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# Managing Human Performance

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## ABSTRACT

Human performance remains a significant factor for management attention not only from a reactor safety perspective, but also from a financial one. Recent significant events analysis shows that human errors are still dominant causes and contributors to them. An analysis of significant events in nuclear industry occurred through 15-years period revealed that three of four significant events were triggered by human error, although the number of events have dropped by more than a factor of four.

A number of human performance breakdowns occurred in the application of error-prevention techniques. These included a lack of pre-job briefs, inadequate turnover of tasks, ineffective use of peer checking, inadequate procedure adherence, and failure to apply a questioning attitude when unexpected changes were encountered in the task.

Attempts by the industry to improve human performance have traditionally focused at the worker level. However, human error occurs within the context of the organization, which can either foster or resist human error. The greatest room for improvement lies not only in the continued improvement of front-line worker performance but more so in the identification and elimination of weaknesses in the organizational and managerial domains that contributes to worker performance at the job site.

Based on mentioned analysis, other industrial sources and own operating experience, NPP Krško is paying more attention to improve human performance among own as well as contractor workers. Through series of programs and activities, such as Reactivity Management Program, Safety Culture Program, Self-assessment Program, Corrective Action Program, Plant Performance Monitoring Program, developed in last few years, and through new procedures, written guides and publications, training and management efforts, number of human errors is going to be reduced.

Involvement of higher levels of NPP Krško organization in promotion and use of Human Performance techniques is indispensable to achieve goals set to maintain safe and reliable operation of the plant.

## 1 INTRODUCTION

Human performance remains a significant factor for management attention not only from a reactor safety perspective, but also from a financial one. Recent significant events analysis shows that human errors are still dominant causes and contributors to them. An analysis of significant events in nuclear industry occurred through 15-years period revealed that three of four significant events were triggered by human error, although the number of events have dropped by more than a factor of four.

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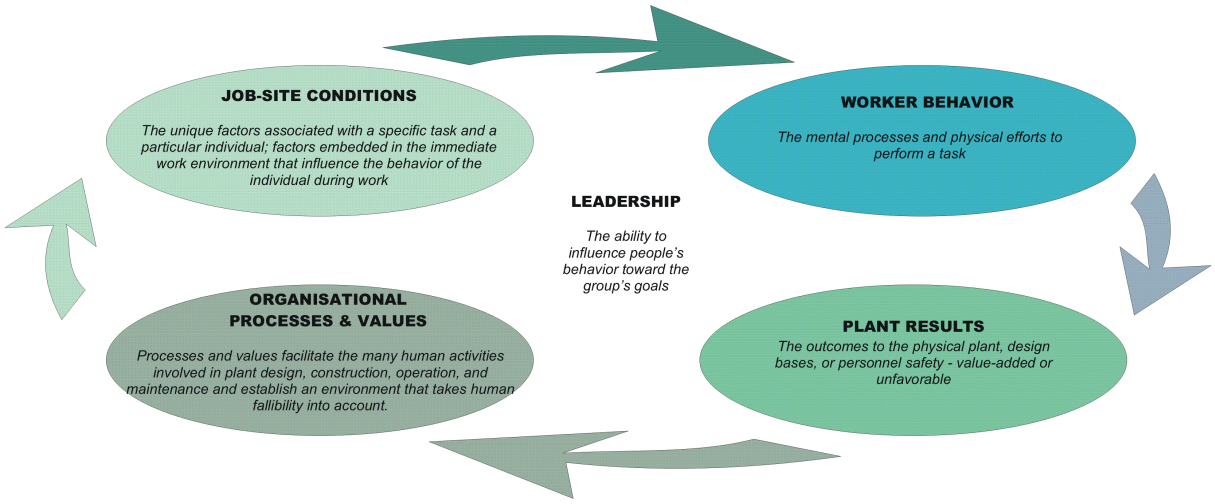
## 2 ORGANIZATIONAL NATURE OF HUMAN PERFORMANCE

Human performance occurs within the context of the organization. Human performance is the system of processes, values, behaviors, and their ultimate results determine plant performance. This perspective contrasts with the more traditional opinion that human performance is simply a worker issue. Understanding organizational systems and the impact of station processes and leadership dynamics on job-site human performance is important to effective management of human performance.




Managers, administration staff, supervisors, and workers join together as a team to accomplish the station's missions. Teamwork is usually directed by several management control systems, and it takes teamwork to generate electricity safely and reliably.

Performance model (above) illustrates interdependencies between organizational processes and values. Job-site conditions, worker behavior, plant results and leadership are conditions and processes that influence each other as shown by arrows.

## 3 ORGANIZATIONAL PROCESSES & VALUES

Processes and values facilitate the many human activities involved in plant design, construction, operation, and maintenance and establish an environment that takes human fallibility into account. Examples of NPP Krško activities that support work in the plant include procedures revisions, training, clear responsibility, rewards and reinforcement, meetings on different levels, safety analyses process, work order system, operating experience program, clear expectations, communication, change management, ALARA, scheduling, work management, safety, self assessment, reviews and approvals, Corrective Action Program, trend analysis, problem solving and benchmarking.

## 4 JOB-SITE CONDITIONS

Job-site conditions are the unique factors associated with a specific task and a particular individual. Factors are embedded in the immediate work environment and influence the behavior of the individual during work. Examples from NPP Krško include equipment ergonomics and human factors, environmental condition, worker knowledge, skill and proficiency, roles and responsibilities, accountability, Foreign Material Exclusion, procedure/work package quality, tagging, Fitness for duty, wary attitude, personal motives, housekeeping, intolerance for error traps and tools quality.

## 5 WORKER BEHAVIOR

Worker behavior is the mental processes and physical efforts to perform a task. The effect of workers behavior is change in the state of plant structures, systems and/or components. Workers use tools and techniques that are directly related to their behavior. NPP Krško promotes these tools and techniques through training, indoctrination, various briefings and meetings. Error reduction tools and techniques are also included in procedures and miscellaneous documents in NPP Krško. Emphasis is on 3-way communication, Procedure use and adherence, Self checking, Conservative decision making, Place-keeping, Management monitoring, Questioning attitude, Troubleshooting, Corrective program, Supervision, Double verification, Stop when uncertain and some others tools and techniques.
For the end of the 2004, NPP Krško is preparing Human Performance Improvement course for plant engineers. Special cards-reminders “For better Human Performance” (trial cards are already in use) will be created for internal use in all levels of organization and will be presented at that course.

## 6 PLANT RESULTS

These represent the outcomes to the physical plant, design bases, or personnel safety - value-added or unfavorable. Examples of plant results include unit capacity factor, forced outages, heat rate, loss-time accident rate, equipment reliability, safety-system availability, outage effectiveness, and trips and transients. The paper plant, the design bases, may contain flaws in engineering calculations used in the safety analysis of plant systems.
The effect of plant performance determines how well plant operation achieves station mission and goals - organizational effectiveness. NPP Krško monitors these effects through Performance Monitoring Program where operating indicators are defined that in a broad sense demonstrate nuclear power plant operation in aspects of safety, reliability, installation performance, waste generation, personnel safety, etc. These indicators are intended principally for plant management use for trending performance and progress to set challenging goals for improvement, to gain additional perspective on performance relative to other plants, and to provide an indication of the possible need to adjust priorities and resources to achieve improved overall plant performance.

## 7 LEADERSHIP

Leadership is the ability to influence people’s behavior toward the group’s goals. Anyone can take on the role of leader. This refers to those in positions to influence worker beliefs, values, attitudes, and behavior, but also plant performance and organizational

processes. Good leader motivates, clings to high standards, coaches, demonstrate questioning attitude, courage and integrity, respect others, reinforces, reacts accordingly, sets examples, communicate openly and honestly and demonstrate healthy relationships. NPP Krško procedure "Načela Varnostne Kulture" highlights these values as values that represent strength of the leaders on all levels of organization structure.

## 8 HUMAN PERFORMANCE IMPROVEMENT

To manage processes described in Performance model, all levels in plant organization must be involved. NPP Krško is aware that continuous improvement of human performance is the way to achieve the better plant performance.
INPO document Excellence in Human Performance provides practical suggestion that promote excellent human performance and it is the base document in development of NPP Krško Human Performance Improvement Plan.
To optimize successful performance at the job site, appropriate individual and leader behaviors must occur in concert with appropriate organizational processes and values. All three must work in unison during all phases of a task, from work identification through completion of documentation. Therefore excellent human performance depends on the alignment of individual and leader behaviors and organizational processes and values.

## 9 ORGANIZATIONAL PROCESSES & VALUES

Managers advocate a defense-in-depth philosophy by establishing various means to eliminate error-likely situation that challenge built-in defense. Managers verify that organizational goals, policies and priorities take human fallibility into account and encourage a pattern for shared understandings, processes and values toward safety and reliability. Institutionalizing the following activities encourages excellence in human performance:

A. Managers Foster a Culture that Values Prevention of Events
- Implement processes so that people do not experience hastiness.
- Provide individuals with opportunities to work with positive role models.
- Simplify work processes.
- Eliminate workarounds.
- Verify adequacy of plans for special tests of infrequent plant evolutions.

B. Strengthen Integrity of Defenses
- Facilitate free flow of information.
- Delegate authority to the lowest competent level.
- Facilitate ease of operation and maintenance of plant equipment.
- Develop clear, understandable procedures.
- Communicate policies for procedure use and adherence.
- Verify integrity of defenses.
- Facilitate supervisors time in the field.

C. Preclude the Development of Error-Likely Situations
- Train people to recognize error-likely situations.
- Alert workers and supervisors to key task decision points.
- Relieve individuals of tasks better suited for machines.

- Verify workers are trained to diagnose and respond to unanticipated conditions.
- Retrain on infrequently performed tasks prior to performance.

D. Create a Learning Environment that Promotes Continuous Improvement
- Conduct self-evaluations.
- Learn from errors.
- Implement a corrective action process.
- Use proactive as well as reactive measures of human performance.

## 10 LEADERS

Leaders generate the essential linkage between the organization and front- line worker. Leader behaviors that promote excellence in human performance are not exclusively associated with a management position. Leaders verify that organizational processes and values are aligned with desired individual behaviors and desired results. The following behaviors characterize leaders who promote excellence:

A. Facilitate Open Communication
- Clearly communicate roles responsibilities, expected behaviors, results, & standards.
- Cultivate an atmosphere of open communication.
- Challenge shared values, assumptions and beliefs that potentially breed complacency.

B. Promote Teamwork to Eliminate Error-Likely Situations and Strengthen Defenses
- Identify potential error-likely situations.
- Reinforce uniform adherence to high standards.
- Confirm workers accurately perceive the potential consequences of unsafe behavior.
- Resolve conflicts.
- Verify worker capabilities to achieve tasks.
- Minimize unfamiliarity among members of an operating crew or work team.
- Compensate for weaknesses in supervision, training or procedures.

C. Search for and Eliminate Organizational Weaknesses that Create Conditions for Error
- Solicit and act on feedback from workers.
- Determine fundamental causes of performance problems.
- Monitor trends in plant and human performance.

D. Reinforce Desired Jobsite Behaviors
- Specify behaviors important for task success.
- Reinforce desired individual behaviors.
- Monitor and coach workers through firsthand observation, listening and questioning.
- Stop unsafe behavior.
- Participate in training activities.

E. Value the Prevention of Errors
- Promote nuclear safety as overriding priority.
- Encourage candid acknowledgment of personal limitations.
- Assign individuals to tasks using established criteria

– Incorporate defensive measures into tasks important for nuclear safety to accommodate organization-wide distractions in the workforce.
– Be a role model.

## 11 INDIVIDUALS

Work is influenced by multiple factors that may not be apparent to the individual. Consequently, to optimize individual performance and reduce vulnerability to error, individuals throughout an organization should engage in the behaviors described below.

A. Communicate to Create Shared Understanding
– Communicate accurately and frequently.
– Inform coworkers, supervisors or managers of potential problems.
– Practice team skills: inquiry, advocacy, initiative, conflict resolution, & critiquing.

B. Anticipate Error Likely Situations
– Self-check.
– Peer-check.
– Focus on the task at hand.
– Expect success, anticipate failure.
– Take time to do the job right.

C. Confirm the Integrity of Defenses
– Follow approved procedures with caution.
– Question the appropriateness of disabling or degrading safety systems to perform work.
– Monitor vital parameters.
– Stop and collaborate when unfamiliar/unanticipated conditions arise.

D. Improve Personal Capabilities
– Seek ways to improve knowledge, skills, fitness, attitude.
– Acquire knowledge of human behavior factors.

## 12 CONLUSION

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