compromising posture that may give the appearance of sleeping or inattention to duties. Individuals are encouraged to immediately raise any issue to their supervisor that may place themselves or the reliability of the plant in jeopardy.

Additionally, distraction and/or perceived distraction are caused when personal reading material finds its way into and around the work environment. *Therefore, personal reading material is not acceptable in the work area during work periods. Employees are to ensure that personal reading material is appropriately stored away and only read during approved break periods and in approved break locations.*

If we are to retain the confidence of our regulators and the general public, we must all be fully engaged and focused on the critical tasks we are performing. Employees must understand that the current work environment requires that nothing distract us from focusing on work performance or give the appearance that it may distract from our primary work. Employees must always be attentive to their work. Even a perception of in-attentiveness damages our efforts.

We are all personally accountable for our actions and total cooperation regarding this matter is critical to our success.

All PSEG Nuclear Employees

FROM: Harry Keiser -President & Chief Nuclear Officer-PSEG Nuclear

SUBJECT: **OPENNESS AND PERSONAL ACCOUNTABILITY**

DATE: April 16, 2001

As employees of PSEG *Nuclear*, we are committed to uncompromising standards of excellence. Even the slightest deviation from these standards can result in significant consequences to the continuous safe, uneventful operations of the plant.

To ensure safe, reliable, and cost-effective operations of our plants, employees are expected to take every precaution to ensure that they adhere to all performance guidelines in order to avoid mistakes. However, it would be unrealistic to presume that every error can be anticipated and avoided. We are human and occasionally we make mistakes. It is the responsibility of each employee to properly come forward and take personal accountability with complete information about personal actions and plant conditions. Prompt identification of these situations allows us to take appropriate action to rectify problems and avoid costly follow-up investigations. Withholding information or failing to completely disclose details of a situation can be more detrimental than the incident itself.

I expect each one of us to encourage an environment of open communication and information sharing. It is my expectation that employees who make a mistake come forward promptly so that the situation can be rectified and costly investigations can be avoided. The appropriate response to an admission of a mistake or near miss is to identify the rationale or causes behind the situation and address those underlying issues so that we can learn from the situation and prevent it from reoccurring. The appropriate response is not to blame or humiliate. We will not tolerate such behavior. Becoming a "learning organization" that continually seeks to learn from mistakes or failures is vital to our future. I expect all managers and supervisors to provide an environment, which encourages our employees to be open and personally accountable.

I expect every PSEG *Nuclear* employee, myself included, to support this effort fully and to help create an environment where we can learn from our mistakes and avoid repetitive errors.

JC:jc

That you are responsible for both your fellow workers and yourself, and

That you are personally accountable to perform each of your tasks in a safe and reliable manner.

As the Chief Nuclear Officer, my commitment is to demonstrate, through my actions, that safety is our only choice. I expect that you join me in this commitment.

TO: All Nuclear Business Unit Employees & Supporting Associates

FROM: Harry Keiser -President - PSEG NUCLEAR & Chief Nuclear Officer

SUBJECT: **SAFETY EXPECTATIONS**

DATE: April 16, 2001

As the PSEG Nuclear's Chief Nuclear Officer, I am the person ultimately accountable for the safe, reliable, and cost-effective operation of our three units. I am, therefore, the person ultimately accountable for personal, nuclear, and radiological safety. I am the person ultimately accountable for you and every other person who works at this site. The buck stops here.

As your leader I want you to know that:

I am committed to us being an accident-free workplace. This means we do whatever it takes to prevent, stop, and keep accidents from happening. This means we focus first and foremost on safety, second on our schedules and work plans. Safety is our top priority, in word and deed.

I am committed to the workers at the PSEG Nuclear being safe and prepared. This means having the proper tools, equipment, and supervisory support and guidance to do the job right the first time. This means that we will take the time to prepare and perform every job so that it will achieve the results of safety and long-term reliability.

I am committed to effective, timely communications that support each and every one of us being safe, doing our jobs to the best of our abilities, and returning home safely to our loved ones. This means that we will listen to each other, work together as a team, and bring our best to each job.

This is what I expect of you:

That you place the safety of yourself, your co-workers and power plants first,

That you are knowledgeable of the consequences of your next action or in-action and you pay careful attention to your surroundings and their risks,

That you have a right and obligation to express your safety concerns and resolve them,

TO: **All PSEG Nuclear MAST Associates**

FROM: **Harry Keiser -President & Chief Nuclear Officer- PSEG Nuclear**

SUBJECT: EMPLOYMENT AT WILL

DATE: April 16, 2001

PSEG is an "employment at will" company. That means that absent an express agreement to the contrary, an employer or employee may terminate the employment relationship at any time, for any reason (or no reason at all), with or without notice and with or without cause. In simpler terms, if a MAST Associate decides to move on to another job, he/she can do so without offering the company any explanation. Similarly, if the company no longer desires an Associate's services, his/her employment can be terminated at any time, with or without a reason.

This letter is a reminder that although the company has and may continue to use a variety of corrective action programs or tools (such as Positive Discipline, which is no longer in use for MAST Associates), management is not limited by those programs or tools and can take any action it deems appropriate.

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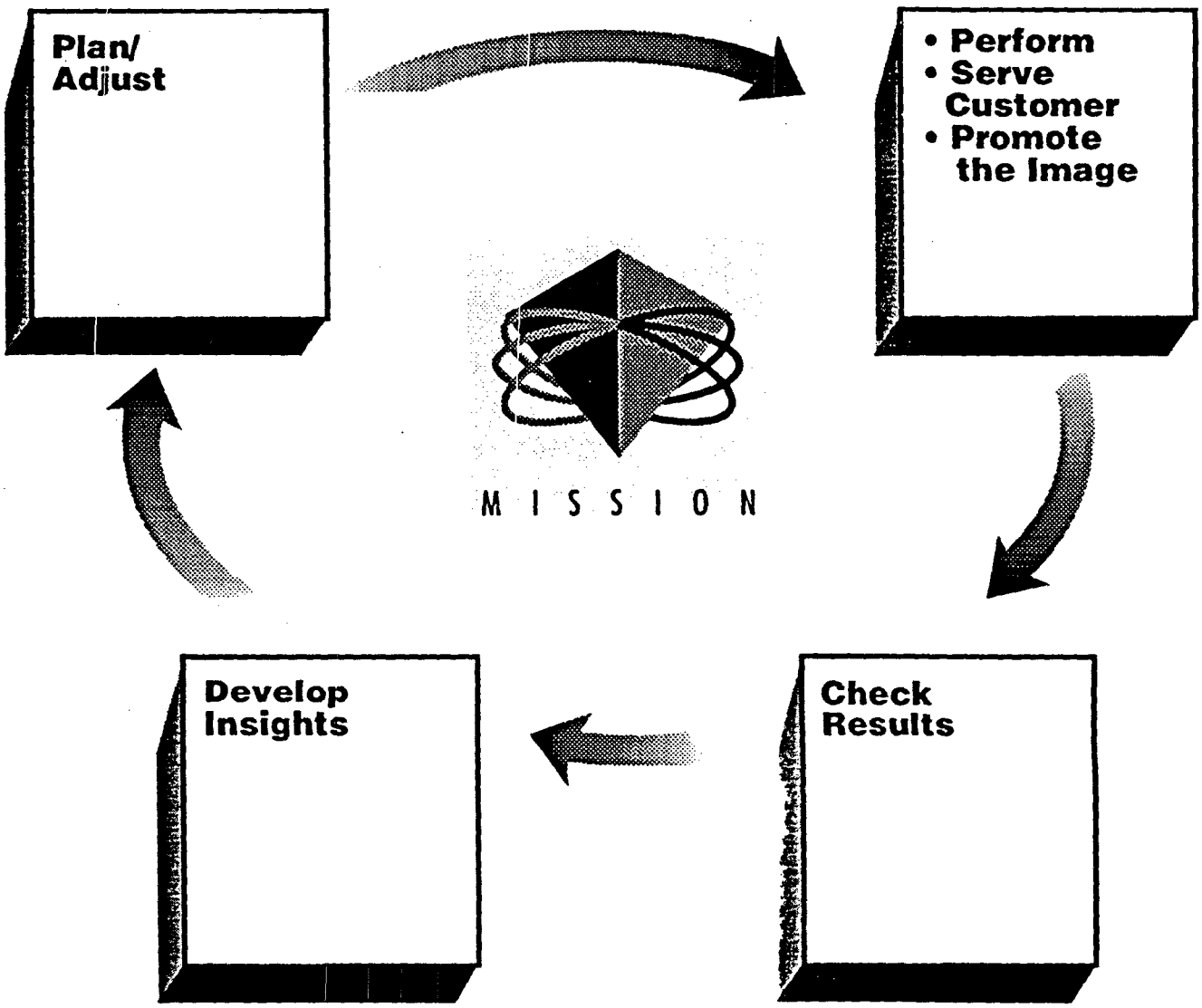
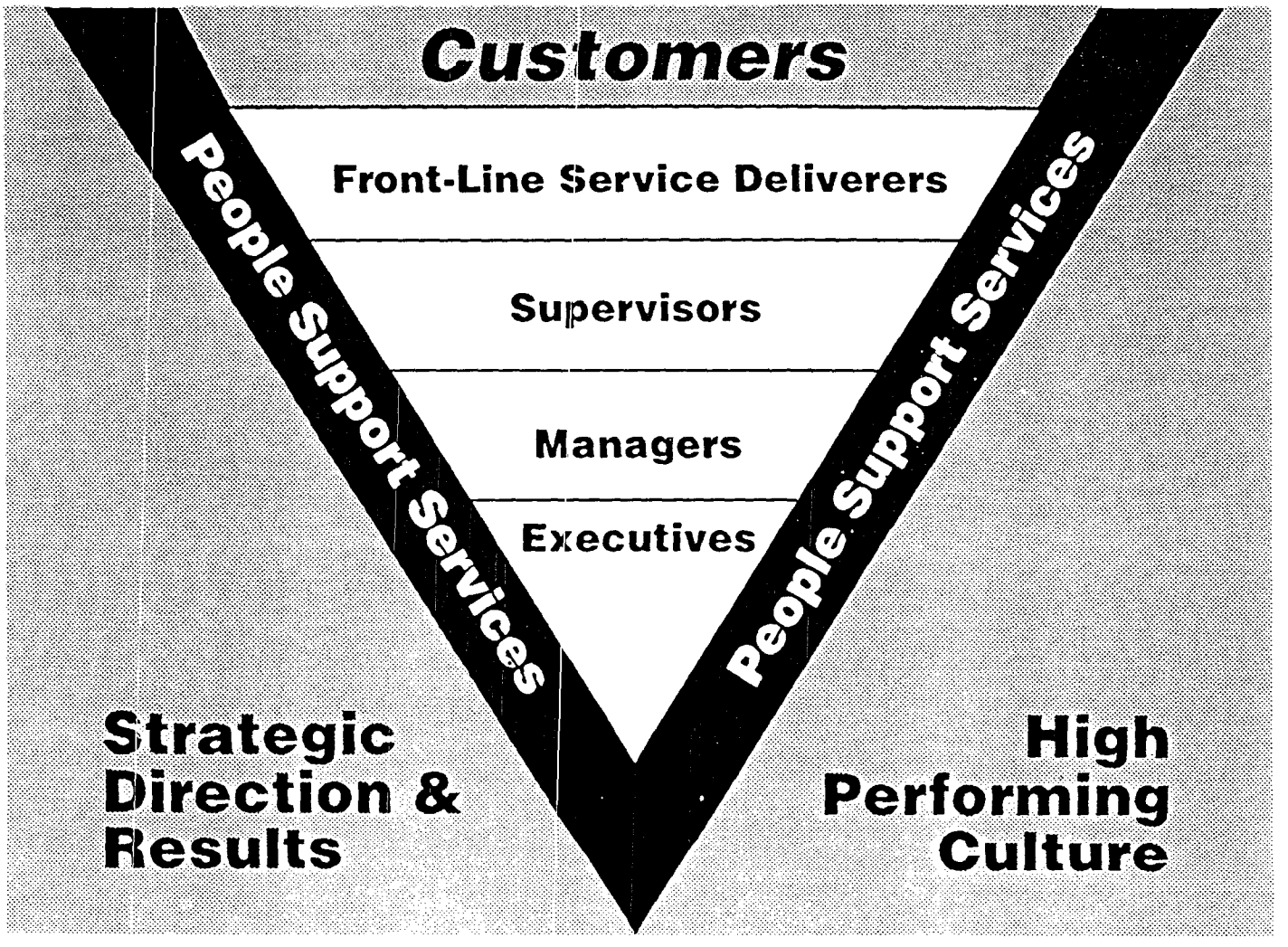
Continuous Improvement Worksheet



The "Strategically" Empowered Organization



CHAPTER I

Maintenance Management and Leadership

A. INTRODUCTION

Maintenance managers achieve high standards of performance in maintenance through effective management of all department activities and effective interaction with functional area managers whose activities affect the performance of maintenance activities. Corporate and station policies should reflect a philosophy of striving for excellence in maintenance. This chapter addresses some key attributes of effective maintenance management, including fundamental aspects such as providing appropriate direction and monitoring. INPO 92-002, *Guidelines for the Organization and Administration of Nuclear Power Stations*, and NUMARC 93-01 (Revision 1), *Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, contain additional information on this topic.

B. DISCUSSION

The establishment and reinforcement of maintenance standards by corporate and station managers provide clear direction to maintenance personnel. Standards clearly define maintenance objectives, expected performance levels, and responsibilities and accountabilities for maintenance activities. Standards for maintenance activities are integrated into maintenance department policies and procedures.

Maintenance standards are reinforced in training. Department goals and objectives provide direction, establish high standards, and foster continuing improvements.

Excellence in maintenance management includes the commitment of station and corporate managers to effectively monitor and assess maintenance activities. Managers motivate maintenance supervisors to observe the activities of workers in the field and initiate coaching or corrective action.

Maintenance managers continually assess the effectiveness of maintenance programs through a variety of techniques such as collecting and analyzing selected data, observing work practices in the field, and identifying root causes of maintenance-related problems. This assessment addresses both personnel and equipment performance and the effectiveness of processes. Maintenance department staffs are trained to perform these types of assessment activities.

Maintenance department personnel are held accountable for their performance. Effective feedback mechanisms for personnel performance, such as supervisory coaching, performance appraisals,

recognition and rewards, and disciplinary measures are established. Feedback is actively solicited from all members of the maintenance organization and selected members of the plant staff.

Maintenance managers and supervisors effectively manage change within the organization. Maintenance performance is closely monitored to ensure changes have the intended effect and to make additional modifications, as necessary.

In summary, management of maintenance activities can be strengthened by establishing and communicating high standards, monitoring personnel and equipment performance, assessing the effectiveness of the maintenance program, and implementing improvements with an emphasis on individual accountability.

C. GUIDELINES

1. Direction

Maintenance managers should establish mechanisms to provide direction to personnel conducting maintenance activities. These mechanisms should employ both written and oral means and address the following aspects of management direction:

a. Maintenance Department Standards

It is a primary responsibility of the maintenance manager to establish and maintain high standards of performance and to ensure implementation of corporate and station policies that affect the achievement of these standards. Clearly define responsibilities for implementing these standards and policies, including the responsibility of maintenance personnel. Although management sets the standards, it is important that workers are given an opportunity to help define them. Maintenance personnel must understand their authority, responsibility, and interfaces with other groups.

Maintenance standards establish an atmosphere that supports proper work ethics and attitudes and specific management expectations that are realistic and within the capabilities of the staff. Standards of performance can be derived from a variety of sources such as INPO 97-002, *Performance Objectives and Criteria for Operating Nuclear Electric Generating Stations*. Industry experience and station operating experience are used to develop performance standards. Industry technical standards such as ASME or ANSI documents that normally provide scientifically developed and industry-accepted parameters for fulfilling technical performance criteria may also provide a basis for some standards.

Policies that guide maintenance department activities in procedures or other definitive documentation are specified by management. These documents also specify the types of controls necessary to implement department standards.

b. Lines of Communication

An integrated approach to managing maintenance activities includes clear lines of communication developed among station departments and external groups that contribute to and support the maintenance function (for example, operations, health physics, materials management, quality control, engineering, training, chemistry, and modifications). The maintenance program charts the relationship among these supporting groups, as related to overall plant maintenance, by defining responsibility and authority and addressing organization and process interfaces. Information across interfaces is transmitted accurately and efficiently. The need to formally control some interfaces may be necessary; however, informal interfaces among members of the maintenance staff and other organizations should also be fostered.

c. Long-Range Planning

Effective long-range planning of maintenance programs supports high levels of equipment availability and reliability over the life of the plant. Resources are managed to support ongoing maintenance and continuous improvement of equipment performance and reliability. The following are examples of activities that should be included in maintenance program long-range planning:

- recurring major maintenance items such as turbine overhaul, steam generator inspections, and major pump rebuilds
- timing of planned maintenance and refueling outages
- major projects and modifications requiring maintenance organization involvement
- future organizational structure and staffing changes aimed at continuing improvements in the maintenance program
- replacement of components that are projected to reach the end of their service life or become obsolete
- coordination of common resources used for outages with other plants

- contingency plans for regulatory or industry issues and events that may impact the maintenance program
- contractor and corporate support
- ongoing self-assessments to determine effectiveness of maintenance activities
- personnel development needs

d. Personnel Selection and Development

Initial screening of applicants for maintenance positions takes into account the importance and potential impacts of tasks that personnel are likely to perform. The selection process verifies that applicants have the aptitude to develop the skills and knowledge to perform assigned duties. The screening includes verification of educational and professional background, suitability for the utility's culture and environment, ability to perform maintenance tasks, and potential for advancement. Whenever practical, preselection testing and candidate interviews should be used to determine the candidate's potential for success in the selection process. The selection process may also be used to assess the individual's potential for development into other positions.

For manager and supervisor applicants, the candidate's maturity, judgment, and ability to perform manager duties are evaluated. Focus the screening process on integrity, leadership, management capabilities, and technical competency. ACAD 90-010 (Revision 2), *Guidelines for Maintenance Supervisor Selection, Training, and Development,* and the *Principles for Enhancing Professionalism of Nuclear Personnel* provide additional information.

Career development plans are implemented for professional growth and to develop a source of potential supervisors and managers.

The goal of these plans is to provide maintenance personnel the opportunity to strengthen their leadership, analytical, and teamwork skills. These professional development activities allow personnel to better understand and support management expectations and the individual's role in these expectations. The activities address the needs and desires of the individual and complement department and plant goals. The activities could include the following:

- visiting other nuclear stations to broaden the individual's perspective of maintenance activities and to stimulate comparison and emulation of good practices

- working for short periods in other functional areas in the nuclear organization to broaden their perspective and understanding of overall plant functions (for example, operations, engineering, and outage)
- developing or revising maintenance programs
- participating in maintenance department problem-solving and decision-making task forces
- participating in self-assessment activities

e. Goals and Objectives

Maintenance goals are consistent with corporate and station goals and serve to focus management and worker direction. Maintenance goals are used as a management tool to involve cognizant groups in improving maintenance program performance. Examples of general goals related to maintenance include the following:

- the number of unplanned reactor trips caused by maintenance activities
- the number of power reductions attributable to maintenance program deficiencies
- equipment deficiencies that adversely impact the operators' ability to effectively operate the plant
- the number and duration of unplanned outages
- unplanned challenges to safety-related systems
- maintenance personnel radiation exposure and radiological contaminations
- timeliness of scheduled surveillances, preventive maintenance activities, and predictive maintenance activities
- management of maintenance backlog
- work delays and contributors

Goals should be challenging but achievable. Actions to support the goals are determined with input from personnel involved in conducting maintenance activities. Additionally, the status of meeting goals is given frequent and wide dissemination. Station information centers, with easily interpreted displays such as bar graphs, could be used to provide personnel with timely information on goals and their statuses.

2. Monitoring

Maintenance performance is monitored through observations of work activities, inspection and monitoring of equipment performance, and follow-up of corrective actions. Effective monitoring methods that should be part of the maintenance-monitoring program include the following:

a. Manager Field Observations

Routinely conduct field observations that support face-to-face communications and provide feedback to the various levels of the maintenance organization. Establish expectations for first-line supervisors to monitor field work, coach personnel to improve performance, and reinforce management expectations in their station tours. Review and adjust the first-line supervisors' workloads to allow sufficient time to monitor work in the field. Station tours and personnel contacts are planned for selected weekend or backshift periods and cover selected areas or maintenance activities. Use observations from these tours to improve performance.

b. Supervisor Field Observations

Routinely monitor work in progress to determine ways to improve maintenance and verify maintenance activities are conducted in accordance with policies and procedures. Good work practices are recognized and encouraged; improper work practices are corrected on the spot. Self-checking is reinforced. Causes of improper work practices are identified and corrected, and generic corrective actions are initiated as needed. Corrective actions to consider include clarifying expectations, holding workers accountable for their actions, and revising training programs. Examples of practices or conditions to be checked include the following:

- proper use of prejob and postjob briefings (Refer to *Excellence in Human Performance* for additional details on briefings and other behaviors that contribute to excellence in human performance.)
- quality of workmanship, material, and parts

- use of and adherence to procedures and policies
- practices for foreign material exclusion (Refer to SOER 95-1, "Reducing Events Resulting from Foreign Material Intrusion.")
- accountability for tools, chemicals, and materials
- use of correct tools for the job
- maintenance of clean and orderly work sites
- work progress and time required to perform the job, especially if time-critical maintenance is involved for equipment vital to plant operation
- work being performed on the correct component, train, system, and unit
- adequacy of turnover for work spanning multiple shifts
- industrial safety and radiological protection practices
- worker awareness and knowledge of the impact of maintenance on system/plant performance
- adequacy of postmaintenance tests
- techniques for quality verification
- effectiveness and timeliness of communication of problems and delays encountered in critical activities
- worker knowledge and proficiency on maintenance being performed

c. Data Monitoring (Performance Indicators)

Selected maintenance data is monitored and trended to determine performance in achieving maintenance goals and objectives. Periodic reports to management include trends, a brief explanation for trends that appear to be unusual (positively or negatively), and corrective measures where warranted. Data trends that can be used by senior management in the assessment process are discussed in later parts of this chapter.

The following are examples of quantitative and qualitative measures for key aspects of the maintenance program. Consider these or similar measures when developing a performance monitoring program.

(a) Preventive Maintenance (PM) Effectiveness

Develop parameters to monitor PM program effectiveness. These may include the following methods:

- number of equipment failures
- mean time between failures
- preventive maintenance tasks overdue
- number of overdue preventive maintenance tasks accepted with technical justification
- components and systems requiring corrective maintenance more than a designated number of times within a given interval
- components and systems with high unavailability or low reliability
- analysis reports of component performance that indicate failure rates greater than industrywide averages
- historical equipment data that indicates high maintenance cost

(b) Availability of Spare Parts

Procurement and associated activities effectively support maintenance. Monitoring of useful data may include the following:

- items not in stock on demand (percent of stock items not available on request)
- scheduled work requests delayed because of parts
- work requests in progress with material restraints
- quantity of discontinued and infrequently used inventory

(c) Refueling and Unplanned Outage Effectiveness

Analyze performance of maintenance during outages. Some successful methods used to monitor outage performance include the following:

- actual length of outage compared to scheduled duration
- amount of scheduled work not performed
- evaluation of plant performance during the cycle following the outage with respect to ease of startup, number of unplanned power reductions, heat rate degradation, safety system unavailability, and unplanned capability loss factor

- amount of unscheduled work added to outage

INPO 97-005, *Guidelines for the Management of Planned Outages at Nuclear Power Stations*, describes additional methods of monitoring outage performance.

(d) Rework

Rework monitoring data can be a subset of the repetitive equipment performance problem indicator, or it can be considered separately. Formulate a definition of rework that includes some of the elements noted below.

- corrective maintenance recurring within a specific period (for example, 12 months or a refuel cycle)
- additional maintenance required during or following completion of maintenance activities, possibly involving the following:
  - — incorrect reassembly
  - — damage to other components during maintenance
  - — postmaintenance test failure

Based on a clear definition of rework, monitoring data is collected over an interval sufficient to indicate the number of maintenance activities involving rework.

(e) Work Productivity

Monitor productivity of maintenance activities. Possible methods include the following:

- trending of man-hours expended per work item, particularly repetitive tasks
- summaries of items scheduled versus items completed
- direct observation of work and identification of barriers to work productivity
- benchmarking to compare with similar size/age units

(f) Supervisory Effectiveness

Methods to monitor supervisory effectiveness could include the following:

- review of supervisory observations of maintenance and training activities and associated reports to management
- monitoring of the performance of workers assigned to an individual supervisor, as indicated by personnel errors, injury rate, radiation exposure, rework, and productivity
- monitoring of supervisor during conduct of assigned tasks

(g) Management Effectiveness

Methods to monitor management effectiveness could include the following:

- analysis of recurrence of program weaknesses, communication skills, procedure adherence, and safe work practices, as indicated by personnel errors and their causes
- supervisor performance in reinforcing management expectations, as indicated by overall department performance or by maintenance program monitoring data and self-assessments
- monitoring of manager during conduct of assigned tasks

3. Self-Evaluation

Evaluate the results of the various monitoring measures presented above for areas where corrective measures are needed or where successes should be reinforced. Self-evaluation activities, including inspections, audits, reviews, and investigations, are necessary for an effective maintenance program. Successful assessment methods are described below.

The self-evaluation activities are balanced to provide the management team with a comprehensive review of past performance and identification of performance improvements needed to meet projected performance goals. The following four approaches should be considered when self-evaluations are conducted:

- reactive -- conducted in response to a performance shortfall, such as root cause analyses

- continuous -- conducted on a routine basis to identify performance strengths and shortfalls; for example, manager in-field observations, workweek critiques, and self-checking

- periodic -- conducted on an event-dependent or periodic basis, such as a postoutage critique and scheduled program assessments

- proactive -- conducted to identify improvements needed to move performance to levels that exceed current expectations or to prepare for performance of an evolution; for example, benchmarking and infrequently performed tests

a. Comprehensive Self-Evaluation

Assess the overall effectiveness of the maintenance program periodically. Key attributes that result in successful comprehensive self-evaluations include the following:

(1) The self-assessment is a performance-based review of maintenance field activities that evaluates program implementation, rather than a programmatic review of maintenance procedures and policies for compliance with governing documentation.

(2) Sufficient resources, both personnel and time, are allocated for self-assessment activities. An unbiased input can be achieved by involving personnel from external organizations (that is, the corporate office or a sister plant).

(3) An agenda is developed for the self-assessment with specific areas to examine and a clear definition of standards that are expected to be met in each area.

(4) Ownership is established for solving issues developed in the self-assessment, with a specific time frame for resolution.

b. Program Reviews

Specific elements of the maintenance program are evaluated periodically to help line managers and supervisors identify and correct program strengths and deficiencies. Such reviews, which may be performed by the quality assurance group, include input from maintenance managers and supervisors as well as from groups such as operations, technical staff and appropriate corporate departments. The evaluations address the overall effectiveness of program elements and inter- and intradepartmental coordination.

Areas needing improvement are assigned for corrective action and follow-up. In addition, strengths are evaluated for possible emulation by other work groups. Examples of topics to be considered include the following:

- training and qualification of maintenance staff
- maintenance facilities and equipment
- planning of maintenance work
- scheduling of maintenance work
- postmaintenance testing
- conduct of on-line maintenance
- procurement of parts, materials, and services
- maintenance history

The many aspects of maintenance programs described in this guideline are examples of topics to consider in conducting self-evaluations. In addition, the following should be periodically reviewed to identify additional elements that warrant attention:

- industry guidelines addressing maintenance-related areas (such as ACAD 92-008, *Guidelines for Training and Qualification of Maintenance Personnel*, and INPO 97-005, *Guidelines for the Management of Planned Outages at Nuclear Power Stations*)
- trends in maintenance-related industry events
- results from inspections of maintenance activities at nuclear facilities
- maintenance best practices as identified by organizations such as INPO, Nuclear Energy Institute, and the Electric Power Research Institute Nuclear Maintenance Applications Center

c. Maintenance Problem Analysis

Systematic analysis is used to determine root causes of equipment and personnel performance problems or maintenance-related incidents. The initiation of root cause analysis may result from a management request, an adverse trend, or a desire for assistance in solving a specific problem. A threshold for selecting incidents that warrant root cause analysis is established.

Analysis of human performance errors to address the organizational and environmental factors influencing individual behavior could help identify contributing factors to human performance errors. See INPO *Excellence in Human Performance* for additional information.

Chapter IX, "Maintenance History," provides guidance for collecting and trending maintenance history for recurring equipment failures to be reviewed by the analysis program. Incident reports, post-trip reviews, and other similar operating experience review methods supplement the maintenance history program and provide data, including human error data, to be reviewed by the analysis program.

Additional information on root cause analysis may be obtained in INPO 90-004 (Good Practice OE-907), *Root Cause Analysis*; and INPO 97-011, *Guidelines for the Use of Operating Experience*.

(1) Root Cause Analysis Initiation

Maintenance incidents that require root cause analysis are identified based on incident type and performance trends. (The incident or event is important to the degree that action to preclude repetition is deemed appropriate by the maintenance manager.) Maintenance department management establishes the required threshold for conducting root cause analyses of maintenance incidents. Considerations in making this selection include the following:

- actual or potential consequence of the incident in relation to reactor safety, plant or equipment reliability, and personnel safety
- sequence of occurrences or multiple failures during the incident
- recurring maintenance and human performance problems or equipment failures
- unexpected conditions encountered during the incident
- previous corrective action taken for similar incidents

(2) Information Analysis and Cause Determination

All relevant information is analyzed, and actual or probable causes of a problem are evaluated. A number of proven and accepted techniques are available for analyzing information to determine causes of problems. Examples of these include the following:

- event and causal factor charting
- barrier analysis
- walk-through task analysis
- interviewing
- change analysis and fault-tree analysis

Regardless of the technique used, direct involvement by maintenance line managers, supervisors, and workers in this process is essential to achieve desired continuous improvements and buyin by maintenance personnel.

Events or conditions not identified as warranting investigation for cause are trended to identify adverse performance trends. Where appropriate, adverse trends are investigated to identify apparent or root causes.

Once causes have been identified, additional action is taken to verify that correction of these causes will prevent recurrence. To be validated, potential root and contributing causes meet the following criteria in relationship to the problem:

- The problem would not have occurred had the causes not been present.
- The problem will not recur because of the same causal factors if the causes are corrected or eliminated.

Some factors that contribute to the success of a root cause analysis include the following:

- providing adequate time to investigate
- quarantining the area after an incident to prevent inadvertent loss of as-found information
- interviewing involved personnel as soon as possible after the incident while circumstances are still clear and perceptions have not formed that may rationalize away clues to the root cause

Additionally, care is taken not to limit analysis to merely addressing the symptoms of a problem. The symptoms are sometimes causes in themselves; however, often they are only indications that need to be pursued to find the underlying causes. For example, an instrument

setpoint is found out of tolerance every time it is calibrated. Increasing the calibration frequency may correct the symptom by keeping the setpoint drift within tolerance. However, evaluating an instrument replacement, a range change, or a calibration procedure revision could lead to elimination of the repeated failure.

(3) Corrective Action

Once all of the causes involved have been determined, viable corrective actions are identified for each root cause. The following criteria can be used to determine viability:

- Will these corrective actions prevent recurrence of the condition?
- Is the corrective action within the capability of personnel to implement?
- Have assumed risks been stated clearly and evaluated appropriately?

In determining appropriate corrective actions, consideration is given not only to the impact they will have on the root causes and whether they meet the four criteria above, but also to the impact they will have on other plant organizations.

Experience has shown that the root causes of incidents frequently involve management issues. Therefore, management also should be involved and willing to take responsibility for corrective actions related to management issues.

Once appropriate corrective actions have been defined, management concurrence is obtained and the corrective actions prioritized, scheduled, and tracked for timely implementation. For longer-term corrective actions, the need for interim compensatory actions is considered.

(4) Reporting Results

The results of the root cause analysis are presented to maintenance management. Sufficient information is provided to allow an understanding of the incident, its significance and root causes, and the recommended corrective actions. The results are also conveyed to personnel to prevent recurrence. For example, results can be discussed in training and meetings and routed for information and review in short, written summaries.

Lessons learned from root cause analysis that may be of interest to other nuclear stations are identified. The occurrence and corrective actions of lessons learned are shared with the industry, as appropriate, via such methods as Nuclear Network. The

significance of the event may necessitate reporting before the corrective actions are identified. Follow-up may be necessary to complete the transfer of information to the industry.

INPO 97-011, *Guidelines for the Use of Operating Experience*, provides detailed information on sharing event information with the industry.

(5) Corrective Action Follow-Up/Effectiveness Review

If a maintenance-related event recurs, the original condition or event, in addition to the new condition or event, is reevaluated. Methods are developed for tracking and trending corrective action and root cause information. The analysis program addresses common root causes among different disciplines that demonstrate generic corrective actions need to be taken. The self-evaluation process is evaluated to determine weaknesses that contributed to recurrence of the performance weakness.

In the case of an equipment problem, postmaintenance testing could be used to determine if additional maintenance work or diagnostic fact-finding should be performed. Closely monitoring the equipment during an extended period of operation may also be necessary to provide sufficient assurance that the cause or causes have been properly corrected. Similarly, long-term follow-up is appropriate to determine if the desired results are obtained from corrective actions such as retraining, procedure changes, and preventive maintenance changes.

4. Accountability

Establish accountability for the effectiveness of the maintenance program. Recognize the performance of managers, supervisors, engineers, planners, craftsmen, warehouse personnel, and other personnel who support maintenance. Particularly recognize superior performance. Encourage personnel involved in significant or frequent violations of maintenance requirements to improve through counseling, remedial training, or disciplinary measures, where appropriate. Use feedback through measures such as performance appraisals to improve maintenance personnel performance.

A key element of personnel accountability is an environment in which feedback and communication are continuously encouraged. This environment supports the recognition of strengths and weaknesses and encourages participation in improvements.

Maintenance Management and Leadership

Management Direction and Expectations
Planning and Implementing
Monitoring and Assessing
Follow-Up, Reinforcement, and Feedback

The establishment and reinforcement of maintenance standards by corporate and station managers provide clear direction to maintenance personnel. Standards clearly define maintenance objectives, expected performance levels, and responsibilities and accountabilities for maintenance activities. Standards for maintenance activities are integrated into maintenance department policies and procedures.

Maintenance standards are reinforced in training. Department goals and objectives provide direction, establish high standards, and foster continuing improvements.

Excellence in maintenance management includes the commitment of station and corporate managers to effectively monitor and assess maintenance activities. Managers motivate maintenance supervisors to observe the activities of workers in the field and initiate coaching or corrective action.

Maintenance managers continually assess the effectiveness of maintenance programs through a variety of techniques such as collecting and analyzing selected data, observing work practices in the field, and identifying root causes of maintenance-related problems. This assessment addresses both personnel and equipment performance and the effectiveness of processes. Maintenance department staffs are trained to perform these types of assessment activities.

Maintenance department personnel are held accountable for their performance. Effective feedback mechanisms for personnel performance, such as supervisory coaching, performance appraisals, recognition and rewards, and disciplinary measures are established. Feedback is actively solicited from all members of the maintenance organization and selected members of the plant staff.

Management Direction and Expectations

- Manager are to establish and maintain high standards of performance
- Clearly define the responsibilities for implementing these standards and policies to include:
  - Nuclear safety and critical safety functions
  - Conservative decision-making with respect to the reactor core
  - Defense-in-depth and risk management
  - Integrity and professionalism
  - Iinfrequently performed tests and evolutions
  - Procedure use and adherence
  - Training and qualification of station personnel
  - Radiation safety, including maintaining dose as low as reasonably achievable
  - Industrial safety
  - Communications
  - Fitness for duty

Maintenance managers should establish mechanisms to provide direction to personnel conducting maintenance activities. These mechanisms should employ both written and oral means and address the following aspects of management direction:

a. Maintenance Department Standards

It is a primary responsibility of the maintenance manager to establish and maintain high standards of performance and to ensure implementation of corporate and station policies that affect the achievement of these standards. Clearly define responsibilities for implementing these standards and policies, including the responsibility of maintenance personnel. Although management sets the standards, it is important that workers are given an opportunity to help define them. Maintenance personnel must understand their authority, responsibility, and interfaces with other groups.

Maintenance standards establish an atmosphere that supports proper work ethics and attitudes and specific management expectations that are realistic and within the capabilities of the staff. Standards of performance can be derived from a variety of sources such as INPO 97-002, *Performance Objectives and Criteria for Operating Nuclear Electric Generating Stations.* Industry experience and station operating experience are used to develop performance standards. Industry technical standards such as ASME or ANSI documents that normally provide scientifically developed and industry-accepted parameters for fulfilling technical performance criteria may also provide a basis for some standards.

Policies that guide maintenance department activities in procedures or other

Promoting Effective Teamwork

Recurring Issues

Significant events have occurred because station personnel did not function as a team. Control room operators occasionally found themselves challenged to operate in situations that were not addressed by procedures or prior experience. Inappropriate decisions were made and implemented by managers without the synergistic benefit derived from using the information and perspective of all personnel involved.

Events

SER 25-95, "Improper Valve Positioning Results in Undetected Loss of Shutdown Cooling"

On July 9, 1995, Hope Creek Generating Station was shut down and cooling down with the shutdown cooling system when control room operators opened a valve, causing shutdown cooling flow to bypass the reactor vessel. To address a perceived concern about valve thermal binding, operators left a reactor recirculation discharge isolation valve partially open. The shift manager was not aware of reactor coolant system status. Further, the reactor operators rationalized that there was no reason to notify the shift manager or seek concurrence for their actions. Although one senior reactor operator was aware of the potential for cooling flow to bypass the reactor, he did not know that the reactor recirculation pump discharge valve had been left partially open. *This event demonstrates that when shift personnel operate independently and not as a team, important information known to some individuals but not available to the entire crew can contribute to events.*

SER 8-97, "Switchyard Circuit Breaker Failure Results in Motoring Main Generator"

On January 17, 1997, after a switchyard circuit breaker failed, the main generator at Fermi 2 was damaged because control room operators opened the field excitation breaker while the generator was still connected to the grid. This action motored the generator, causing high input current that damaged the rotor and stator. Through subsequent investigation, station personnel determined that an auxiliary contact (for one phase) in the main generator output breaker failed to close when the breaker was first closed, and this caused one phase to remain closed when the breaker tripped open. The operators became confused because conflicting indications had not been seen before, such as the main generator output breaker being open while generator load was at approximately 12 MWe. Neither normal nor

abnormal operating procedures provided specific guidance. As a result, operators relied on their system knowledge, diagnostic abilities, and problem-solving and decision-making skills. However, they did not work as a team to use collective input, questioning, and briefings to solve the problem. Shift managers directed that the field excitation breaker be opened, without soliciting input from the control room crew or resolving the conflicting indications. *This event illustrates the importance of using available information and input to help determine a proper course of action.*

SER 4-97, "Incorrect Use of Emergency Operating Procedures During a Potential Anticipated Transient Without Scram"

On September 16, 1996, following an automatic scram from 100 percent power, operators at James A. FitzPatrick Nuclear Power Plant incorrectly applied emergency operating procedure guidance by not entering the anticipated transient without scram procedure when they were unable to verify all control rods were fully inserted. Following the scram, power was lost to nonsafety-related loads, causing the full core display and all other control rod position indicators to deenergize. The two senior reactor operators chose not to enter the emergency operating procedure for this potential anticipated transient without scram condition without soliciting input from or providing the rationale to the rest of the control room crew. Their decision was not in accordance with emergency procedure guidelines or training, and it reflected inappropriate direction by the shift manager and a lack of teamwork by the operating crew. *This event demonstrates how inappropriate decisions can result if managers do not solicit input from their personnel or, when appropriate, involve them in the decision-making process.*

Similar teamwork issues involving multiple departments are addressed in SER 5-97, "Liquid Leak Sealant Material Migrates Into Reactor Vessel Head Vent System," and SER 13-96, "Screen House Repair Activities Result in Potential Common-Cause Loss of Ultimate Heat Sink."

"A Review of Flightcrew-Involved Major Accidents of U.S. Air Carriers, 1978 through 1990," NTSB/SS-94/01, PB94-917001

In January 1994, the National Transportation Safety Board released a study of airline accidents involving crew performance with insights on crew teamwork that can be applied to the nuclear industry. For example, 73 percent of the airline accidents occurred on the first day a crew had flown together. Nearly half of the accidents happened on the first leg of the first trip. *It is apparent that crew members who are familiar with each other make fewer mistakes than those who are working together for the first time.* About half the accidents involved an error by the captain that was not challenged by the crew. This reveals the value of crewmembers advocating a position that is contrary to the

leader's decision, when they feel it is necessary to do so. *Crewmembers should practice monitoring each other's actions and challenge any action they do not understand.* Furthermore, the captain was flying when many of the crashes occurred. It is apparent that the captain is more effective overseeing rather than becoming involved in crew activities.

Insights

INPO 88-003, "Guideline for Teamwork and Diagnostic Skill Development"

INPO, "Excellence in Human Performance: Building on the Principles for Enhancing Professionalism," September 1997

INPO 92-002, "Guidelines for the Organization and Administration of Nuclear Power Stations"

INPO 97-002, "Performance Objectives and Criteria for Operating Nuclear Electric Generating Stations"

When station personnel are confronted with situations for which established plant procedures do not specifically apply, it is important that they leverage their abilities to clearly understand the situations and make correct decisions by involving appropriate personnel, such as the entire operating or maintenance crew. Input and advice from technical experts should also be considered, time permitting. Effective teams share several common characteristics, including the following:

- They operate with well-defined goals.
- They share common objectives.
- They enact the same expectations.
- They base decisions on team input in complex situations.

Human performance experts state that in approximately half of the instances in which individuals are in knowledge-based performance, they have incorrect mental models of the situations. This results because each person can have different facts, insights, and perspectives. In those circumstances, communication (including assumptions) is key to expose the decision-makers to the collective knowledge of the team. Conversely, when an independent decision is reached, briefing the team on the basis for the decision can validate the mental model and provide a barrier to inappropriate actions.

Once an effective team is established, its teamwork skills become self-perpetuating. The key to developing effective teamwork is for station managers to establish an environment that promotes and reinforces the characteristics of teamwork. When teamwork is part of the station culture, individuals exhibit behaviors that support teamwork when they are confronted with unfamiliar situations. Specifically, if teamwork and collaboration are the norm, then the probability is high that personnel will act as a team during

normal and abnormal situations. Teamwork is strongly dependent on individuals understanding the standards and expectations that have been demonstrated and communicated by management.

Discussion Points: PREVENT EVENTS for Managers	The following points are provided for discussion among station managers to examine the level of teamwork at the station:
INPO 97-003 (Preliminary) "Safety Focus During Changing Times - Recognizing Indications of Declining Plant Performance"	• What methods do we use to ensure our personnel function as a team to address situations when procedure guidance is not available? • What measures do we use to verify that our people consider all relevant information before making a decision? How well do we critique the crews' responses to conflicting information during a plant event or simulator scenario?
INPO 96-008, "Guidelines for the Conduct of Operations at Nuclear Power Stations"	• Where have we clearly established high standards for briefings during transient conditions? How have we communicated these expectations to the operating crews?
SOER 96-1, "Control Room Supervision, Operational Decision-Making, and Teamwork"	• How do we demonstrate, by our own actions and communications to station personnel, that effective teamwork is expected? What incentive measures do we use to positively reinforce those behaviors? What indicators reflect the success of our efforts to enhance teamwork? • What simulator scenarios have we developed that require the control room crew to apply diagnostic and teamwork skills? How do we monitor the effectiveness of those simulator exercises? How do we apply these same methods and principles to other plant workers? • How do we identify individuals who exhibit the desired characteristics of teamwork and develop them for supervisory positions?

Planning and Implementing

- Managers ascertain that staffing and resources are sufficient
- Resource needs, such as personnel, capital, equipment and parts, and information, are identified and integrated into business plans.
- Changes to plant equipment, procedures, and processes are planned and implemented systematically.
- Change objectives, responsibilities, and implementation schedules are clearly communicated.
- Change initiatives are managed and coordinated.
- Information and data are used for planning, performance monitoring, and decision-making. Information sources are integrated to improve the accuracy, timeliness, and availability of information.
- Resources are allocated to meet station priorities and to avoid overlapping or duplication of work.

Monitoring and Assessing

Manager Field Observations
Supervisor Field Observations
Data Monitoring (Performance Indicators)
- Preventive Maintenance (PM) Effectiveness
- Availability of Spare Parts
- Refueling and Unplanned Outage Effectiveness

Rework
- Work Productivity
- Supervisory Effectiveness

Management Effectiveness
Self-Evaluation

Maintenance performance is monitored through observations of work activities, inspection and monitoring of equipment performance, and follow-up of corrective actions. Effective monitoring methods that should be part of the maintenance-monitoring program include the following:

a. Manager Field Observations

Routinely conduct field observations that support face-to-face communications and provide feedback to the various levels of the maintenance organization. Establish expectations for first-line supervisors to monitor field work, coach personnel to improve performance, and reinforce management expectations in their station tours. Review and adjust the first-line supervisors' workloads to allow sufficient time to monitor work in the field. Station tours and personnel contacts are planned for selected weekend or backshift periods and cover selected areas or maintenance activities. Use observations from these tours to improve performance.

b. Supervisor Field Observations

Routinely monitor work in progress to determine ways to improve maintenance and verify maintenance activities are conducted in accordance with policies and procedures. Good work practices are recognized and encouraged; improper work practices are corrected on the spot. Self-checking is reinforced. Causes of improper work practices are identified and corrected, and generic corrective actions are initiated as needed. Corrective actions to consider include clarifying expectations, holding workers accountable for their

Monitoring Station Activities

Recurring Issues

Events have occurred at nuclear stations for which line managers observing station activities did not take action to correct deficiencies in communication, teamwork, and procedure adherence. In other events, with managers present in the control room, operating crews became confused as to who was responsible for decisions. In some cases, managers observing control room activities were not briefed on their responsibilities or were unfamiliar with the expectations for conduct of operations, test control procedures, or prior industry operating experience for the evolutions in progress.

Events

SER 9-97, "Unrecognized Reactivity Mismanagement During a Reactor Shutdown"

On February 21, 1997, Zion Station Unit 1 experienced a reactivity event during a forced shutdown. A technical specification limiting condition for operation for a containment spray pump had expired, placing the reactor in a shutdown action statement. Several managers were in the control room throughout the event; however, they focused on the efforts to repair, align, and test the spray pump and not on core reactivity changes being made by the reactor operator. None of the managers effectively monitored the crew's actions and were, consequently, unaware that the crew had deviated from the shutdown plan. While reducing reactor power, the reactor operator inserted control rods continuously for approximately four minutes, adding a large amount of negative reactivity, and then continuously withdrew the control rods for approximately two minutes in an attempt to stabilize reactor power. None of the crewmembers or managers were aware of the reactor operator's actions.

Similar management issues are also addressed in SER 1-97, "Nonconservative Operations During Isolation of a Reactor Recirculation Pump Seal Link."

Several barriers broke down while managers were distracted by the containment spray pump repair efforts and were too involved with other activities to recognize that the crew lost its focus on the reactor shutdown. For example, the shift manager did not enforce standards for minimizing distractions and limiting excessive overlapping activities in the control room. The crew did not exhibit good teamwork skills such as open communication and the willingness to challenge each other prior to actions being taken. Station standards for preevolution briefings, supervisory oversight, and peer-checking were not implemented. Additionally, station

policies regarding core manipulations, power changes, and reactivity management were not followed.

SER 3-96, "Failure to Perform Reactor Scram and Turbine Trip When Test Limits Were Exceeded"

A similar event occurred at Seabrook Station on June 22, 1989 and is described in SER 24-89, "Failure to Manually Scram the Reactor When Startup Test Conditions Were Exceeded."

On August 6, 1995, Quad Cities Station Unit 2 operators were performing a postmodification test of a feedwater regulating valve when the valve failed to automatically respond to a step change input. During the crew's unsuccessful efforts first to close the feedwater valve and then to isolate it, reactor vessel water level exceeded both the manual scram limit established during the preevolution briefing and the nominal setpoint for the high level automatic turbine trip. Two nonlicensed senior management observers monitoring the test took no action when the control board operators did not scram the reactor, and neither the unit supervisor nor shift manager ordered a scram. These same managers had been present earlier when the test procedure was reviewed and did not question the lack of criteria in the test procedure for aborting the test or scramming the reactor. The managers also observed the crew's preevolution briefing, which was informal and did not cover items required by station policy to be addressed, such as thresholds for intervention, assignments of responsibilities, and identification of limits and required actions. *These events illustrate the importance of timely intervention by managers to correct deviations from established station policies and practices and the need to provide guidelines and expectations for management personnel who routinely observe control room activities.*

Insights

Formal and informal observation and monitoring of control room activities have become routine management activities over the past decade. These observations are performed by managers from within as well as outside the operations organization. It is entirely within the managers' prerogatives to ask questions of control room personnel if they suspect evolutions are not being conducted in accordance with station policies or management expectations. When managers do not question crew members or request clarification of intended actions, it can be assumed they are tacitly approving the crew's decisions. Managers should address concerns about control room activities only to the shift manager or operations manager to prevent confusion among the control room staff regarding who has command and control in the control room.

To provide effective oversight, managers from nonoperating departments need to familiarize themselves with the station's conduct of operations manual, communication standards, procedure requirements, and administrative controls governing control room activities. Expectations should be clearly established for these managers to perform this function and interact with control room crews. As a result of increased emphasis on management observations and improved control room team skills, operating crews view questions from management observers as important to prevent events, rather than as challenges to their operating knowledge.

INPO 96-008, "Guidelines for the Conduct of Operations at Nuclear Power Stations"

When managers and supervisors coach personnel to attain desired behavior, they must continuously monitor personnel performance, measure against goals and standards, and assess and correct the causes for performance problems to eliminate repeat errors. This monitoring function also extends to management observers who observe anomalous behavior, teamwork breakdowns, or a relaxation of standards in the control room. The situation must be assessed and brought to the attention of the shift manager and corrected before it progresses to an operational transient or significant event.

Discussion Points: PREVENT EVENTS for Managers

The following questions are provided to stimulate discussion among managers regarding the identification and correction of activities that exhibit symptoms of nonconservatism or deviate from management expectations:

INPO 97-003 (Preliminary) "Safety Focus During Changing Times - Recognizing Indications of Declining Plant Performance"

- What station procedures or policies define the roles and responsibilities of personnel performing control room oversight or observations?
- What are our expectations for how a manager should interact with a crew when crew performance problems are observed? How have we communicated these expectations to the managers and crews?
- What are the station expectations for on-the-spot corrective action? How do we expect the crew to respond?
- How does the guidance we provide for managers observing infrequently performed tests and evolutions differ from our guideline governing routine control room observations?

- What training do we provide control room observers to help them determine when a crew is not performing in accordance with management expectations?

- What simulator scenarios or exercises include interaction between management observers and the crew? How are management observations and station policies addressed in the crew critique?

- How do we apply these expectations and methods to other plant workers?

Follow-Up, Reinforcement, and Feedback

→ see open communications

If a maintenance-related event recurs, the original condition or event, in addition to the new condition or event, is reevaluated. Methods are developed for tracking and trending corrective action and root cause information. The analysis program addresses common root causes among different disciplines that demonstrate generic corrective actions need to be taken. The self-evaluation process is evaluated to determine weaknesses that contributed to recurrence of the performance weakness.

In the case of an equipment problem, postmaintenance testing could be used to determine if additional maintenance work or diagnostic fact-finding should be performed. Closely monitoring the equipment during an extended period of operation may also be necessary to provide sufficient assurance that the cause or causes have been properly corrected. Similarly, long-term follow-up is appropriate to determine if the desired results are obtained from corrective actions such as retraining, procedure changes and preventive maintenance changes.

Recognizing Latent Organizational Deficiencies

Recurring Issues	**Long-standing organizational deficiencies, such as weaknesses in station programs, processes, or procedures, have contributed to recent significant events.** In some cases, the organizational deficiencies were recognized as error-likely situations but were not corrected because their potential contributions to plant events were not realized. In other cases, managers decided that the potential benefits to correct them were not worth the resources necessary. In retrospect, it is apparent these latent organizational deficiencies were "events waiting to happen," or they degraded the effectiveness of plant processes to provide barriers against events. Lessons learned from plants that have experienced long-term shutdowns revealed that latent organizational failures were the major contributors. Organizational deficiencies such as weak self-assessment and oversight processes, procedures and processes that don't support strong performance after management changes, misalignment of operations and engineering priorities, and plant staff overconfidence (based on past performance) are some examples.
Events *SER 1-96, "Transformer Explosion and Loss of Off-Site Power"*	On October 21, 1995, during a refueling outage, one of the Diablo Canyon Power Plant auxiliary transformers exploded and burned. Station personnel mistakenly left a temporary grounding breaker in a nonvital bus cubicle while restoring the transformer to service. Neither station practices nor procedures provided for rigorous control of temporary grounding devices. For example, guidance for using grounding devices was not consistent between operations and maintenance procedures. Additionally, the work package for restoring the nonvital bus to service did not address the grounding device. Improperly controlled grounding devices were involved in previous station events as recently as 1994, but the corrective actions for these earlier events were not effectively implemented. *This event resulted because plant procedures did not provide consistent direction for using temporary grounding devices, and the processes did not ensure that temporary grounding devices were used properly. Previous events demonstrated these weaknesses existed; however, corrective actions were ineffective.*

SER 8-95, "Service Water Spill in Switchgear Area/Loss of Physical Separation Between Safety-Related Electrical Facilities"	On October 20, 1994, with Millstone Nuclear Power Station Unit 2 shut down for refueling, water spilled from the service water system and entered a safety-related switchgear enclosure. Personnel improperly coordinated a clearance and, as a result, approximately 150 gallons of saltwater sprayed out of the service water system and into a cofferdam in the upper switchgear room. The switchgear room is designed with a cofferdam and drain to direct water away from electrical equipment; however, the drain line was plugged, causing water to overflow the cofferdam. Because the flooring inside the cofferdam was deteriorated and the drain leaked, water penetrated the floor directly above an energized switchgear enclosure. Two years earlier, deficiencies in the cofferdam were identified, and a warning sign was posted to alert station personnel not to put liquids into the cofferdam because the liquids would leak into the switchgear room below. *This event resulted because known deficiencies were not corrected to maintain the plant in its proper materiel condition, even though it was recognized that a small problem would easily lead to a larger problem.*
SEN 179, "Long-Standing Design Weaknesses and Ineffective Corrective Actions Cause Gas Binding Failures of High Head Safety Injection Pumps"	Long-standing design weaknesses in the charging/high head safety injection (HHSI) system piping configuration and ineffective corrective actions at Beaver Valley Power Station possibly caused at least two pump shaft failures and resulted in periodic pump unavailability over a 10-year period. The failures and unavailability resulted from the accumulation of gas bubbles in the suction piping and subsequent ingestion into the pump during pump starts. The station tolerated periodic venting to minimize the potential for pump damage, effectively implementing a workaround to compensate for system and pump recirculation orifice design inadequacies. System venting became an accepted practice over time and was performed at a set frequency and prior to pump starts, masking potentially degraded pump performance. The manual venting process was not fully effective, and occasionally, little or no gas was actually vented. After Unit 2 experienced an HHSI pump shaft failure on September 12, 1997, station management assembled a team to determine the root cause for the ineffective resolution of the gas binding. *Station management tolerated periodic system venting, effectively implementing a workaround to compensate for system design inadequacies. Insufficient consideration was given to the effects this venting had on*

pump operation, potentially masking degraded pump performance. The root causes were not identified following multiple HHSI pump failures that occurred from 1986 through September 1997 caused by the ingestion of gas bubbles. Consequently, safeguards equipment was periodically unavailable over a 10-year period.

SER 16-96, "Multiple Personnel Injuries Caused by High-Energy Reheater Drain Pipe Failure"

On September 24, 1996, during startup, an 18-inch second-stage reheater drain pipe failed and injured seven workers at Oconee Nuclear Station Unit 2. A water hammer in the second-stage reheater drain piping caused an overpressure condition that ruptured the pipe. The reheater drain system was susceptible to water hammer events because of its design. Water hammer events were accepted as routine occurrences during plant startups.

Although pipe hangers were damaged, there were no system failures; therefore, a high priority had not been placed on installing the modifications recommended in 1992 after an in-depth study of the occurrences. In addition to engineering modifications, station personnel identified alternate valve lineups, initial conditions, limitations, and precautions necessary to safely operate the reheater drain system to be incorporated into the operating procedures. However, managers later stated that the operating culture at the station tolerated weak procedures. As a result, a low priority was placed on modifying the procedures, and those used during the startup did not contain guidance that would have reduced the chance of a water hammer. *This event illustrates how tolerating design and procedure weaknesses resulted in a plant event with personnel injury.*

Insights

SOER 92-1, "Reducing the Occurrence of Plant Events Through Improved Human Performance"

Station managers are responsible for developing a culture in which all personnel identify and seek to correct problems that may cause an event or that require compensatory actions to avoid an event. Many of the events summarized here can be categorized as "human performance errors." Managers from stations that have successfully reduced human performance problems attribute their success to line management involvement in identifying and eliminating the underlying causes of human performance events. Those underlying causes often turn out to be latent organizational deficiencies. SOER 92-1 notes "personnel do not make errors intentionally

INPO, "Excellence in Human Performance Building on the

... and many factors contributing to successful task performance are not controlled by the worker." Error-likely

Performance: Building on the Principles for Enhancing Professionalism," September 1997

situations are predictable, manageable, and preventable. Station management is responsible for eliminating latent organizational deficiencies, such as the following:

- confusing, unclear, or inconsistent procedures
- weak or error-tolerant processes
- cumbersome plant designs or modifications
- unclear or informally changed expectations
- degraded plant equipment
- superficial corrective actions in response to operating experience

INPO 97-002, "Performance Objectives and Criteria for Operating Nuclear Electric Generating Stations"

Criteria for the Self-Evaluation performance objective discuss the need to compare actual performance with management expectations. In addition, the criteria highlight the need for managers to critically examine daily activities for broad-based improvements. Self-assessments are valuable for identifying organizational deficiencies.

Discussion Points: PREVENT EVENTS for Managers

The following points are provided for discussion among station managers to examine the station's tolerance for latent organizational deficiencies:

INPO 97-003 (Preliminary) "Safety Focus During Changing Times - Recognizing Indications of Declining Plant Performance"

- What steps have we taken to ensure our line managers and supervisors are actively involved in identifying and eliminating the causal factors of human performance problems? How have we set the example?

- What have we done to instill in our people a culture of low tolerance for deficiencies or unreliable equipment? How does this relate to the accuracy of station procedures? How do we ensure that we have placed the appropriate priority on our responses to deficiencies?

SOER 94-1, Revision 1, "Nonconservative Decisions and Equipment Performance Problems Result in a Reactor Scram, Two Safety Injections, and Water-Solid Conditions"

- What have we done to raise the sensitivity to long-term deficiencies that might be institutionalized, such as normally operating automatic systems in manual?

- What actions have managers taken to encourage their personnel to actively raise potential problems, identify nonconsequential events, and provide suggestions for improvement?

- What actions have we taken to ensure our corrective actions address the fundamental causes of problems, rather than just the symptoms? How do we know these actions are effective?

- What methods are in place to periodically review equipment deficiencies to assess the aggregate effects of degraded equipment on plant personnel? What efforts have we made to apply a similar approach to identified process weaknesses?

- What expectations have been provided to system engineers that would promote intolerance for degraded equipment conditions? What is their understanding about how to focus attention on the need for corrective actions? How do we ensure that system engineers are periodically developing and implementing plans for maintaining future high levels of system reliability?

- How do we ensure that remote areas of the plant, such as intake structures and switchyards, are receiving adequate preventive maintenance?

- How do we become aware of and respond to a human performance error that presents no challenge to plant reliability or our margin of nuclear safety?

- When we decide not to take action to resolve an identified problem, how do we communicate that decision to station personnel so that they are not discouraged from identifying other problems?

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LEADERSHIP ATTRIBUTES

PSEG NUCLEAR

OWN THE WHOLE

- Focus on and achieve end results at PSEG Nuclear
- They accept ownership of PSEG Nuclear's performance and drive for Top Quartile in Safety, Reliability and Cost through People

ENERGY

- To create change
- Relentless pursuit of results
- Totally committed
- Creates alignment/teamwork – Build partnerships, focus on integration and alignment, up/down/horizontal
- Tenacity and persistence – to implement change and improve performance

ENERGIZE OTHERS

- Own success and failure of their personnel
- Holds themselves and others accountable
- Creates trust and an open environment
- Creates leadership in others – who then go for excellence
- Inspire others
- Develops people
- Champion change

EDGE

- Drives and creates change (get better every day)
- Self-initiate ideas and results
- Yes/No not Maybe (decisive, action oriented)
- Create healthy tension
- Words and actions consistent

EXECUTE

- Deliver results
- Know the details – they put their eyeball on the scene and know what is going on
- Knowledge – they know what they are talking about

RECOGNIZES PEOPLE

- They celebrate results with their people
- Talk about people not themselves when discussing success
- Positive attitude
- Teamwork (don't let others fail)
- Values people, relationships and diversity
- Straight talk and candid performance feedback focused on success of individual
- Listens to our workers
- Voice of management and PSEG
- Values corrective action, self-assessment and training to get better every day

TRUST ASSESSMENT SUMMARY SHEET
(RATING YOUR ORGANIZATION OR TEAM)

																			Total	Avg	Rtg
Exhibit Trust	10	23	25	16	13	21	11	18	28	17	17	8	20	21	17				265	17.7	L
Achieve Results	15	28	22	20	18	16	11	20	24	14	16	14	24	23	21				286	19.1	M
Act with Integrity	11	29	23	21	11	28	14	19	31	15	23	14	20	24	18				301	20.1	M
Demonstrate Concern	15	27	26	22	16	29	19	23	32	17	21	19	27	24	24				341	22.7	M
INDIVIDUAL TOTAL																					

Trust Summary Rating

Low Trust:	Scores from 8 - 18
Moderate Trust	Scores from 19 - 29
High Trust	Scores from 30 - 40

KYMM,

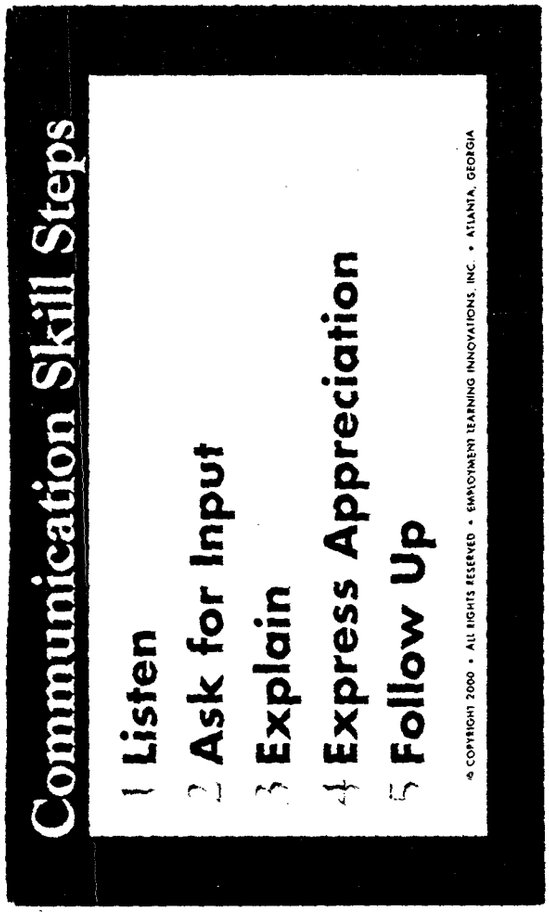
THIS IS MY TAKING ACTION TRAINING PACKAGE.

- THUMBNAILS OF THE ANIMATED POWER POINT PRESENTATION
- COURSE HANDOUT
- TAKING ACTION INDICATOR / COMMUNICATION SKILL STEPS CARD
- RATINGS SHEET

THESE ARE OTHER CASE HANDOUTS & MATERIALS WE OFFER IN CLASS

- HAVE PROVIDED THIS ~ 4 HOUR TRAINING TO OVER 250 SUPERVISOR & ABOVE MAST ASSOCIATES. OFFERED AS PART OF THE LEADERSHIP ACADEMY AND AS STAND ALONE CLASS.

TOM



EMPLOYEE CONCERNS TRAINING
"Taking Action"

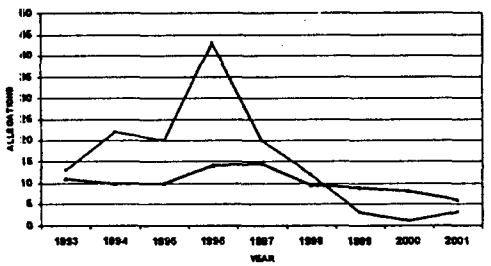
Tom Lake, Employee Concerns Investigator

Jack Carey. Manager – Industrial Safety

Wayne Grau, NRB Coordinator

EMPLOYEE CONCERNS PROGRAM

NRC ALLEGATIONS AT MULTI-UNIT SITES



— Hope Creek/Salem — Avg. Multi-Unit Sites

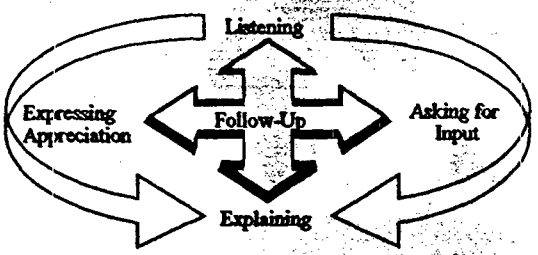
"TAKING ACTION"

COURSE OBJECTIVES

- Display a welcoming attitude when receiving issues and concerns from employees & contractors.
- Utilize guidelines (Taking Action Indicators) to effectively manage the concern resolution process.
- Recognize and prevent threats to the Safety Conscious Work Environment.

"TAKING ACTION"

Conversation Model

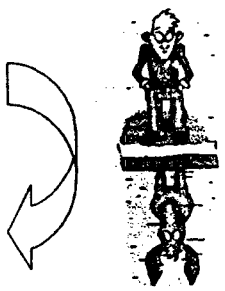


"TAKING ACTION"

Intent

Behavior

Impact



"TAKING ACTION"

TAKING ACTION INDICATORS

T ake Ownership

E ngage Experts

A ssemble Facts

M aintain Focus

S how Respect

[illegible] employee learned function with performance.

"TAKING ACTION"

Protected Activity

Raising safety concerns to an employer.

Refusing to work when the employee has [illegible] that the assigned task poses a safety hazard.

Testifying about safety concerns at judicial [illegible] hearings.

Refusing to work when the employee has [illegible] that the assigned task poses a safety hazard.

"TAKING ACTION"

Examples of Discriminatory/Retaliatory Practices

- **Wrongful discharge or demotion.**
- **Denial of promotion.**
- **Poor or declining performance evaluation.**
- **Harassing or intimidating behavior.**
- **Assignment of undesirable tasks.**
- **Refusal to hire.**

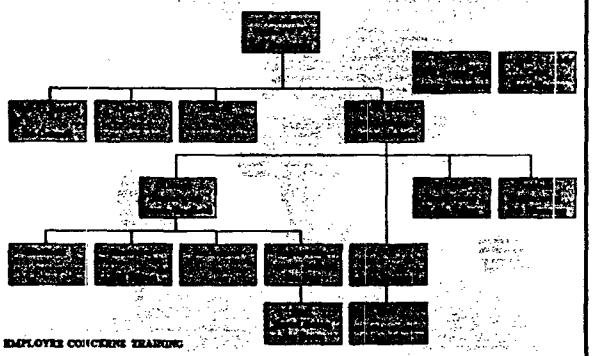
"TAKING ACTION"

KEY POINTS

- **Use "Communication Skill Steps" and "Taking Action Indicators"**
- **Think before Speaking**
- **Remain Calm**

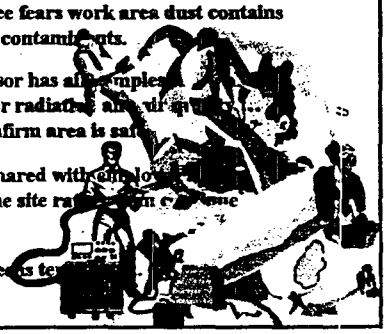
TAKING ACTION INDICATORS

"TAKING ACTION"



"TAKING ACTION"

- Employee fears work area dust contains possible contaminants.
- Supervisor has all samples tested for radiation and air quality. tests confirm area is safe.
- Status shared with employee. leaves the site rather than come to work.
- Employee is te



"TAKING ACTION"

KEY POINTS

- Management must maintain focus on the concern..... not who raised it or their motive.
- Employees have a right to go anywhere to raise a concern (internal or external)..... and can not be disciplined for going outside the chain-of-command.
- NRC holds licensees accountable for preventing contractor discrimination.
- Do not let the co-employment concept cloud your judgment.

"TAKING ACTION"

S afety Issues

H arassment, Intimidation, Retaliation, and/or Discrimination related to a concern

O ther task-related issues

P ersonnel non-safety issues

"TAKING ACTION"

S afety Issues

Follow 'TEAMS"

- Did contractor raise issue with the employer?
- If not, are there any barriers?
- If barriers are mentioned .... Contact EC/P

"TAKING ACTION"

H arrassment, Intimidation, Retaliation, and/or Discrimination related to a concern

- Contact internal experts.

HR

EMPLOYEE CONCERNS PROGRAM

"TAKING ACTION"

Other task-related issues

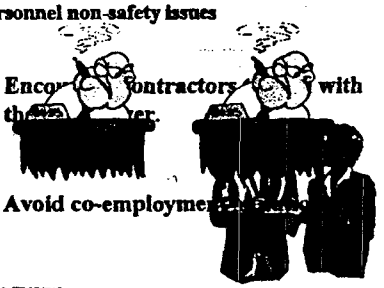
Follow "TEAMS"

- **Notify appropriate internal organizations**

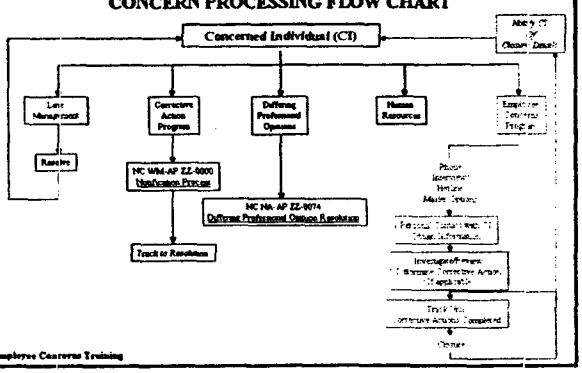
"TAKING ACTION"

Personnel non-safety issues

- **Encou[illegible]ontractors [illegible] with th[illegible]er.**
- **Avoid co-employme[illegible]**



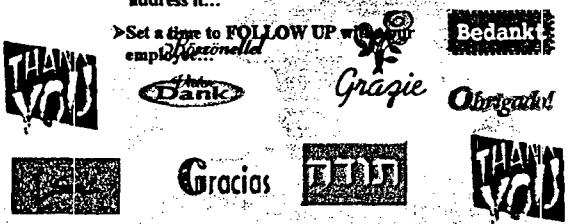
"TAKING ACTION"
CONCERN PROCESSING FLOW CHART



"TAKING ACTION"

KEY POINTS

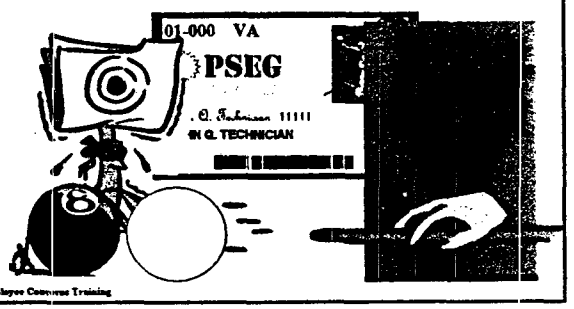
- Thank your employee for identifying the issue and giving you the opportunity to address it...
- Set a time to FOLLOW UP with your employee...



Employee Concerns Training

"TAKING ACTION"

HOSTILE WORK ENVIRONMENT



Employee Concerns Training

"TAKING ACTION"

HOSTILE WORK ENVIRONMENT
KEY POINTS

- Allowing behavior like Larry's to continue without addressing indicates the behavior is acceptable...
- Ask yourself the following:
  - Are exhibited behaviors unwanted
  - Are the behaviors reasonably offensive
    - *Conduct extreme or outrageous
    - *Is it pervasive
    - *What impact has it had, is it having, or could it have

Employee Concerns Training

"TAKING ACTION"

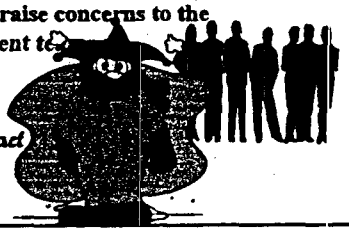
KEY POINTS

- Face to face updates keep communications open.
- Organize the info, even if discussion is informal.
- Understand what you are communicating to show you are taking the concern seriously.

"TAKING ACTION"

What is a CHILLED ENVIRONMENT?

- When individuals are unwilling or unable to raise concerns to the management te



Conversation Model
Intent Behavior Impact
TEAMS

"TAKING ACTION"

WHAT IS DUAL MOTIVE?

- Action taken for both legitimate and impermissible reasons.
- Employer must show that it would have taken same action absent the concern

"TAKING ACTION"

WHAT IS DELIBERATE MISCONDUCT?

- Any deliberate [illegible] s a licensee to be in [illegible] rule, regulation or [illegible]

EMPLOYEE CONCERNS TRAINING

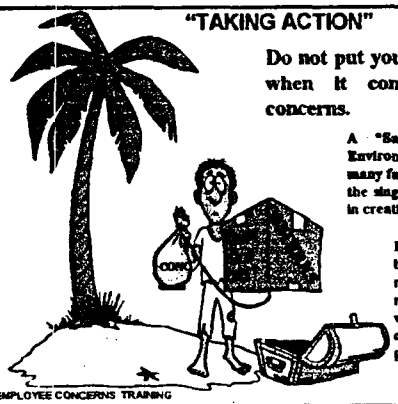
"TAKING ACTION"

SUCCESSFULLY MANAGE PERFORMANCE

- Apply performance standards consistently.
- Interven[illegible]
- Provide [illegible]
- Exp[illegible]
- Engage experts if yo[illegible]

EMPLOYEE CONCERNS TRAINING

"TAKING ACTION"



Do not put yourself on an island when it comes to handling concerns.

A "Safety Conscious Work Environment" is impacted by many factors, but a Supervisor is the single most important factor in creating it.

Don't manage this way because it is the law or a rule, do it because it is the right thing to do and it is what will help us achieve our goal of top quartile performance.

EMPLOYEE CONCERNS TRAINING

PSEG Nuclear
2004 Business Plan

Safety

Owners: Vic Fregonese, Kevin O'Hare, Jack Carey

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
		Super/supt observation training	H		
		Training – human performance prevention	H		
		Peer coaching	M		
		supervisor presence in the field	M		
		Pre- & post-job briefing	L		
		Process implementation	L		
OSHA Recordable Accident Rate (Indicative of the number of hours worked)	0*	Accountability	H		
		Inclement weather readiness	H		
		Accident Investigation	M		
		Incentives (PIP – based on OSHA)	M		
		Leverage Technology	M		
		SAFE notification backlog	M		
		Safe Patrol/Walkdowns	M		
Radiation Protection (ALARA - RPM)	225	Personal worker incentives	H		
		Technology improvements	H		
		Improved cleanup	M		

PSEG Nuclear
2004 Business Plan

Safety

Owners: Vic Fregonese, Kevin O'Hare, Jack Carey

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
Site Wide INPO Plant Performance Index (Average of all three Units)	99*	Chemistry system performance	H		
		Forced loss rate	H		
		LCO Management	H		
		Maintenance backlog	H		
		Maintenance worker proficiency	H		
		Safety system reliability	H		
		Seasonal Readiness	H		
		Work package implementation	H		
		Ability to effectively use experience to improve	M		
		Collective dose	M		
		Fuel reliability - FME control during refueling	M		
		Hope Creek technologies	M		
		Management field presence	M		
		Predicting planned outages	M		
		Salem design (circ water) with respect to capability factor	M		
		Salem outage – head inspection/SG's	M		
Event-free Clock Resets (Avg. Days Between Reset)	40*	Better use of OE	H		
		Better use of tools	H		
		Configuration management	H		
		Connective action effectiveness	H		
		Design improvements – leverage technologies	H		
		institutionalize human performance	H		
		Project implementation	H		

PSEG Nuclear
2004 Business Plan

Cost Effectiveness

Owners: **Kenda Knight**
Dave Hughes x 1313 377 768 8052
Rob DeNight x 5303

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
Refueling Outage Durations (Days)	50	How Projects are Budgeted/Funded	M		
		Contract Utilization Strategy	M		
		24 – Month Cycles!	L		
Budget (Labor, Material, Contractor, Other, SERVCO, Fleet, Internal Settlements, Fringe Benefits, IT and Other Activity excluding Insurance and Assessments) (Million)	$384	Even with Money and People, Can't get Work Done	H		
		Unavailability, Productivity	H		
		Overtime without Control	H		
		Resource Reallocation	H		
		Material Gap	H		
		Process Complexity and Hand Offs	M		
		Reevaluate Strategic Partnerships	M		
		Automatic Progression (Union Contract/Hourly Rate Paid)	L		
		Contract Root Cause	L		
		Resource Control (Who is Working, Where are They?) Less Moving	L		
		Worker Qualifications	L		
Cents per Kwh (Labor, Material, Contractor, Other, SERVCO) (Million)	1.02	Execution of Projects	H		
	$280 Million	How do we Purchase Material? (Decision Process) Work Order Level	H		
		Leveraging Purchases (Industry or Core Basic Needs)	H		
		Need Cop, Don't Police Ourselves	H		
		Project Contracts	H		
		Reassess Chemistry (Cooling Tower)	H		
		Reduction of Headcount	H		

PSEG Nuclear
2004 Business Plan

Cost Effectiveness

Owners: Kenda Knight, Dave Hughes, Rob DeNight

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
		O&M Contracts	M		
		Renegotiate Contracts (Best Deal for Money)	M		
		Think Year-Round, Not 12-Week	M		

PSEG Nuclear
2004 Business Plan

Reliability

Owners: **Lon Waldinger**
Pat Walsh x 1343
Bob Deppi x 2765

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
Capacity Factor (Percentage)	95%*	Work Management Doesn't	H		
		Even with Money and People, Can't get Work Done	H		
		Human Performance	H		
		Lack of Fundamental Knowledge – Can't Connect Dots – Lack of Effectiveness at getting to Solution that Sticks	H		
		Lack of Site Focus	H		
		LT Reliability = Spend $ for New Equipment	M		
		24 – Month Cycles!	L		
		Change CMT's on Turbine Rel. Testing	L		
Generation (Gigawatt Hours in the Thousands)	27.4*	More Work than Days (Outage)	H		
		Summer CF = Do No Work!	H		
		What's the Management Model?	H		
		Optimizing Down Powers and Line Outages	M		
		Process Complexity and Hand Offs	M		
		Site Planning Philosophy	M		
		Think Year-Round, Not 12-Week	M		

PSEG Nuclear
2004 Business Plan

People

Owners: Dave Braun, Skip Sindoni, Pete Tocci

Measure	2004 Target	Challenge	Priority	Ranking	Strategic Result Area
Organizational Effectiveness / Gallup Survey Improvements	3.9	Communications	H		
		don't use employees in resolution of problems	H		
		Ineffective CAP	H		
		lack of positive reinforcing management team	H		
		mgmt union relations	H		
		self-assessment	H		
		development plans	M		
		Gallup action plans	M		
		Team building	M		
		2 C's	L		
		SAP still cumbersome	L		
		Terrible IT technology	L		
Corrective Action (The number of issues reviewed by CARB and determined to be effective).	95%				
Site wide Backlog of Non-Outage Power Block Corrective Maintenance (CM) orders (starting at 576).		Everything gets in - Remove impediments	H		
		Ineffective WIN team	H		
		Poor planning	H		
		Warehouse (right parts/right time)	H		
		IT support	M		
Most Significant Outage and Online Work Orders effecting Station Reliability and System Health (starting at 500).					