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Human performance improvement in organizations: Potential application for the nuclear industry

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FOREWORD

This report is primarily for managers and specialists in nuclear facility operating organizations working in the area of human performance improvement. It is intended to provide them with practical information they can use to improve human performance in their organizations. While some of the information provided in this report is based upon the experience of nuclear facility operating organizations, most of it comes from human performance improvement initiatives in non-nuclear organizations and industries.

In 2000, the IAEA Technical Working Group on the Training and Qualification of NPP Personnel (TWG-T&Q) suggested that the IAEA should develop a publication on human performance improvement. In March 2001, IAEA-TECDOC-1204, A Systematic Approach to Human Performance Improvement: Training Solutions, was published. At its 2002 meeting, the IAEA TWG-T&Q indicated that IAEA-TECDOC-1204 was a quite useful report, but suggested that an additional report be developed that focused on the full range of human performance solutions and that also considered experiences in other industries. This report is prepared in response to that recommendation.

The preparation of this report was an activity of the project on Effective Training to Achieve Excellence in the Performance of NPP Personnel. The objective of this project is to enhance the capability of Member States to utilize proven practices developed and transferred by the IAEA for improving personnel performance. The expected outcome from this project is the increased use by organizations in Members States of proven engineering and management practices and methodologies developed and transferred by the IAEA to improve personnel performance.

The IAEA officer responsible for this publication was T. Mazour of the Division of Nuclear Power.

EDITORIAL NOTE

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1. INTRODUCTION

1.1. Objective and rationale

The objective of this report is to provide examples of good practices and lessons learned concerning the management of human performance improvement in non-nuclear organizations, which may have potential application for the nuclear industry.

The nuclear industry has a long tradition of sharing good management practices in order to foster continuous improvement. However, it has not always realized that many of the practices that are now well established initially came from non-nuclear industries and were adapted for application to nuclear power plant (NPP) operating organizations. There is, therefore, good reason to periodically review non-nuclear industry practices for ideas that might have direct or indirect application to the nuclear industry, in order to potentially gain benefits such as the following:

— new approaches to certain problem areas
— insight into new or impending challenges
— improving existing practices
— benchmarking opportunities
— development of a learning organization
— avoiding collective blind spots.

The IAEA is committed to sharing ideas within the nuclear industry and to encouraging nuclear organizations to adopt methods that are known to be effective. This report does not intend to imply either that current nuclear industry practices are lacking or that current good practices should be set aside. Rather, since a learning organization continually looks to improve, one potentially important source of improvement ideas is from organizations outside the nuclear industry. Therefore, this report is intended to be a catalyst for reflection, and new ideas. Readers need to realize that rarely — if ever — can conditions in one organization be identically replicated in another. Each organization is unique; what works for one rarely works in identical fashion for another. Typically, the process of considering the experiences — good and bad — of others is what leads to creative, situation specific improvement ideas.

1.2. Scope and format

While this report focuses on experiences from non-nuclear organizations, some nuclear industry examples have also been included if they originated outside the industry and have not yet been widely implemented therein. The information is presented as a set of case studies that are organized based on a comprehensive human performance improvement (HPI) process map. Summaries of the case studies are presented in the appendices.

This report treats human performance in a very broad sense. Essentially, the entire set of management processes in a nuclear organization involves the active participation of people. Therefore, all the processes include human performance elements. Also, people perform their work within a nested set of “communities” and their performance is effected in these various subgroups of the larger organization. For example, the individual, the supervisor, the work team, the organization and the broader community all impact on people’s patterns of thinking and behaviour — their culture. Consequently, changes in human performance have to be recognized as taking place within a wide range of contexts.

This report considers human performance at all levels of the organization. Case studies are provided that address human performance at the working level and other levels up to and including corporate management.

1.3. Use of this report

The material is presented in a way that allows for self-selection of areas of interest. The following points are provided for guidance.

Methods of application

The material in the case studies can be useful in a variety of ways. For example, some case studies may be directly applicable to a similar area in a nuclear organization. However, some may not be directly transferable but may serve to indicate that other industries are working on similar problems. In such cases, the perspectives represented may be worth pursuing because some may point to completely new areas for attention.

Questions to ask

It should be helpful to approach this material with a questioning attitude. For example, one might ask the following:

- Are we already working on a similar challenge?
- Does the case study address an issue that could face our organization in the future (e.g. impending commercialization, or loss of key talent)?
- Even if the material presented is not directly applicable, could we identify yet another industry that might have a more comparable situation?
- Are we able to contact the source(s) of the information in the case study to find out if the initiative described was successful in the longer term, whether it has been subsequently changed or improved, and to ask if it would still be recommended?
- Could we run a pilot project to test and adapt the concepts before committing to a wider implementation?
- How might we involve affected staff in examining alternatives, designing applications and implementing changes?
- How might we measure performance improvements in the target areas?

Things to pay particular attention to

The following are points that should be considered when new ideas are being examined.

- If they are to result in potential benefit, changes need to be well conceived, planned and implemented. Human performance improvements are typically among the hardest of all types of changes to implement well. Therefore good change management processes should be applied lest the desired results not be achieved.
- The potential safety impacts of all changes should be assessed as part of the change management process.
- The overall amount of change in progress in an organization at any given time should be limited — don't try to change everything at once. This will require effective internal communication and coordination between organizational subgroups. Otherwise, well-

intended change initiatives could compete and confuse individuals whose responsibilities transcend or are affected by different subgroups within the organization.

- All major changes need top management commitment to be successful.
- Changes in work practices often result in an initial decline in real or apparent performance until the new methods are fully functional and widely adopted. This decline should be expected; otherwise it can lead management to abandon an initiative prematurely. Yet, safety must always be monitored and preserved. Changes that unexpectedly lead to hazardous situations must be stopped immediately for further analysis.
- No human performance initiative should be adopted blindly; it should be properly reviewed for its "fit" to a given situation, and adapted accordingly.
- Changes should be implemented for good and valid reasons. There should be an identified need for the changes, and some means should be pre determined to assess the impact of the changes.
- New human performance initiatives may have to be implemented differently in different cultures. Even though the desired patterns of behaviour after the change might be the same, techniques used to change patterns of behaviour and the level of effort needed to be successful can vary widely in different social and organizational cultures.

2. HUMAN PERFORMANCE IMPROVEMENT CASE STUDIES

2.1. Organization of case studies

In order to present the HPI case studies in this report in such a way that readers could best find information that was of interest, these case studies have been organized around a human performance process model. Although there are various human performance process models in existence, the Nuclear Energy Institute (NEI) model presented in Fig. 1 is particularly relevant to nuclear industry operating organizations (see also Appendix I for a more detailed breakdown of the process elements of this model).

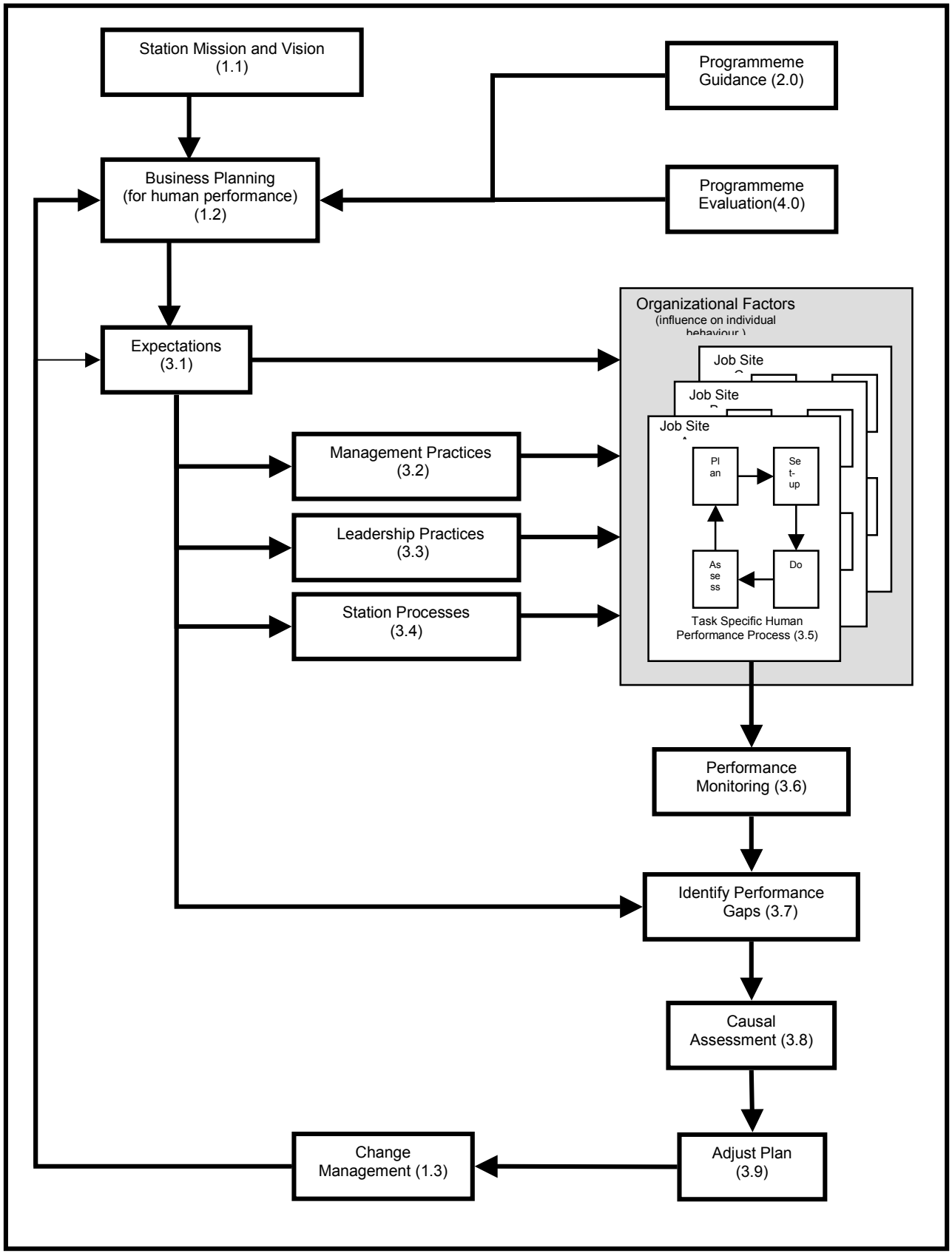


FIG. 1. Human performance improvement process map — overview.

2.2. Human performance improvement case studies

The case studies identified below are organized around the HPI model elements indicated in the preceding section. The reader will note that some case studies were considered to be relevant to two or more process elements. For each case study, the reader is referred to an appendix for a summary of the case. If the reader finds the summary is of further interest, the appendix provides information as to the source(s) to be consulted.

Station mission and vision (1.1)

— Comunication with a CEO regarding the value of investing in HPI in the nuclear industry	Appendix II
— Demonstrating socially responsible business practices	Appendix III
— Lessons learned from the health care industry	Appendix IV
— EDF performance based management contracts	Appendix V

Business planning (1.2)

— Comunication with a CEO regarding the value of investing in HPI in the nuclear industry	Appendix II
— EDF performance based management contracts	Appendix V
— Development of a customer focus	Appendix VI
— FAA air traffic control system human factors plan	Appendix VII

Change management (1.3)

— Patient-centred approaches	Appendix VIII
— Business simulation to facilitate change	Appendix IX
— Moving to a process based organization	Appendix X

Programmeme guidance (2.0*)*

(No case studies are provided for this category. See Appendix I, Fig. 4.1 for examples of programme guidance.)

Expectations (3.1)

— Lessons learned from the health care industry	Appendix IV
— EDF performance based management contracts	Appendix V
— Developing a customer focus	Appendix VI
— Periodic, unannounced evaluation of human performance	Appendix XI

Management practices (3.2)

— Lessons learned from the health care industry	Appendix IV
— Improving commercial awareness	Appendix XII
— Crew resource management	Appendix XIII

Leadership practices (3.3)

— Improving crisis and emergency management capability Appendix XIV
— Performance coaching Appendix XV
— Aligning individual performance and organizational objectives Appendix XVI
— Gallup survey of employee engagement Appendix XVII

Station processes (3.4)

— Patient centred approaches Appendix VIII
— Moving to a process based organization Appendix X
— BT knowledge portal Appendix XVIII
— Technical human performance and associated tools Appendix XIX
— Organizational spatial configuration Appendix XX
— Flexibile learning Appendix XXI
— e-Learning integrated with other learning types Appendix XXII
— Improving the effectiveness of work team briefings Appendix XXIII
— Oil industry: Shared services Appendix XXIV
— Knowledge sharing among organizations Appendix XXV

Task specific human performance process (3.5)

— Periodic, unannounced evaluation of human performance Appendix XI
— Technical human performance and associated tools Appendix XIX
— Organizational spatial configuration Appendix XX
— Flexible learning Appendix XXI
— Improving the effectiveness of work team briefings Appendix XXIII
— Team errors/The aspects of social loafing Appendix XXVI
— FAA blame-free culture: The Aviation Safety Reporting System Appendix XXVII

Performance monitoring (3.6)

— Lessons learned from the health care industry Appendix IV
— EDF performance based management contracts Appendix V
— Periodic, unannounced evaluation of human performance Appendix XI
— Team errors/The aspects of social loafing Appendix XXVI
— A company's mission, vision and values: Balance scorecard Appendix XXVIII
— Appreciative inquiry as a process improvement tool Appendix XXIX

Identify performance gaps (3.7)

— Patient-centred approaches Appendix VIII
— Employee involvement in performance improvement measures Appendix XXX
— Using case studies to communicate lessons learned Appendix XXXI
— HPI: Focus on the organization rather than the individual Appendix XXXII

Causal assessment (3.8)

— Employee involvement in performance improvement measures Appendix XXX
— HPI: Focus on the organization rather than the individual Appendix XXXII
— Punishing people or learning from failure? Appendix XXXIII

Adjust plan (3.9)

— Patient-centred approaches Appendix VIII
— Using case studies to communicate lessons learned Appendix XXXI

Programmeme evaluation (4)

— Appreciative inquiry as a process improvement tool Appendix XXIX
— Gallup: 12 questions to determine employee engagement Appendix XXXIV

Organizational factors (5)

— Financial integrity and risk management initiative Appendix XXXV
— 10 strategies for successful knowledge sharing Appendix XXXVI
— Communities of practice Appendix XXXVII

3. USING THESE CASE STUDIES TO AFFECT CHANGE

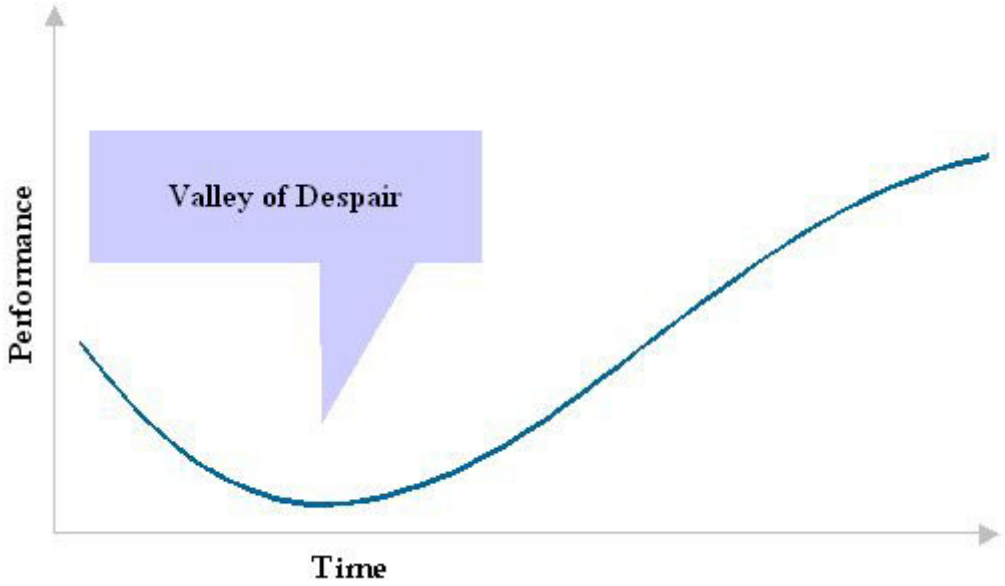
There is a tendency among managers to assume that once they approve a change initiative it will happen as they envision it and it will be successful. Sometimes this may be because of egos. Other times, it may be because managers are simply too busy to monitor the implementation of planned activities. No matter what the reason, the end result will too often be the same for human performance improvements: if they are not regularly monitored, the results will often be quite different from what was originally intended.

Recently, Accenture, a worldwide consulting firm, compiled the following data from various respected business information sources:

— 74% of projects are judged to be unsuccessful and 28% failed altogether;
— 53% of projects cost at least 180% more than planned; and
— 31% of projects were cancelled altogether.

These data should be enough to convince managers that proper up-front analysis and constant monitoring of HPI interventions are absolutely essential.

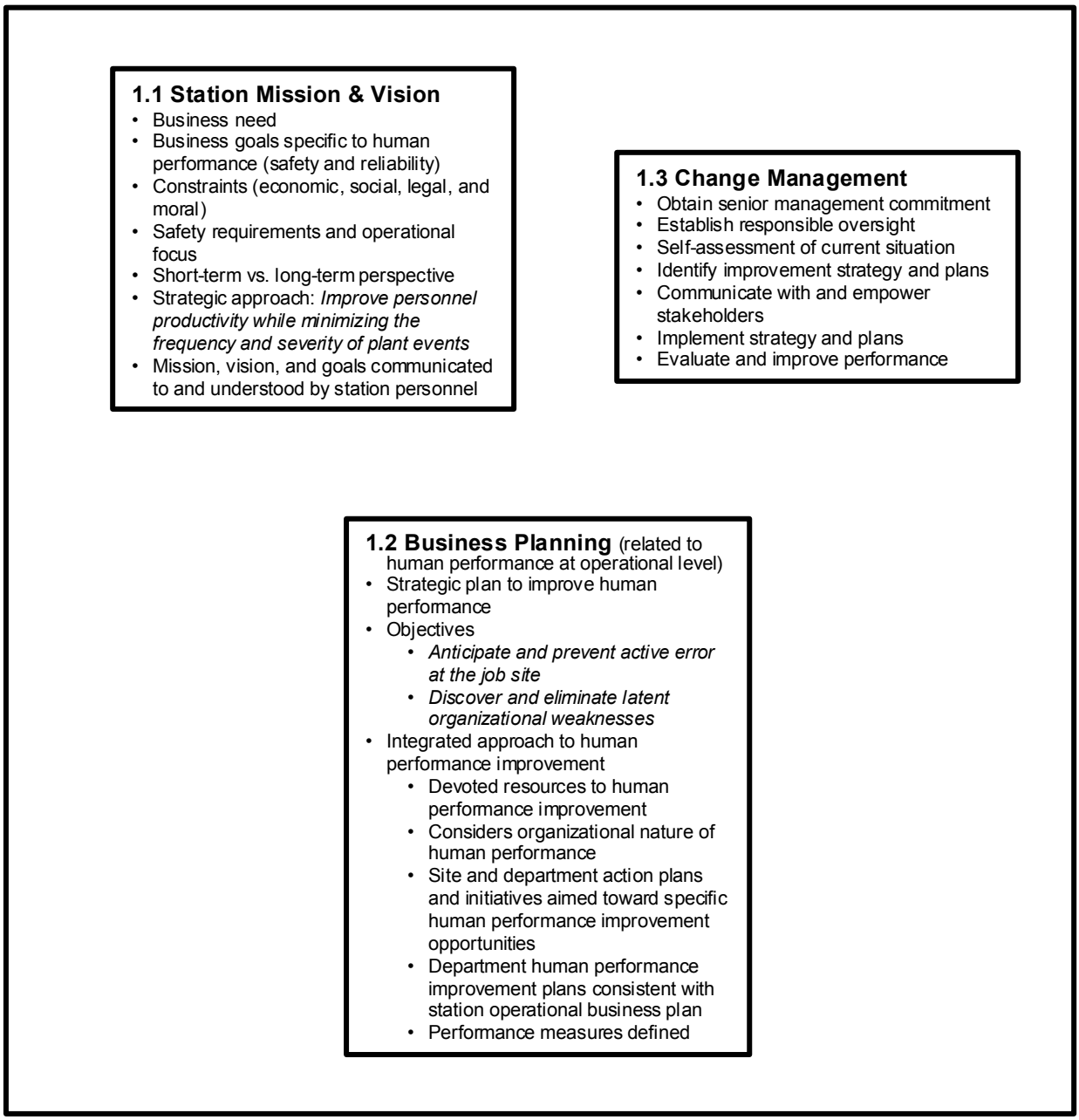
When monitoring the implementation of HPI initiatives, it is also important to understand that short-term performance results may be misleading. For example, shown in the following diagram is what is called by some the “Valley of despair” and by others “the J curve”.



Shortly after initiating a change there is typically a drop in performance because people are learning how to use new methods while still having to do part of their work the "old" way during a transition period. Another phenomenon, called the "Hawthorne effect", can have the opposite effect. In such circumstances, work group performance shows a short-term increase no matter what the intervention, just because people are being given attention. (And, often, performance tapers off after the attention is relaxed.) The message is: after a HPI intervention, short-term performance changes can be unreliable indicators of success. Performance measured six months to a year after the intervention should be more reliable.

Finally, when implementing a change to improve human performance, the reader is again referred to Section 1.3 of this report for additional considerations to ensure that the change achieves its intended results.

APPENDIX I. NEI HUMAN PERFORMANCE PROCESS MAP DETAILS



Programme management

2.1 Regulatory Requirements

- NRC Oversight Process (NEI 99-02)
- NRC Inspection Modules (non requirement)
- NRC, HPIP NUREG-1545
- 10CFR50 App B
- OSHA requirements
- NUREG/CR-1278, Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Application (non-requirement)

2.2 Industry Guidance

- INPO, *Excellence in Human Performance*
- INPO, *Principles for Effective Self-Assessment and Corrective* Action Programs
- INPO 97-002, *Performance Objectives and Criteria for Operating Nuclear Generating Stations*
- ACAD documents (training)
- INPO Human Performance Fundamentals Course
- WANO Performance Indicators Program
- INPO Good Practices
- EPRI Technical Reports
- NEI process descriptions

2.3 Other Guidance (non-regulatory)

- Federal Aviation Administration
- National Transportation Safety Board publications (NTSB)
- International Atomic Energy Agency (IAEA)
- International Society for Performance Improvement (ISPI)
- American Society for Training and Development (ASTD)
- Popular References:
  - Reason, *Managing the Risks of Organizational Accidents*
  - Kotter, *Leading Change*
  - Geller, *The Psychology of Safety*
  - Rummler & Brache, *Improving Performance*
  - Daniels, *Performance Management*
  - Center for Chemical Process Safety, *Guidelines for Preventing Human Error in Process Safety*

Programme guidance

3.1 Expectations (what is acceptable and unacceptable)

- Clear expectations for safety and prevention
- Expectations for all organizational levels
- Expectations for leaders
- Types:
  - Behavioral
  - Processes
  - Procedures
  - Business results
  - Safety results
  - Culture
- Behavioral:
  - Written down
  - Specifies behavior, cues, standards, and reinforcers
  - Function specific (e.g., maintenance)
  - Job-specific (to prevent specific errors)
- Clear communication to users
- Adapted to meet changing business needs and operating experience

3.2 Management Practices

- Management:
  - Setting high expectations and standards
  - Planning
  - Implementing
  - Monitoring
  - Assessing
- Senior manager participation, sponsorship, and ownership
- Review and approval methods
- Methodical problem-solving processes
- Planned and methodical meetings
- Demand for and use of data
- Change management methods

3.3 Leadership Practices

- Leader Opportunities:
  - Facilitate open communication
  - Promote teamwork
  - Reinforce desired behaviors
  - Eliminate organizational weaknesses
  - Value the prevention of error
- In-field monitoring and observation
  - Provide prompt performance feedback
  - Coaching
  - Reinforce behaviors
  - Rewarding results emphasizing behaviors
  - Challenging at-risk behaviors, complacency, and hazardous attitudes and values
- Develop strong relationships:
  - People treated with respect, fairness, and honesty
  - Align shared values with stated values
  - Communication plan to carefully promote core values
  - Prompt response to suggestions
  - Worker engagement
  - Conflict resolution style
- Quality of communication practices & methods (e.g., communication plan)
- Promote shared accountability for safety and prevention
- Leader practices that shape values:
  - Focus of attention and priorities
  - Reactions to critical incidents
  - Criteria for allocation of resources
  - Attempts at role modeling, coaching, and teaching
  - Criteria for allocation of rewards, reinforcement, and sanctions

3.4 Station Processes (AP-929, LP-021, AP-921, AP-908, AP-913, OP96-088, AP series)

- Work planning, sequencing, and scheduling incorporating defense-in-depth (work management)
- Procedure development, revision, review, and approval that addresses error analysis
- Configuration control
- Administrative procedure controls
- Human resources (selection, development, discipline, termination)
- Operating experience program
- Training programs (including human performance fundamentals)
- Safety hazard analysis & error precursor audit (anticipating error traps and potential consequences)
- Identification of error-prone systems & tasks
- Human-centered engineering design
  - Human Factors and Ergonomics
  - Forcing Functions (e.g., interlocks)
  - Physical Conditions (e.g., lighting)

3.5 Task-specific Human Performance Process

(see page 6)

3.6 Performance Monitoring

- Performance Indicators (business plan performance measures)
- Observation program
- Recurring errors and at-risk actions
- Identification of error-prone tasks and systems
- Trend analysis
- Corrective action program trending process
- Organizational Measures of Human Performance (e.g., average number of days between events)
- Use of culture surveys to assess values, beliefs, and attitudes

3.7 Identify Performance Gaps

(see also page 7)

- Compare actual behavior with expected behavior, or actual results with expected results (like with like)
- Identification of:
  - Recurring events
  - Recurring error-likely situations
  - Common errors (by individual, work group, and task) and respective error precursors
  - Individual and generic performance problems
  - Good catches and what went right for near misses
  - Error-prone tasks (risk-significant)
  - Error-prone systems (risk-significant)
  - Inefficiencies
- Criteria for action guided by statistical significance (legitimate need for change)

3.8 Causal Assessment (see also page 7)

- Root cause analysis techniques targeted on human performance issues
- Identifying fundamental causes instead of symptoms
- Common-cause analysis
- Identification of behaviors and their causal factors (e.g., error precursors)
- Identification of defenses that failed to prevent undesirable consequences
- Identification of process and cultural causes of errors, violations, and failed defenses
- Involve principal individuals in evaluation
- Correct causes of minor as well as major events

3.9 Adjust Plan (training and non-training interventions)

- Corrective actions linked with causes
- Corrective actions consistent with performance modes
- Worker involvement in development of changes
- Consideration of inappropriate expectations
- Consideration of Interventions in addition to "counseling, training, and procedures"
- Adoption of long-term corrective actions (months and years), if necessary
- Identify process improvements that reduce presence of error-likely situations
- Communicate results to employees
- Consideration of adverse effects of proposed corrective actions on performance (e.g., equipment modifications or introduction of new technology)

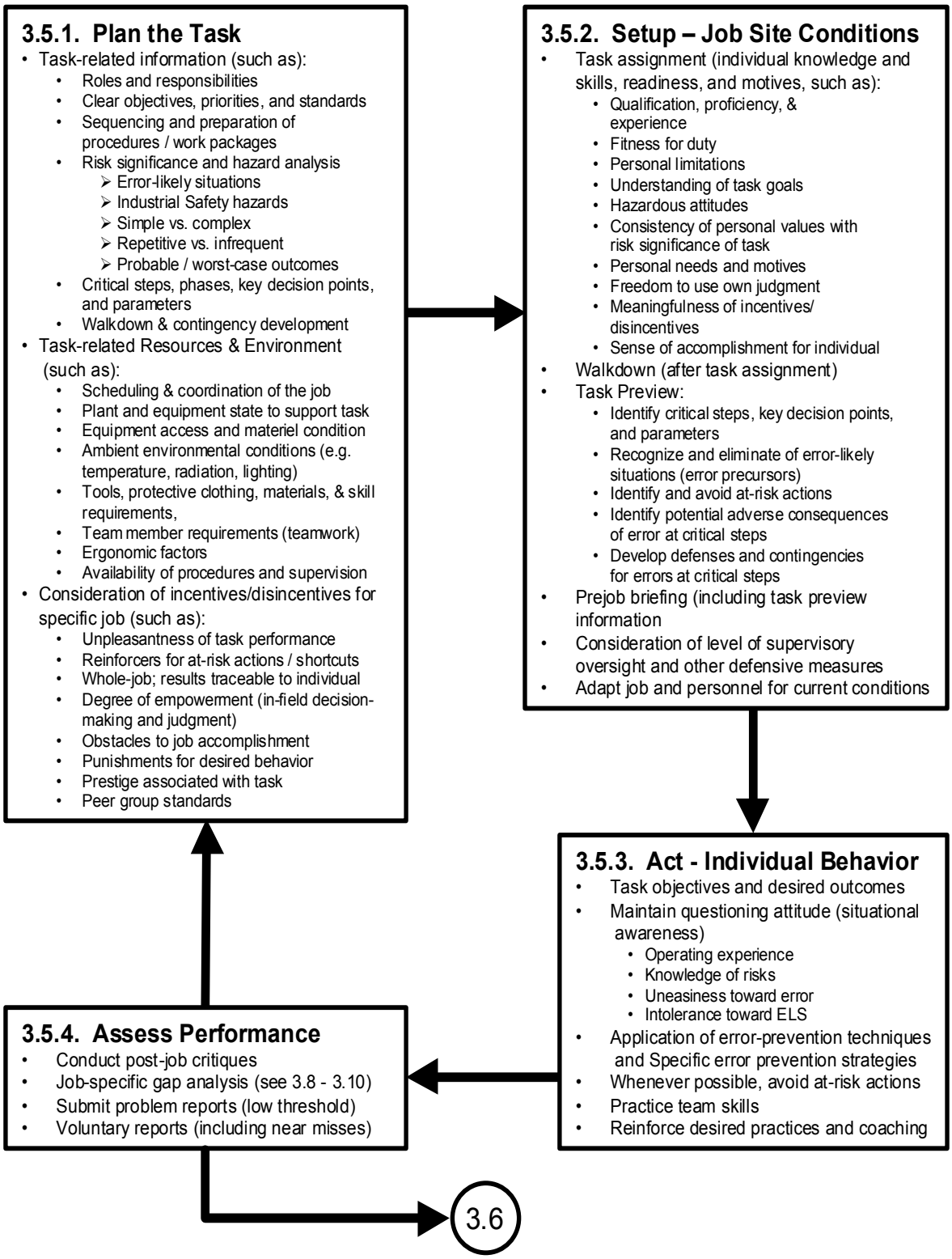
Core activities

4.1 Self-Assessment
- Formal and informal human performance self-assessments
- Quality Assurance audits, 10CFR50.54
- Performance Indicators
- Drill and exercise program
- Training evaluation results

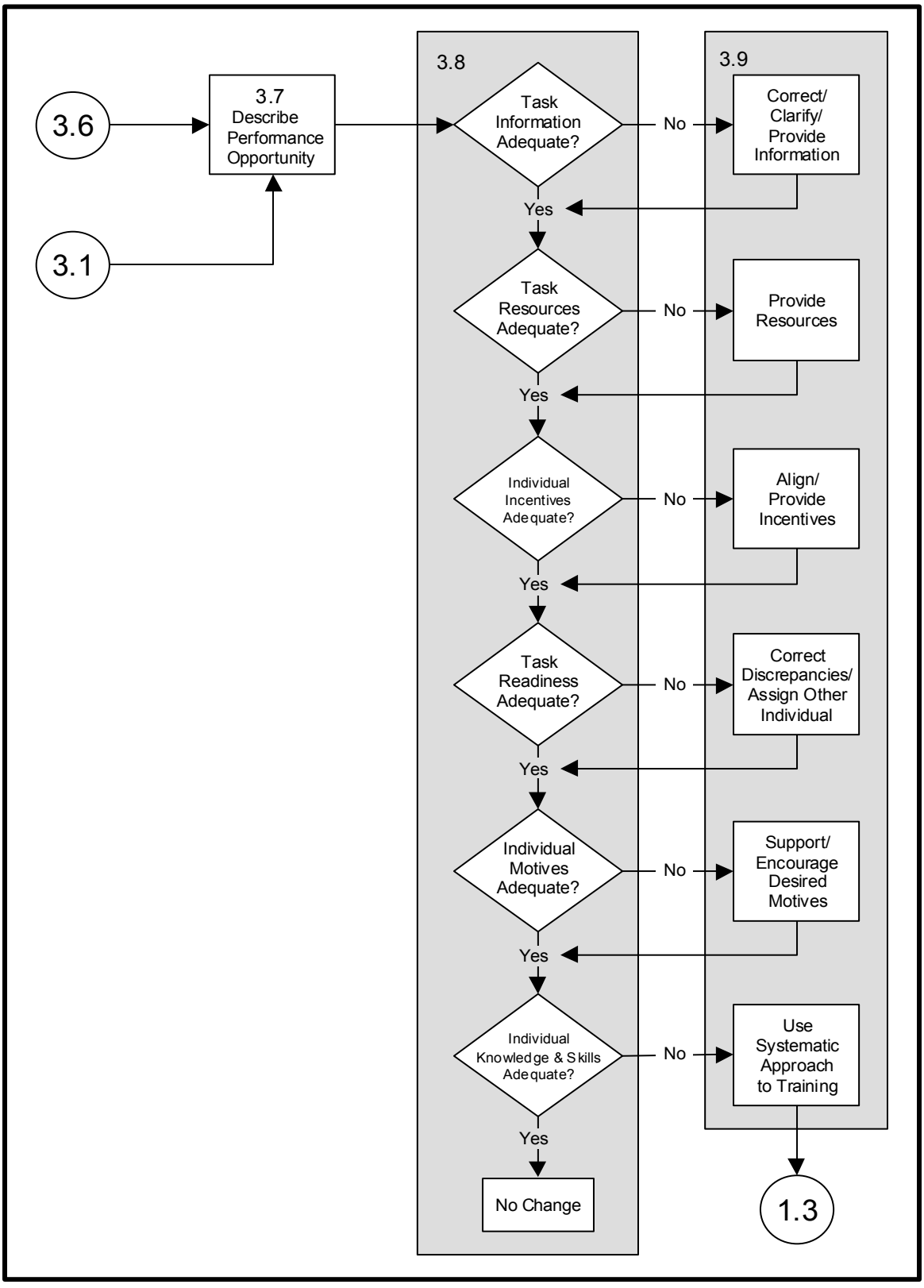
4.2 Benchmarking
- Plant visits
- Industry conferences and workshops
- Industry publications, e.g., INPO's Nuclear Professional
- Owners groups
- Other industries

4.3 External Oversight
- INPO Plant Evaluation Process
- NRC Oversight Process
- FEMA
- OSHA
- Peer "community of practice"

Programme evaluation



Task specific human performance process map



Identify and evaluate performance gaps

APPENDIX II. COMMUNICATING WITH A CEO REGARDING THE VALUE OF INVESTMENT IN HPI IN THE NUCLEAR INDUSTRY (1.1, 1.2)

II.1. Issue/challenge

To be able to effectively communicate with CEOs regarding the value and cost/benefit of human performance interventions.

II.2. Steps taken to resolve the issue

A CEO's focus is generally on maintaining the value and performance of the company. Value and performance of companies are generally measured in terms such as return on investment (ROI), shareholder value and earnings per share. Communicating to a CEO regarding the value of HPI interventions requires concrete means for demonstrating value, i.e. a model for calculating and displaying the ROI of HPI interventions and the increased value of human capital. Published models exist (see, for example, the contact information at the end of this appendix.). The following is a brief description of such a model.

Step 1. Identify priority areas with potential for improved performance. Conduct an analysis to determine the nature of the performance gap (magnitude, value, urgency) and select an appropriate combination of interventions.

Step 2. Calculate estimated intervention costs. Include development, implementation and maintenance costs.

Step 3. Calculate the worth of the performance interventions. Worth is equal to the potential value (V) of achieving desired performance (from step 1) divided by estimated costs (C) of interventions (from step 2): [Worth =V/C].

Step 4. Develop and implement interventions.

Step 5. Calculate the true cost of the interventions. This mirrors step 2: real costs replace estimates.

Step 6. Calculate organizational ROI. This usually requires waiting for six months or more after interventions have been implemented. Gather results data (e.g. error rates, productivity gains, failure rates, absenteeism figures, quality improvements in processes, and safety performance) and assign monetary value to these.

In order to make this model suitable for the nuclear industry it is necessary to look carefully at the "worth" calculation in step 3 above. For the nuclear power industry, the most obvious (and frequently used) measure of worth has been electricity generation (for example, generation improvements resulting from reductions in errors and events). While this measure of worth is very important, another major contributor to the worth of HPI for all nuclear facilities is in the value to the organization in avoiding accidents, incidents and events (i.e., avoided costs). The following discusses a concept for how this might be done.

It is quite feasible to identify the costs of accidents, incidents and events that have occurred in the nuclear industry. For example, to limit the scope of the analysis, we can consider only the US nuclear industry (some 100+ units) and look at the events since 1979 (so as to include the TMI accident). Examples of such accidents, incidents and events would include:

— Major accidents/incidents, including TMI, Davis Besse and Millstone;
— Early termination of plant operations, such as Zion, Maine Yankee and Yankee Rowe;
— Incidents that caused significant unplanned outages;
— Incidents that resulted in reduced confidence of the regulator, public and other stakeholders;
— Licensee Event Reports (LERs) (a cost per LER can be quite easily established).

The costs associated with these accidents/incidents/events should consider both the direct costs of the loss of generation as well as other costs, such as contractor support, costs associated with additional regulator scrutiny, etc. The value of reducing risks associated with human performance is clearly not just about reducing core damage frequency (CDF); for many of the incidents and events included above, the risk was not so much an increase in CDF as a loss of confidence in the operating organization by the regulator, public, investors and other stakeholders.

These costs can then be summed and converted to a per unit, per year figure. For example, if the totals were $50 billion for the past 25 years, this would equate to a "worth" of approximately $20 million per unit per year in avoiding accidents, incidents and events. (It is acknowledged that it is NOT feasible to totally eliminate such risk.)

If one were able to buy insurance to protect against this risk, the annual premium would be expected to be $20 million or more per unit, a sum that no NPP operating organization would consider paying. (It is noted that the nuclear liability insurance that all NPP operating organizations in the US have does NOT generally cover the costs incurred for the accidents/incidents/events identified above; rather, it covers physical damage done off-site.)

II.3. Results/benefits

It is generally accepted that at least half of the risk associated with NPP operations is related to human performance. In some ways all risk is related to human performance, as humans design and build all plant equipment. It is also generally accepted that all of the major accidents/incidents and extended shutdowns identified above were avoidable; that is, all were the result of factors such as flawed judgment, lack of understanding of the risks/consequences associated with decisions, etc.

For the example above, an NPP operating organization that spent $5 million per year on HPI initiatives to "self-insure" against a major accident/incident should expect up to a 400% ROI on this investment. Other benefits gained from such an investment in human capital should include an organization that more quickly and effectively responds to business challenges in the more competitive market in which many nuclear industry organizations find themselves today. It is certainly true that no HPI initiative will reduce the risk of a major accident, incident or event to zero. However, through HPI initiatives that address both short-term and long-term needs, as well as all levels of the organization from the BOD to the technician/operator, such risks can be (and have been) significantly reduced.

II.4. Application to nuclear industry organizations

This appendix discusses application of a ROI approach to HPI to the nuclear industry.

II.5. Further information

PHILLIPS, J.J., The Human Resources Scorecard; Measuring the Return on Investment, Butterworth Heineman, 2001.

APPENDIX III. DEMONSTRATING SOCIALLY RESPONSIBLE BUSINESS PRACTICES (1.1)

III.1. Issue or challenge

Large organizations need to build social issues into their strategies in a way that reflects their actual business importance. Companies that treat social issues as either irritating distractions or unjustified vehicles for attack on business are turning a blind eye to forces that have the potential to fundamentally alter their future. For NPP operating organizations this is particularly the case because of the very visible social issues related to nuclear safety, nuclear proliferation and global warming.

III.2. Steps taken to resolve the issue

The business consequences for companies that do not accept corporate social responsibility for their activities may be significant, as demonstrated by Nike's difficulties in the 1990s as protesters railed against the sweatshop conditions that prevailed in some of its overseas suppliers. However, the path to developing responsible business practices is not a simple one; often, just as an organization's views of an issue grow and mature, so does society's. In addition to organizations getting their own houses in order, they need to keep abreast of the public's evolving ideas about corporate roles and responsibilities. These may be considered as two 'dimensions' of learning, organizational and societal, and these can be combined to create a tool called the 'civil learning' tool.

Organizational learning may be considered as having five stages:

Defensive	Denying practices and responsibilities — "it's not our job to fix that"
Compliance	Policy based compliance approach as a cost of doing business
Managerial	Mitigating the erosion of economic value by integrating responsible business practice into daily operations
Strategic	Adding value by aligning strategy and process innovations with societal issues
Civil	Promoting industry participation in corporate responsibility.

Societal learning may be considered in terms of a practical tool developed by a Danish pharmaceutical company, Novo Nordisk, which addresses four stages of 'issue maturity'; these are:

Latent	Activist communities aware of issue, but scientific evidence weak and issue largely ignored by business community
Emerging	Political and media awareness, but data still weak and only leading businesses experimenting with approaches to dealing with issue
Consolidating	Sector-wide and issue-based voluntary initiatives, litigation occurring, increasing demand for legislation and voluntary standards being developed

Institutionalized Legislation or business norms established, embedded practices becoming a normal part of business excellence model.

The civil learning tool plots these two factors on a graph, producing a line or crossover from 'risky red zone' to a 'higher-opportunity green zone'. Businesses can use this approach to identify where they are at risk or, conversely, where they may have an opportunity to lead the way.

Another applicable tool is the global reporting initiative (GRI), which is a multi-stakeholder process and independent institution whose mission is to develop and disseminate globally applicable sustainability reporting guidelines. These guidelines currently have a status of a kind of unofficial standard. The use of GRI guidelines is voluntary, but hundreds of companies throughout the world are reporting on the financial, environmental and social aspects of their operations in accordance with the GRI sustainability reporting guidelines. A number of NPP operating organizations in countries such as Canada, France, Finland, Germany, Japan, South Africa and Spain are indicated on the GRI website to be using these guidelines (www.globalreporting.org). One example of such reporting is shown on the website of Fortum, which is the operating organization for the Lovisa NPP in Finland (www.fortum.com).

III.3. Results/benefits

The *Economist*, in its 28 May 2005 issue, indicated that from a shareholder value standpoint typically 80% of American and Western European companies' market value is based upon expectations on cash flow beyond the next three years. For NPP operating organizations this figure is most likely low, as an NPP has a longer-term payoff, typically 15 years or more. The long-term impact of social issues such as public health and safety, community relations, and fair and competitive pricing can be particularly important for NPP operating organizations.

III.4. Applicability to the nuclear industry

The nuclear industry has always been highly visible to the public, and is embedded as an issue of public concern. Traditionally, the industry has been primarily responsive to regulation and to internal standards and business drivers. However, there are also emerging areas of concern and attention, and areas where the industry could contribute to society outside the immediate imperatives of operations (such as global warming and environmental protection). Scanning for emerging issues and potential opportunities for social responsibility should be a part of strategic business planning.

III.5. Further information

Parts of the information in this appendix are taken from "The Path to Corporate Responsibility", published in the Harvard Business Review, December 2004, written by Simon Zadek, CEO of AccountAbility (simon@accountability.org.uk).

Also, information regarding use of the GRI guidelines can be found at www.globalreporting.org, and an example of the use of these guidelines for an NPP operating organization at www.fortum.com.

APPENDIX IV. LESSONS LEARNED FROM THE HEALTH CARE INDUSTRY (1.1, 3.1, 3.2, 3.6)

IV.1. Issue/challenge

In recent years, the health care industry has become increasingly aware that it is not as safe as it should be, and can be. For example, in the USA, two major studies in the 1990s determined that at least 44 000 people and as many as 98 000 people died in hospitals in the USA each year as a result of medical errors that could have been prevented. This toll exceeds the combined number of deaths from motor and air crashes, suicides, falls, poisonings and drownings in the USA. Underreporting of adverse events is estimated to range from 50 to 90% annually. Clearly, there is a critical need to minimize medical errors. Part of the need involves making patients aware of the risks and encouraging their becoming active participants in the processes associated with their own health care.

IV.2. Steps taken to resolve the issue

In 1996, the US Institute of Medicine (IOM) launched a concerted, ongoing effort focused on assessing and improving the nation's quality of care. This effort is now in its third phase (see Section IV.5 for details). The first phase of this quality initiative documented the serious and pervasive nature of the nation's overall quality problem During the second phase, spanning 1999–2001, the Committee on Quality of Health Care in America laid out a vision for how the health care system and related policy environment must be radically transformed in order to close the gap between what is known to be good quality care and what exists in practice. This vision is communicated as "Simple Rules for the 21st-Century Health Care System" that are identified below:

Current Approach	New Rule
Care is based primarily on visits.	Care is based on continuous healing relationships.
Professional autonomy drives variability.	Care is customized according to patient needs and values.
Professionals control care.	The patient is the source of control.
Information is a record.	Knowledge is shared and information flows freely.
Decision making is based on training and experience.	Decision making is evidence-based.
Do no harm is an individual responsibility.	Safety is a system property.
Secrecy is necessary.	Transparency is necessary.
The system reacts to needs.	Needs are anticipated.
Cost reduction is sought.	Waste is continuously decreased.
Preference is given to professional roles over the system.	Cooperation among clinicians is a priority.

While some hospitals, medical groups and other health care organizations have installed computer systems to manage patient information, a national infrastructure for standardized data collection and exchange is needed because patients often receive services from many different providers. Routine use of electronic health records would give health care providers

and patients immediate access to complete patient information as well as tools to guide decision-making and help prevent errors.

Health care has lagged behind other industries in implementing reporting systems and other initiatives related to safety. One of the barriers to be overcome in this regard are privacy concerns. Policy documents developed in the health care industry have placed high priority on improving incident reporting as the first step in addressing patient needs, and have called for translation of lessons learned from other industries. The health care industry has studied incident reporting systems from aviation, NASA, petrochemical, nuclear power and nuclear medicine industries, and it has concluded that there are some important common characteristics of these systems, including that they provide benefits to the industry that exceed their costs.

A number of reviews of the health care industry have recommended that it emulate the practices of high reliability organizations (HROs) that operate at five or six sigma quality performance, such as the airline industry. One of the HRO methods of the airlines industry, crew resource management (CRM), is being translated for application to emergency medical care. CRM as applied to the nuclear power industry is described in Appendix XIII.

IV.3. Results/benefits

Despite evidence of promising gains in certain sectors of the health care system, NCQA again in 2004 documented evidence of widespread, unexplained variation in quality that results in thousands of unnecessary deaths, tens of thousands of avoidable hospitalizations and illnesses and billions of dollars in lost productivity — hobbling an economy already encumbered by the ever-growing costs of health insurance. Apart from the health plan quality information that NCQA has published for the past decade, it is still exceedingly difficult for consumers to find comparative information about their health insurance options and providers. But there are encouraging signs. While little objective information about hospital quality was available until recently, many hospitals are beginning to report such data at the urging of the federal government and public interest groups. Similarly, information about the quality of physician practices is scarce. This accountability vacuum must be filled if forward movement on quality is to continue.

One positive example of improvement in the health care industry is the Perinatal Patient Safety Project (PPSP), which created a systematic strategy for operation of high-reliability perinatal (infant care) units by preventing identified causes of perinatal events in the clinical setting. PPSP emphasized structured communication, multidisciplinary rounds, a definition of fetal well being, and practicing for emergencies. Based upon success at four pilot sites, it was implemented at all sites of a major health care provider.

IV.4. Application to nuclear industry organizations

The health care industry issues regarding knowledge sharing and information flowing freely, decision-making moving to an evidence-based approach, transparency and cooperation are also relevant for the nuclear industry. While the nuclear industry has some strengths that the health care industry could benefit from, such as national and industry-wide incident reporting systems, the nuclear industry could potentially benefit from monitoring the ongoing dialogue both within the health care industry and between the health care industry and governmental organizations regarding improvements in human performance.

IV.5. Further information

Information regarding ongoing Institute of Medicine efforts, including status reports, can be found at: www.iom.edu/

Information regarding the NCQA Report "The State of Health Care 2004" can be found at: www.ncqa.org/communications/SOMC/SOHC2004.pdf

APPENDIX V. EDF PERFORMANCE-BASED MANAGEMENT CONTRACTS (1.1, 1.2, 3.6)

V.1. Issue/challenge

Électricité de France (EDF) nuclear stations have initiated the use of performance contracts in the areas of nuclear safety, industrial safety, environment, availability, management and cost control, in an effort to ensure that the work of different departments and work groups is aligned with the overall corporate strategic objectives. The strategic plan and management contracts for EDF stations address both corporate objectives (which contribute to the achievement of corporate strategic plan vision and objectives) and station objectives specific to departments. These objectives are used with indicators for each management level. The control system is a decision aid tool used by the management team, covering all the objectives of the strategic plan.

V.2. Steps taken to resolve the issue

Management contracts are established between corporate headquarters and the station director, and between the station director and department heads and advisors. They are drawn up on the basis of priorities as defined by the Strategic Steering Committee. As a part of the management contract monitoring, each department defines its contribution to corporate goals and objectives, and commits itself to performance indicators enabling progress in achieving these goals and objectives to be assessed and monitored. The respective director and department manager sign contracts for a one-year period. Every six months the contracts are reviewed for progress. Contracts not only incorporate department initiatives, but the plant and corporate objectives as well.

V.3. Results/benefits

The result of this initiative is that all the plant and contractor employees are more aware of how their efforts support both the corporate and the station mission, visions, goals and objectives. The contracts provide an effective tool to maintain a focus and alignment of corporate, plant and department objectives. The results for the five most significant indicators are individually notified monthly to each employee, which helps to reinforce staff commitment to the plant's main objectives and priorities.

This is a good practice identified by IAEA OSARTs at EDF plants in 2000 and 2002. (OSART good practices are by definition practices that are beneficial to safe and reliable NPP performance, and that are disseminated because they are not generally used effectively in the nuclear industry.)

V.4. Application to nuclear industry organizations

This is an example of an NPP operating organization effectively adapting a practice developed outside the nuclear industry.

V.5. Further information

EDF headquarters organization (http://www.edf.fr/)

APPENDIX VI. DEVELOPING A CUSTOMER FOCUS (1.2, 3.1)

VI.1. Issue/challenge

With the creation of a more competitive electricity market in the early 1990s in the UK, Nuclear Electric (now British Energy) developed a new business model to reflect its role in the new market. One aspect of this was the operation of NPPs as 'profit centres' and of support organizations such as training, human resources, IT, etc., as 'cost centres'. Developing in parallel was the concept of 'customers and suppliers'. Having not previously had any direct external customers, the company had little experience of the concept of customers and suppliers.

VI.2. Steps taken to resolve the issue

After conducting an initial training needs analysis, the company recruited an external training organization used by the national airline, British Airways, made up mainly of ex-airline cabin staff, who were very experienced in customer care. A training programmeme was developed and delivered, particularly for corporate support staff. The programme helped support departments to identify who their customers were, both internal and external, to develop techniques for establishing customer expectations, and to establish agreed customer targets

VI.3. Results/benefits

Support departments gained a better understanding of who their key customers were, and, based on customer feedback, were able to tailor their products and services to the needs of their customers. This was particularly useful when, after privatisation, the company began to have real external customers.

VI.4. Application to nuclear industry organizations

Many energy companies operate in a monopoly market and as such have not had the need to consider a customer focus. With the planned deregulation of many markets, a customer focus in a competitive market will become crucial. The idea of a strong service focus for internal customers is also key, as organizations strive to become more efficient. If different departments understand the needs of one another, better cooperation and therefore results should occur. An example would include training services provided to the operations organization.

VI.5. Further information

British Energy (http://www.british-energy.com/)

APPENDIX VII. FAA AIR TRAFFIC CONTROL SYSTEM HUMAN FACTORS PLAN (1.2)

VII.1. Issues/challenges

To ensure that human factors policies, processes and best practices are integrated in the research and acquisition of air traffic control systems; human factors in this context is a part of HPI with particular emphasis on the human–machine interface and ergonomics.

VII.2. Steps taken to resolve the issue

The US Federal Aviation Administration (FAA) is responsible for the national air traffic control system. It has established in its human factors plan a goal by 2005, to ensure that human factors policies, processes and best practices are integrated in the research and acquisition of 100% of FAA air traffic control systems and applications. The achievement of this goal is to be measured by the percentage of systems and applications that satisfy human factors policies, processes and best practices. This programme is implemented through key projects with specific objectives, milestones and performance measures. The plan includes the following elements: human factors policy and process; human factors standards, conventions, guidelines and techniques; and human factors training

For example in the area of human factors training, the plan addresses the following:

Awareness training. Basic information about human factors, including:

- Human factors awareness training
- FAA acquisition management system training (HF module)
- Human factors process improvement and consultation
- Life cycle acquisition management process forums/seminars.

Tailored programme training. Instruction focused on an integrated product team, acquisition programme office or acquisition system, including:

- Human factors in integrated requirement team activities
- Human factors in investment analysis team activities
- Human factors process improvement and evaluation
- Exit criteria for human performance issues
- Human factors in test and evaluation.

Specialized technical training. Technical areas of human factors of specific or general interest to the air travel control population, including:

- Color in ATC displays
- Questionnaire and survey design
- Principles and measurement of noise
- Human factors lab capabilities demonstration
- Designing CHI and CHI prototyping techniques
- Warnings, alerts and alarms.

VII.3. Benefits experienced

Steady progress has been made in the past few years in the application of human factors to acquisition systems across the five major functions of the programme (as measured by objective programme ratings).

VII.4. Application to NPP operating organizations

NPPs have many of the same human factors issues as those identified here for air traffic control systems. Both need to be high reliability organizations. USNRC NUREG-0711 and ISO 964 are documents developed in the nuclear industry to address these needs.

VII.5. Further information

http://www.faa.gov/about/plans_reports/business_plan2005

APPENDIX VIII. PATIENT CENTRED APPROACHES (1.3, 3.4, 3.7, 3.9)

VIII.1. Issue/challenge

The UK National Health Service (NHS) is undergoing a period of rapid and significant change. One of the many approaches adopted to facilitate this change was a project called "Smartcare". Within the project, nine key areas of NHS activity, especially areas of chronic disease, were funded and supported to pilot new approaches, some of which were radically different from the traditional ways of working within the health service. At the end of the two-year project, each area was reviewed for lessons learned, i.e. what worked well and what worked less well. These lessons learned then formed the basis of further roll-out across the NHS.

VIII.2. Steps taken to resolve the issue

For each pilot area, a steering group was formed comprising appropriate health professionals, full-time project managers facilitated health service managers and patients. The current patient management processes or "patient journey" were mapped from both the health service and the patients' perspective to identify bottlenecks, process inefficiencies, negative patient experiences, etc. An ideal "patient journey" was also mapped. These two process maps were then compared to identify where improvements could realistically be made, and a number of mini-projects were launched to manage these improvements and ensure they did not have a detrimental effect elsewhere in the process or on other processes.

In all of these activities the views of patients were sought to ensure that, regardless of benefits to the health service, any changes were seen as positive by the patients themselves. In some cases, independent patient groups were established to review proposed changes.

VIII.3. Results/benefits

The benefits experienced varied according to the nature of each of the areas covered by the project, but generic benefits included:

- Reduction of waiting times for patients to see the appropriate health specialist;
- Better awareness for patients of what was likely to happen to them in the future;
- An increase in the 'partnership' aspect of the patients' treatment, i.e. more involvement by the patient in decisions about treatment;
- Recognition by patients that the health service wanted to better understand their needs, i.e. improved customer care.

VIII.4. Application to nuclear industry organizations

The development of partnerships between different NPP departments and workgroups that must interact to operate the facility could provide a better understanding of overall issues and facilitate overall process improvements.

VIII.5. Further information

Brian Molloy (brianrmolloy@hotmail.com), a Steering Group member.

APPENDIX IX. BUSINESS SIMULATION TO FACILITATE CHANGE (1.3)

IX.1. Issue/challenge

Essent is a multi-utility group active in the electricity, gas, heat, cable/telecommunications and environment/waste processing sectors, employing around 12 000 people. Its local market covers the southern, northern and eastern regions in the Netherlands, and it is also active in other European countries such as Belgium and Germany. The legislative changes that are driving the creation of new market structures and dynamics also are driving the re-engineering of those companies that operate within this market, as well as the separation of their retail and network businesses. This means that companies in the Dutch utilities market have to extensively restructure their organizations, create entirely new business capabilities and execute step-change improvements in operational efficiency.

IX.2. Steps taken to resolve the issue

The first phase of this transformation began with the implementation of a new enterprise solution that will allow people to access and manage real-time information across an organization. This solution included a customer relationship management (CRM) software system for the retail company, a new system supporting procurement, investment projects, maintenance and finance processes within the network company, and a new billing system for both retail and network companies.

Working in collaboration with a consultant, a suite of day-in-a-life simulations was developed that provide an integrated learning environment where groups of 30–70 people work in an integrated way with their new systems and processes, acting on their new roles and responsibilities using actual data and real-life business cases. The business processes were simulated from end to end, including all interfaces between different processes and organizational units. The role specific and real-time scenarios, however, were supported with real-life inputs such as e-mails, letters and phone calls. Everything is real, except the consequences.

IX.3. Results/benefits

The day-in-a-life simulations helped Essent employees to develop a better understanding and knowledge of what they will need to do in the future and how their performance will align with the overall objectives of the business. These employees have experienced the benefits of change and gained confidence in their own ability to be successful.

IX.4. Application to nuclear industry organizations

The concept of creating business simulations for nuclear industry organizations, especially those facing deregulation, is directly applicable. Indeed, such business simulations have been used successfully in a limited number of nuclear organizations (see Appendix XII for an example).

IX.5. Further information

http://www.essent-finance.nl

APPENDIX X. MOVING TO A PROCESS BASED ORGANIZATION (1.3, 3.4)

X.1. Issue/challenge

Telenor is Norway's leading provider of telecommunications, data and media communications services, with more than 22 000 employees in Norway and other countries.

Telenor has set a goal to become one of the leading service assurance units within the European telecommunications industry. To realize these high ambitions, the organization recognized it had some major challenges related to high operating costs. Systems operations were handled at multiple locations; reporting structures were unclear; duplication of efforts occurred; and there was a lack of focus on core activities. Telenor Networks' 375-member systems operations were inefficient and lacked adequate support for such important processes as monitoring the network and correcting faults. The company's complex IT architecture made it difficult to monitor the network for disruptions of operations — it required a large workforce to monitor its many screens and relied on manual processes. Meanwhile, the company's technology-oriented workforce lacked the customer focus that is critical to understanding — and delivering — the network that users need.

X.2. Steps taken to resolve the issue

In an initiative that was innovative in its holistic approach, Telenor Networks collaborated with an external consulting company to transform the company's systems operations from a function-based to a process-based organization. Telenor merged disparate systems operations into a single location and deployed technology to automate the company's network alarm system — reducing the need to manually monitor 50 000 alarms. To help the company save even more time and resources, the 560-member field force operation was reorganized.

Telenor Networks analysed the required organizational, process and cultural changes that would both reduce costs and significantly improve the effectiveness of the company's workforce. To achieve these objectives, the company created a transformed organization built around redesigned business processes. The core competences that would be required for each redesigned process were identified, and then the new roles to support each competence were clarified. Employees were relocated to the appropriate departments that enabled Telenor Networks to more effectively utilize employees' skills and knowledge. The company was no longer focusing on non-core activities, an improvement that has helped eliminate work redundancy and improve efficiency. From that, the new, tightly structured organization was designed.

Change agents were identified in each department — individuals who were involved in decisions and in communicating the importance of the changes to employees. Management training was delivered, and now a measurement and incentive system for workplace performance is being developed.

X.3. Results/benefits

Telenor Networks has significantly improved the cost effectiveness of its workforce, and has reduced operating costs by as much as 25%. With the consolidated systems operations, and the redesigned processes and organization, the company now requires 200 employees to achieve what only a year ago called for 375 employees. The innovative, wide-scale initiative to transform Telenor Networks was delivered on time and under budget.

X.4. Application to nuclear industry organizations

The aspects of this case study related to strengthening operational processes are applicable to NPP operating organizations.

X.5. Further information

http://www.telenor.com

APPENDIX XI. PERIODIC, UNANNOUNCED EVALUATION OF HUMAN PERFORMANCE (3.1, 3.6)

XI.1. Issue/challenge

Training assessment tools, used at the end of initial or continuing training courses, are not designed to identify the extent of degradation (over time) of human performance after completion of training, or inadequate reinforcement of the standards by supervisors. In response to this identified limitation, Exelon Nuclear (USA) developed what it calls an "out of the box evaluation" (OBE). An OBE is an assessment in which fully qualified/authorized workers are evaluated on a specific work task by their supervisor and a training instructor. There is minimal time allotted for the worker to prepare for the evaluation, because the exercise is designed to assess the behaviours that should be used as part of any task the individual is qualified to perform.

XI.2. Steps taken to resolve the issue

The first step was to create an evaluation process that identifies weaknesses in the workers' knowledge and skills prior to attending refresher training. The following steps are taken for implementation.

Evaluation preparation

- First line supervisor (FLS), training instructor and worker meet in a private meeting room.
- The FLS describes the overall outline of the OBE process to the worker.
- No formal pre-job brief will be given. No preconditioning, such as practising the task, will be allowed.
- The FLS reviews scoring criteria with the worker.

Implementation

Worker reviews the work package for not more than 15 minutes.

Worker performs/simulates the task as required.

FLS and training instructor conduct the evaluation using the OBE Evaluation Form and management expectations.

FLS and training instructor are not allowed to provide coaching of any kind to the worker during performance of the task.

The evaluation will be stopped for reasons of personnel safety and/or damage to equipment. The stoppage is then rectified, to enable continuation of the evaluation. A complete evaluation of task performance must be conducted in order to grade the applicable maintenance fundamentals and management expectations. A worker has the potential to fail a number of criteria. Fully completing the task will allow all deficiencies to be recorded and will lead to a thorough remediation.

The FLS provides role-playing as needed:

When a verification is required, the worker will be the “performer” and the evaluator will be the “verifier”.

If a field check is required, the FLS will grade the jobsite readiness as it stands when notified by the worker to perform the check.

Post-evaluation

FLS, training instructor and worker return to a private meeting room.

Worker waits outside of room while FLS and training instructor compare scoring notes. The training instructor could possibly give the FLS a failing grade as an evaluator for not adequately upholding required standards. If this happens, see * below.

The debrief of the worker is led by the FLS. This is most important. Do not hurry through it. The FLS should cover what the worker did well and what the worker did poorly.

If the worker scored a PASSING grade, gain buy-in from the worker:

> Ask: Why do you think we are conducting Out of the Box Evaluations?
>
> Human performance tools are there to help you.
>
> Discuss past events that affected shop performance.
>
> Reinforce expectations and requirements.
>
> Coach severely on the negative comments.
>
> Ask worker what they are going to do differently going forward. This should be in their minds when they leave. Make these actions specific.

Worker may return to work.

The training instructor saves all documentation, performs record keeping, and practises exam security.

If worker scored a FAILING grade, worker is NOT allowed to perform any plant work until remediation and re-evaluation occur.

Remediation (if needed)

Worker meets with Department Manager to discuss failure.

Department Manager will note remediation plan.

Worker reports to Training Department or shop for study time and remediation.

Re-evaluation on the same task takes place the next business day.

** If FLS fails*

The training instructor will be considered the higher authority.

Counselling the FLS on the deficient standard will take place immediately.

Use reference materials if needed (e.g. procedures, expectations, etc.)

Ensure the FLS is re-aligned with the standards.

Continue with scoring the worker's performance.

XI.3. Benefits experienced

Reduced plant events due to improved knowledge and skills of the error prevention tools by the workers and supervisors. Improved alignment of the standards reinforced by supervisors. Improved coaching by the supervisors.

NPPs that have implemented OBEs in their training programmes have observed an increased level of engagement between workers and supervisors.

XI.4. Application to NPP operating organizations

The use of OBEs is applicable to reinforce and evaluate human performance behaviours associated with field workers and supervisors within the NPP organization.

XI.5. Further information

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APPENDIX XII. IMPROVING COMMERCIAL AWARENESS (3.2)

XII.1. Issue/challenge

At the time of creation of the new electricity market in the UK in 1990, Nuclear Electric plc (now British Energy) developed a 'critical success map'. 'Commercial culture' was identified as a key area that could be detrimental to the company's future success if it was not improved.

XII.2. Steps taken to resolve the issue

The company established contact with an organization, Business Training Systems (BTS), which specialized in business simulations for commercial organizations.

From a training needs analysis conducted among the company's directors and senior managers, BTS developed a training workshop based around a realistic model of how the company operated in the new electricity market. Programmeme participants were divided into five teams, each running a fictitious company, competing with each other in the model market over a 4–5 year period. The business simulation was dynamic and realistic, with each team's business decisions being affected by those of the other teams, general developments in the business environment and incidents within their own companies.

At the end of each 'year' the results for their 'company' were fed back to all the teams who were ranked, based on their performance. These feedback sessions also acted as 'know-how' sessions with the trainers helping participants to see how the 'lessons learned' could be translated to Nuclear Electric. At the end of the workshop, each team fed back their major learning points to a senior director and each team member was required to develop an individual action plan to take back to their workplace.

XII.3. Results/benefits

Over a 2½ year period, the programmeme was delivered to over 2000 staff. In terms of direct financial benefits, graduates who returned their 3–6 month post-course evaluation forms identified over £13 million savings directly attributable to the training.

In addition, a number of less tangible benefits were identified:

- Helping staff to see the need for change in the company;
- Providing a clear idea of the importance of costs and the need for cost control;
- Giving staff a better idea of how their own work affected other parts of the company;
- Improving the company's understanding of its position in the marketplace.

XII.4. Application to nuclear industry organizations

This is an example of a business simulation developed for commercial companies being tailored to the needs of an NPP operating organization.

XII.5. Further information

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APPENDIX XIII. CREW RESOURCE MANAGEMENT (3.2)

XIII.1. Issue/challenge

During its reorganization and restructuring in preparation for privatization, Nuclear Electric plc (now British Energy) recognized the need to deliver a common message across the company with regard to the non-technical skills required to carry out job duties. At the time (early 1996), each NPP was training in different non-technical skill areas: team building, conservative decision-making, conduct of operations, and STAR (Stop, Think, Act and Review). The goal was to bring together in one programmeme the behavioural skills necessary to operate the plant safely and effectively.

XIII.2. Steps taken to resolve the issue

In order to rationalize these activities (team building, conservative decision making, etc.), a working group was set up to establish consistent human performance training arrangements, which also looked outside the nuclear industry to any other relevant training.

Many of the behavioural skills were to be found in a course delivered by British Airways (BA) to their flight crews under the Crew Resource Management Course (CRM). This programmeme was respected worldwide, being standard training for all major commercial airlines and mandatory training for all air pilots. Company staff therefore liased with BA to develop a similar course for Nuclear Electric. Two further sessions were added to the main body of the course (conduct of operations, and shift work) and all other sessions were made relevant to the nuclear industry where applicable by the introduction of in-house video vignettes, case studies and statistics. The course included sessions on:

- Operational conduct
- Decision-making
- Situational awareness
- Choosing behaviour
- Health at work (e.g., stress, shift work)
- Group feedback
- Feedback
- Communication
- NASA team skills.

XIII.3. Results/benefits

Although originally developed for shift teams only, the feedback received was so positive that a generic version was developed for day staff as a company-wide Human Performance Foundation Course. An objective effectiveness assessment methodology was developed in cooperation with a leading university to confirm the benefits of the programmeme.

XIII.4. Application to NPP operating organizations

Self-evident.

XIII.5. Further information

British Energy (http://www.British-Energy.com)
British Airways flight training (http://www.ebaft.com)

APPENDIX XIV. IMPROVING CRISIS AND EMERGENCY MANAGEMENT CAPABILITY (3.3)

XIV.1. Issue/challenge

Subsequent to creation of the new electricity market in the UK in 1990, Nuclear Electric plc, the operator of England's NPPs, worked hard to transform itself into a high performing organization. As part of this, the development of its managers focused on safety, people development and effective business performance skills. By the late 1990s it became evident that there had been an erosion of the more traditional 'command and control' skills, a need commented on by the regulatory body, based on their observations of a number of emergency drills at NPPs.

XIV.2. Steps taken to resolve the issue

In researching options, it became apparent that similar problems had been experienced by the UK offshore oil industry, a factor heavily criticized in the inquiry into the Piper Alpha Oil Platform disaster in 1988, in which there was extensive loss of life. Through contacts in the oil industry, Nuclear Electric engaged the services of a company, the Operational Command Training Organisation (OCTO), to conduct a needs analysis and develop a tailored programmeme for those staff involved in emergency management. OCTO is staffed mainly by very experienced retired senior military personnel with first-hand combat experience.

In addition to developing and delivering a 'command and control' training programme, the Access Control and Crisis Management Centres at the NPPs and the Corporate Crisis Management Centres were physically redesigned, and new support systems were installed to enhance the implementation of the new techniques and skills learned by programme participants.

XIV.3. Results/benefits

The individual competence of crisis management staff was demonstrably increased, resulting in superior performance during emergency exercises. Organizational performance was improved through improved information flows, leading to a better awareness of developing situations and more proactive decision-making, resulting in improved rating of exercises by the regulatory body.

XIV.4. Application to nuclear industry organizations

This is an example of a HPI tool developed for other high reliability organizations being applied to the nuclear industry.

XIV.5. Further information

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APPENDIX XV. PERFORMANCE COACHING (3.3)

XV.1. Issue/challenge

During Nuclear Electric plc's (now British Energy) period of change in the early 1990s, brought about by the establishment in the UK of the new electricity market, the company was looking for new ways of motivating staff and improving performance.

XV.2. Steps taken to resolve the issue

An opportunistic encounter between one of the company's senior directors and a representative of a newly formed company, promoting the application of sports coaching techniques in business, led to the development of a new programme, initially for senior company managers. The programme is based on a sports coaching model called GROW:

- **G**oals – what you want to achieve,
- **R**eality – what is happening now,
- **O**ptions – what options you have/what else can be done,
- **W**ill – what you are going to do.

The coach, or manager, helps an individual to solve a problem/improve their performance by asking appropriate open questions to enable them to identify options/solutions from within, rather than the manager suggesting solutions. The purpose of the coach is to raise the performer's awareness (self-directed appropriate focus to gather information of a high quality) and responsibility (the performer's choice to 'own' a task, to see it through to completion). An important element of the process was for senior managers to effectively model the technique themselves, and to hold their direct reports accountable for their coaching behaviours.

XV.3. Results/benefits

As a result of coaching, individuals take greater ownership of tasks/solutions than when they implement someone else's solutions. Individuals feel more 'empowered' to make and implement decisions. However, feedback from managers showed that they found it difficult to identify what questions to ask and that sometimes there were just too many unknowns to be able to create a specific goal. Performance coaching gave managers a method of eliciting information from individuals with a minimum of distortion. It has the added benefits of making the choice of questions relatively simple, so that more attention is placed on what the individual says. Those being coached also report that they feel valued and experience rapport when the clean language process is used.

XV.4. Application to NPP operating organizations

This is an example of a HPI tool developed for the sports being applied to the nuclear industry.

XV.5. Further information

www.cleancoaching.co.uk

APPENDIX XVI. ALIGNING INDIVIDUAL PERFORMANCE AND ORGANIZATIONAL OBJECTIVES (3.3)

XVI.1. Issue/challenge

Wyeth is one of the world's largest research driven pharmaceutical and health care products companies. Since 1998 the company launched three of the ten most successful prescription medications of all time. In order to maintain that pace of innovation and high performance, Wyeth needed to better coordinate the efforts of its four research centres and create a tight system of performance accountability for its 1200 scientists.

Wyeth hired a consulting firm to help cultivate an organizational culture within its research and development (R&D) function — one of the competences most critical to the success of a pharmaceutical company — focused on personal performance and accountability.

The challenge was to align individual performance with organizational objectives to improve business results, and to restructure the organization accordingly.

XVI.2. Steps taken to resolve the issue

Working in collaboration with Wyeth, the consultant company designed and helped implement the organizational changes required to improve performance and ensure accountability. Wyeth also implemented a new governance structure that focuses senior managers on a single set of principles and improves senior management accountability. Wyeth R&D senior management crafted a list of organizational objectives, and objectives for lower level managers that back up the organizational objectives.

To measure progress, the team defined performance metrics for both individual R&D employees and groups. The team put it all together in a comprehensive "balanced scorecard" that provides a quantitative method of assessing performance on a quarterly basis, utilizing Web-based technology that simplifies data collection. The consultant company provided training and helped roll out the programme. Just two months after beginning the project, Wyeth R&D had implemented the changes necessary to maximize the productivity of its workforce.

XVI.3. Results/benefits

Wyeth R&D now benefits from a team-based structure that crosses functions and allows for the appropriate level of delegation and empowerment. The human performance effort has contributed to a 300% increase in the output of Wyeth's R&D Drug Discovery operation. The productivity gains have not impacted quality and are expected to be sustainable over the long term.

XVI.4. Application to NPP operating organizations

Alignment of individual performance with organizational objectives should be an important objective for NPP operating organizations.

XVI.5. Further information

www.wyeth.com/research/

APPENDIX XVII. GALLUP SURVEY OF EMPLOYEE ENGAGEMENT (3.3)

XVII.1. Issues/challenges

Today many organizations are looking for methods to better engage employees in the organization's mission, and thus improve its performance. The lack of such engagement has been demonstrated to have a tremendous cost.

XVII.2. Steps taken to resolve the issue

Shown in Fig. 3 are the results of a recent Gallup survey of some 3 million employees. The results should be disturbing for managers in that less than one third of those employees surveyed indicated they were engaged in helping their organizations succeed. Even worse, some 16% indicated that they were actively disengaged, meaning that they were actively working against their organization's success.

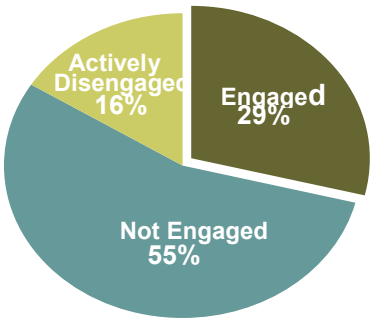
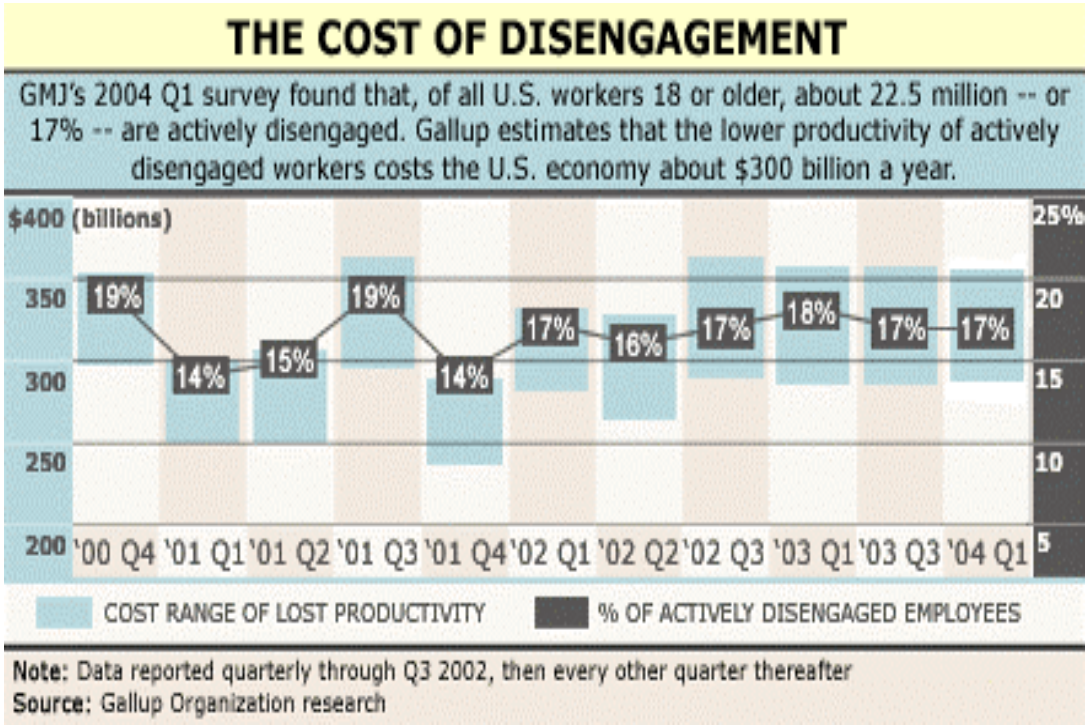


FIG. 3. Results of a recent Gallup survey of employee engagement.

Shown in Fig. 4 is the estimated cost of this disengagement.



Gallup estimates suggest that there are more than 22 million workers — in the United States alone — who are extremely negative or "actively disengaged". This rampant negativity is not only disheartening, it's *expensive*: It costs the US economy between $250 and $300 billion every year in lost productivity alone. When you add workplace injury, illness, turnover, absences and fraud, the cost could surpass $1 trillion per year, or nearly 10% of the US gross domestic product (GDP). These costs are not specific to the United States; they exist to varying degrees in every country, industry and organization Gallup has studied.

Gallup further suggests that these figures are conservative. To estimate costs accurately, they only accounted for the direct impact that "actively disengaged" employees have at work. They quantified the productivity — or lack thereof — occurring in each person's own workspace. In analysing the data, they had to assume that each disengaged employee simply sat in his or her cubicle and didn't wreak havoc elsewhere — an unlikely assumption, of course. Most disengaged employees do plenty of things each day that bring others down with them.

XVII.3. Benefits experienced

The concepts of "recognition" and "praise" are two critical components for creating positive emotions in organizations. In fact, the Gallup organization has surveyed more than 4 million employees worldwide on this topic. Its latest analysis, which includes more than 10 000 business units and more than 30 industries, has found that individuals who receive regular recognition and praise:

- increase their individual productivity,
- increase engagement among their colleagues,
- are more likely to stay with their organization,
- receive higher loyalty and satisfaction scores from customers,
- have better safety records and fewer accidents on the job.

Of course, there's a flip side. From Gallup's perspective, right now, the majority of workers don't give or receive anywhere near the amount of praise that they should. As a result, they are much less productive, and in many cases completely disengaged in their jobs. According to the US Department of Labor, the number one reason people leave their jobs is because they "do not feel appreciated".

XVII.4. Application to NPP operating organizations

The nuclear power industry cannot afford to have employees actively working against the company's success, particularly as related to nuclear safety. The fact that the above situation exists to the extent indicated should be a warning to NPP operating organization managers both to have means to monitor the extent to which employees are engaged in the organization's goals and objectives and to have in place methods to guard against active disengagement.

XVII.5. Further information

Rath, T., Clifton, D.O., *How Full Is Your Bucket?* (Gallup Press, 2004)www.gallup.com

APPENDIX XVIII. BT KNOWLEDGE PORTAL (3.4)

XVIII.1. Issue/challenge

To increase customer satisfaction in the communications industry through delivering higher quality service while reducing costs through more effective and productive customer service representative interactions.

XVIII.2. Steps taken to resolve the issue

BT Retail is the United Kingdom's largest communications service provider, to residential and business markets. Through its workforce of 50 000 people, BT Retail provides end-to-end communications services for 21 million customers. BT Retail understood that increasing customer satisfaction and enhancing the customer experience was critical to improving overall business performance. Recognizing that customer service is a core competence of the organization, leadership was committed to creating a capability that would deliver higher quality service while reducing costs through more efficient and productive customer service representative (CSR) interaction. BT teamed with Accenture, a consulting company, to help drive BT's vision of a new customer focused strategy. Together, they designed an innovative knowledge management portal — OWL (Optimizing Working Life) — that brought vital product, service and procedural information together into a single structured content architecture and intuitive portal interface. Using OWL, CSRs could readily access accurate information while handling and resolving customer inquiries on the first attempt.

To ensure the success of OWL, the solution has been designed by users for users. Based on interviews, focus groups and ongoing feedback, OWL was iterated and evolved to achieve optimum visibility and impact. This was backed by the design and implementation of a dedicated support organization to ensure that the right people get the right information at the right time. The portal has also been integrated into the company's overall internal communications programmes. In less than five months, BT and Accenture defined, created and rolled out OWL to 5500 call center representatives. It now serves over 8000.

XVIII.3. Benefits experienced

The results were improved customer satisfaction and a 23% increase in CSR confidence. Improved call handling efficiencies have led to a saving of £900 000 in the first year alone and have laid the building blocks for improved compliance and reduced content management costs.

XVIII.4. Application to NPP operating organizations

NPP operating organizations have a strong need for product, service and procedural information to be readily available for their personnel.

XVIII.5. Further information

www.bt.com (customer contact)

www.accenture.com

APPENDIX XIX. TECHNICAL HUMAN PERFORMANCE AND ASSOCIATED TOOLS (3.4, 3.5)

XIX.1. Issue/challenge

Technical human performance consists of the behaviours which effectively use knowledge, skills, training, experience, processes and a healthy questioning attitude in order to identify and manage risks to prevent plant events. Inadequate technical human performance has resulted in station events, failures to resolve plant issues, operational challenges and unnecessary rework. In addition, the significant occurrences due to lapses in technical human performance have led to a loss of confidence and erosion of margin with external stakeholders.

XIX.2. Steps taken to resolve the issue

Exelon Nuclear in the USA has initiated a programme to communicate and educate the organization on technical human performance. There are eight behaviours that demonstrate and support excellent technical human performance. Each manager, supervisor and individual contributor is expected to model the following behaviours during the conduct of work activities:

— Leadership engagement
— Questioning attitude
— Awareness of surroundings
— Challenge
— Passion
— Ownership and accountability
— Valuing the corrective action programme
— Communication.

The technical human performance tools described can be summarized in three categories:

Checks

— Self-verification
— Effective decision-making
— Questioning attitude
— Risk management.

Reviews

— Peer review
— Supplemental review
— Independent review.

Briefs

— Technical task pre- and post-job briefs.

XIX.3. Results/benefits

The results have been a decrease in the number of plant events that resulted from technical errors.

XIX.4. Application to nuclear industry organizations

This is an example of the successful application of a human performance tool to the nuclear industry.

XIX.5. Further information

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APPENDIX XX. ORGANIZATIONAL SPATIAL CONFIGURATION (3.4)

XX.1. Issue/challenge

Much attention has been paid in the fields of organizational development and human performance improvement to the configuration of an organization — who reports to whom and who does what. However, considerably less attention has been paid to the physical locations of the people involved and to the relationships between their workspace locations and their productivity and effectiveness as a team.

XX.2. Steps taken to resolve the issue

In the 30 May 2005 issue of *Business Week*, an article reported on the location of a new BMW automotive plant in Germany in spite of a trend by the competition to locate new plants in eastern Europe, where wage levels tend to be lower. In bucking the trend, BMW is counting on flexible personnel policies and innovative techniques in manufacturing to more than offset the higher labour costs.

One key component of the increased efficiency being designed in as the plant is being built is the location of groups of support staff directly at the centre of the production lines.

XX.3. Results/benefits

To quote the *Business Week* article: "The star-shaped layout, with logistics engineers, quality experts, and administration located at the center, is to speed communications by keeping managers and technicians a few steps from the production line instead of in a separate building." It is only fair to assume that other behavioural and emotional benefits will be derived as further by-products of this innovative special arrangement.

XX.4. Application to nuclear industry organizations

Due to the nature of the operation and maintenance functions of most NPPs````, staff and administrative support offices are typically located in separate buildings that are "healthy" walks away from the plant buildings and, in some cases, even in different geographic locations. Following BMW's example might not be possible unless a new power plant is being built. However, there is usually ample space outside radiological protection areas that could be made available for critical support functions and administration. Even if the construction of additional space were required near the "heart of the NPP", the resulting benefits gained in terms of ownership, communication and teamwork could make the initial investment worthwhile.

XX.5.

— Bavarian Motor Works (BMW) Automobile Group (AG)
http://www.bmw.com/com/en/index_narrowband.html

APPENDIX XXI. FLEXIBLE LEARNING (3.4, 3.5)

XXI.1. Issue/challenge

To provide training on-site with emphasis on satisfying user needs.

XXI.2. Steps taken to address the issue

As part of its business redesign and reorganization, a UK NPP operating organization made a strategic decision to decentralize its training processes, relocating its simulators from central facilities to the NPP sites and transferring classroom-based training delivery to sites in the process. As part of this process the company recognized the opportunity, and the need, to revise training content, and delivery, in a way that reflected individual needs. In order to achieve this, an external consultant with up to date expertise in the design and development of training material for other industries/businesses was employed. After extensive research, both within the organization and in other organizations, a 'flexible learning' approach was adopted whereby the training material was organized into short modular packages which could be combined to form a tailored programmeme, based on pre-assessment of individual needs. Delivery was CBT, audiovisual or paper-based, depending on material content, and was designed to accommodate both individual learning and tutor led delivery as appropriate.

Dedicated 'studybase' facilities were established at each site, and a learning support network was developed which included local training administrators and subject matter experts. Company-wide training material is developed/maintained centrally to ensure quality and consistency, and local training material is developed according to company standards, with a peer review type process established to verify ongoing integrity.

XXI.3. Results

Some of the delivered benefits of the scheme included:

- Substantially improved access to, and timing of, training — available when and where it is needed;
- Training content focused on individual needs, based on pre-assessment;
- Provides an enabling resource for other company initiatives;
- Supports team leaders in their people management role;
- More targeted and tailored training via diagnostic assessment;
- Time off at plant level is reduced;
- Flexible enough to accommodate expansion and development.

Implementation of this flexible learning project was a key enabler in closing central training centres and reducing corporate training staff, making substantial company savings.

XXI.4. Application to NPP operating organizations

This is an example of a human performance tool, flexible learning, being successfully applied to the nuclear industry.

XXI.5. Further information

www.british-energy.com

APPENDIX XXII. E-LEARNING INTEGRATED WITH OTHER LEARNING TYPES (3.4)

XXII.1. Issue/challenges

As part of its growth strategy, Accenture, a global consulting company, is building a network of businesses — consulting, technology, outsourcing, alliances and venture capital. To support this strategy, it needed to operate its learning programmes as it operated its businesses — that is, continuously enhance the quality of programmes and make them more efficient and more relevant to the market's changing demands.

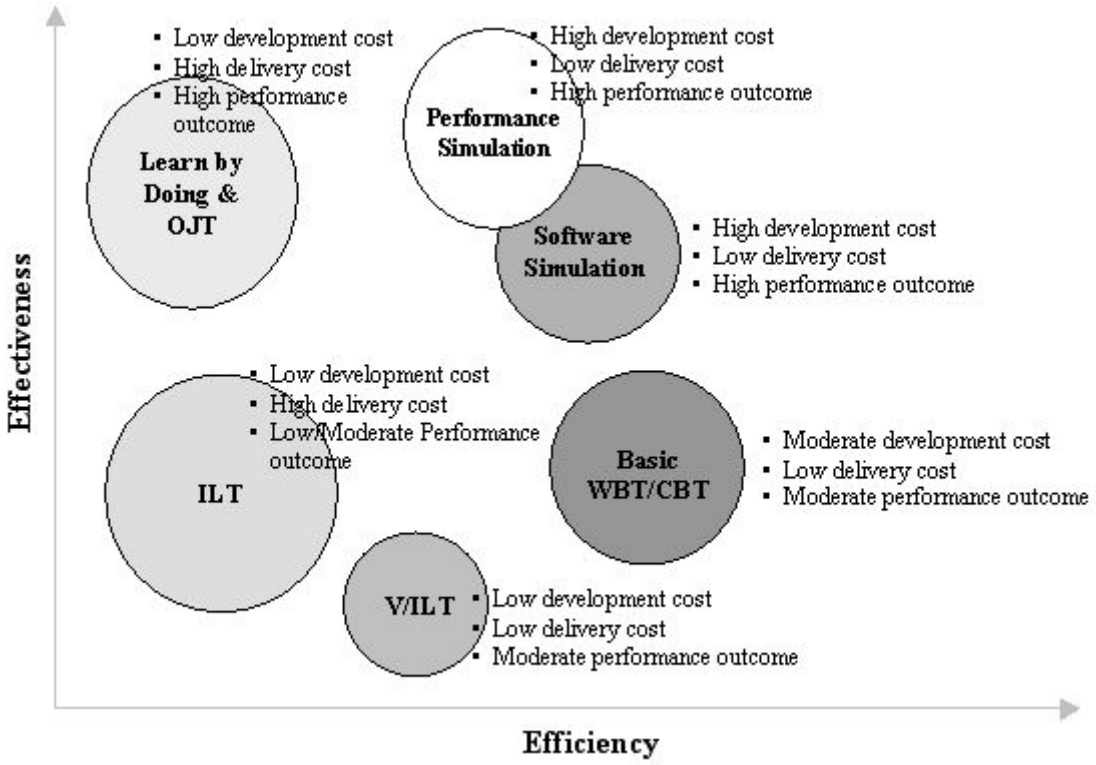
XXII.2. Steps taken to resolve the issue

The following were the principal considerations for this learning system:

- Accenture needed to quickly and effectively revise or create learning programmes and services in advance of market demand.
- Learning could no longer focus on a limited range of static content areas applied to large numbers of people in classroom settings. Rather, employees needed to learn a greater number of dynamic subject areas, and across many distributed businesses and geographies, at their point of need.
- Learning needed to occur at the individual and team levels, to drive performance improvements and a common culture throughout the organization.
- Systems were needed that would allow learners to continuously and easily access a wide range of highly relevant learning assets — especially in areas subject to unpredictable, discontinuous change — at any time, anyplace.
- Reporting mechanisms needed to measure the utilization and effectiveness of the specific learning programmes.

Based upon these considerations, Accenture's eLearning infrastructure comprises three components:

- A customized, docent-based Learning Management System (LMS) that is integrated with its existing course delivery channels and external content providers.
- New e-Learning delivery strategies, including a standardized delivery platform for distance education that allows multiple users to take courses at the same time in different places in an instructor-led environment. In addition, the customized LMS provides self-study courses that allow users to participate in Web-based learning from any location, at any time.
- An intuitive, personalized Web-based learning portal that provides employees with easy and immediate access to live, on-line "virtual classroom" events, as well as traditional classroom courses and computer-based learning assets. Through this portal, users can search the entire spectrum of learning opportunities for relevant courses, receive personalized learning recommendations based on their individual profiles, and provide feedback on specific learning events.



Several options exist in terms of learning solutions to migrate to, each with its individual benefits depicted in Fig. 5. ILT: instructor-led training, V/ILT: virtual ILT, OJT: on-the-job training, WBT/C: Web-based training/curriculum.

XXII.3. Benefits experienced

The eLearning strategy was rolled out to 75 000 Accenture professionals worldwide in June 2001. As of 2003, 7300 learning assets reside on the myLearning course catalogue. Within the first two months of its release, the system reported 177 000 visits. Specifically, more than 20 000 employees have enrolled in 100 000 self-study learning events, and 15 000 have registered for more than 24 000 instructor-led classroom sessions.

XXII.4. Application to NPP operating organizations

The approaches described are not dependent upon technical content, thus they should have general applicability.

XXII.5. Further information

www.accenture.com

APPENDIX XXIII. IMPROVING THE EFFECTIVENESS OF WORK TEAM BRIEFINGS (3.4, 3.5)

XXIII.1. Issue/challenge

Work team briefings with maintenance or operating crews have the potential to significantly improve human performance. However, recent observations of these briefings reveal that in most cases a supervisor reads to the group from either a prepared script or from the employee safety handbook. These briefings are almost always one-way communications, and within only a few minutes it is evident that the workers quickly lose interest. The workers internalize little or no valuable information.

XXIII.2. Steps needed to resolve the issue

To address this weakness, work briefings at one NPP operating organization were modeled from the US Special Forces lessons learned brief. Each day a first line supervisor (FLS) or department manager selects the best practice-briefing topic by reviewing the jobs accomplished that day. The team that completed the job presents their experience to the entire work group. A day in advance, the FLS notifies the selected work team that they need to discuss the job the following morning and answer the following questions. The lead worker of the team briefly addresses (1–3 minutes):

(1) What was the job?
(2) What were the major steps accomplished within the job?

The team then addresses (3–7 minutes):

(1) What went right with the job?
(2) What went wrong with the job?
(3) What did we learn?

The FLS should assist the workers in the presentation of information until the work group is comfortable. The FLS should also encourage open participation and discourage any inappropriate comments.

XXIII.3. Results/benefits

This type of brief allows the entire work group to benefit from the lessons learned from fellow workers. The appropriate issues or associated actions from the lessons should be captured. These briefings will increase the level of task specific knowledge within the entire work group, allow for input from other workers listening to the brief, and allow for lessons to be learned and potential problems corrected before they can occur.

XXIII.4. Application to nuclear industry organizations

Work team briefings are recognized as important contributors to NPP HPI; however, many NPPs have difficulty in making these briefings relevant, informative and effective in knowledge transfer. The approach as discussed above is completely transferable as is.

XXIII.5. Further information

This application is being piloted at the Quad Cities and Peach Bottom NPPs (www.exeloncorp.com/generation/nuclear/)

APPENDIX XXIV. OIL INDUSTRY: SHARED SERVICES (3.4)

XXIV.1. Issue/challenge

Woodside, a major company in the Australian oil market, is organized in five business units, each unit having its own service group providing administration, finance and IT (information technology).

In response to a reduction of operational and administrative costs, in 1998–1999, in a pioneering effort, Woodside teamed with Accenture, a consulting company, to design and deliver a cross-functional Shared Services organization that included finance, information technology, procurement and logistics, office facilities and human resources. The objective of a cross-functional organization was to deliver sustainable cost and service improvements, allowing Woodside's business units to focus on their core activities.

XXIV.2. Steps taken to resolve the issue

To deliver results and service excellence through a Shared Services model did mean a whole new approach and culture for the Shared Services teams. It meant merging the unique cultures of five previously independent support organizations to create one united culture focused on seamless high-quality service delivery. The following five cultural characteristics were identified to help mobilize the Shared Services organization to achieve service excellence:

Caution should be exercised with the following: a number of weak service teams do not necessarily form a strong, efficient central Shared Service centre. It may lead in that case to waste of time and less efficiency. The first step should therefore be to investigate the strong and weak points of the service teams and then bring them together with a team building and correctional programme. The second step would be that these characteristics were brought to life through the execution of a culture assessment and associated culture training and communication programmes.

XXIV.3. Results/benefits

Customers agree that the culture change programme quickly laid the groundwork for a customer-centric culture. If executed correctly, the results are that the Shared Service centre staff is responsive, professional and knowledgeable, saving employees time and allowing them to concentrate on mission critical activities.

XXIV.4. Application to nuclear industry organizations

The concept of Shared Services is certainly applicable to multi-unit sites, or multi-site NPP operating organizations. The merging of organizational cultures through such consolidation would also be relevant for NPP operating organizations.

XXIV.5. Further information

www.woodside.com.au

APPENDIX XXV. KNOWLEDGE SHARING AMONG ORGANIZATIONS (3.4)

XXV.1. Issue/challenge

Knowledge sharing between diverse organizations belonging to a larger company is considered a positive step in achieving higher efficiency, lower costs and higher safety levels.

This principle is highlighted here with the specific example of Thales, an international IT (information technology) company that developed a sophisticated knowledge management capability from 1988 onwards.

Thales is a large international electronics/IT firm with three distinct business units — defence, aerospace and information technology — each of which retains considerable autonomy. The company dedicates nearly a third of its workforce and approximately 20% of its revenues to developing cutting-edge technologies, products and systems. Thales recognized early on that the success of its R&D efforts would require the seamless transfer of knowledge between its defence and civil operations, converting technologies it developed for the defence and aerospace markets into products for the IT sector. Similarly, it regularly took its cost effective IT products and re-injected them back into the defence and aerospace sectors. In this way, the company enjoyed a long history of enabling customers in all sectors to benefit from its global resources and best practices. To achieve optimal benefits, the company established a cross-market entity, Thales Research & Technology, whose mission was to build links between the various units and promote the sharing of best practices. The company further recognized that it needed to install an efficient knowledge management tool to further transform the capabilities of its workforce.

XXV.2. Steps taken to resolve the issue

The company created 13 virtual communities of shared practices — known as Common Efficiency Teams — all over the world. The existence of these groups was an essential prerequisite to implementing a system quickly. Accenture, a consulting company, and Thales surveyed members of the Common Efficiency Teams, as well as a number of field engineers from Thales' different business units, to identify their primary frustrations, their expectations and their knowledge management needs. The team members' main concern centred on finding the information they needed quickly. Thus, the new system needed to centralize data and help Thales' employees find information faster, collaborate within and across teams, and benefit from a personalized interface. To satisfy these goals, Accenture and Thales decided to implement a collaborative, Web-based portal that would serve as a working tool for the Common Efficiency Teams. Innovative features of the new system include the following:

— Users can create temporary workspaces for team projects.
— Researchers can display published material with a single operation.
— The interface is highly intuitive, allowing easier information access and retrieval.
— The team created entirely new processes to support the new role of Knowledge Managers responsible for their subportals.

XXV.3. Results/benefits

The company estimates that the new system allows users to shave 1 hour from the 4–5 hours they typically devoted to searching for information each week. In addition to providing better and faster access to information at the user level, the new system provides the company's

management team with greater visibility into research currently in progress. In the case of major programmes, which require the mobilization of numerous teams over several years, such visibility dramatically improves the executive teams' decision-making capabilities.

XXV.4. Application to nuclear industry organizations

While Thales is quite a different organization from NPP organizations, gains in efficiency and effectiveness similar to those described in this case study could be expected for NPP operating organizations if they had a knowledge management system that provided access to needed information, both internally for sharing among engineering, maintenance, operations, technical support and administrative and financial functions, and with external stakeholders (e.g. suppliers, subcontractors and regulators).

XXV.5. Further information

www.thalesgroup.com

APPENDIX XXVI. TEAM ERRORS/THE ASPECTS OF SOCIAL LOAFING (3.5, 3.6)

XXVI.1. Issue/challenge

The effects of the skills or behaviours of a team are not typically analysed as the result of a problem or event. Team errors can go undetected or even unidentified by the organization.

Many events that occur within the NPP involve more than one individual; however, when analysing the event we focus on the last individual (the pointed end) to touch the switch. There are several influences that can develop within a team based on the team make-up. Werner Naef 's research demonstrates team performance in *Aviation Training*. This case study describes the parallels the nuclear industry can develop from it.

When a configuration control issue exists, more often than not two or more people are involved. There are several factors that influence the work dynamics between people. Several of the influences can be discussed or viewed as "aspects of social loafing". The definition of social loafing is: "When individuals within a group perceive that they can neither receive their fair share of rewards nor appropriate blame, they tend to hold back." Many times we add barriers to our processes to protect or minimize consequence. One of our traditional barriers is a second individual to accompany or assist the first. How could anything possibly go wrong when we've got two people on the job? The influences between team members can be characterized in the examples below, which provide a broader definition of team errors.

- *Pilot/Co-pilot*: An individual does not feel it is his/her place to challenge the actions of the lead worker.
- *Drop your guard*: A worker trusts his partner to do the job correctly, and consequently lowers his/her own guard. The problem is amplified when both workers have high confidence in the other, and both workers lower their guard.
- *Free riding*: Benefiting from the efforts of the other group members while contributing no effort in the performance of the task.
- *Group think*: A mode of thinking that people engage in … when members' striving for unanimity overrides their motivation to realistically appraise alternative courses of action.
- *Risky shift*: A tendency for groups to gamble with decisions more than they would as individuals making decisions on their own.

A proactive approach can be used to minimize any negative influences by team errors. A supervisor can assess the potential for any of these team errors prior to assigning a task. Simply discussing the possible influence of these team dynamics with the workers prior to them performing the task can raise their awareness and in many cases prevent any negative influence. The team itself can critique their performance following a decision to determine if any of these influences were part of their decision.

XXVI.2. Steps taken to resolve the issue

Educate the workforce on the dynamics that can occur between team members that may result in negative consequences.

Reinforce expectations to the workforce through communications and related actions.

Add team errors to the corrective actions and operating experience programmes. For example, as part of a root cause investigation, evaluate if any team errors occurred.

Measure the effectiveness of the changes. Caution: once you educate the organization on team errors, their ability to identify them obviously will increase and a false trend may be identified. Time must be given for the organization to stabilize.

XXVI.3. Results/benifits

NNPs that provide training to workers on team errors and analyse team errors as part of the operating experience programme have realized a reduction in significant team errors.

XXVI.4. Application to NPP operating organizations

The concept of team errors is applicable to all aspects of operation and support within a NPP organization. Team errors can be identified in fieldwork or jobs supporting fieldwork.

XXVI.5. Further information

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Robert Coovert at Exelon Nuclear Main Office Cantera, Robert.Coovert@exeloncorp.com.

APPENDIX XXVII. FAA BLAME-FREE CULTURE: THE AVIATION SAFETY REPORTING SYSTEM (3.5)

XXVII.1. Issue/challenge

The US aviation community and the public have benefited from a historic interagency agreement that was signed in 1976 between the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA). This cooperative agreement was in part a response to an aircraft accident in 1974 that was the result of an ambiguous and misunderstood communication between air traffic control (ATC) and a flight crew. The flight crew descended too soon and hit a mountain in what is called a controlled-flight into-terrain accident. In the accident investigation by the National Transportation Safety Board (NTSB), it was discovered that another airline, six weeks prior to the accident under investigation, had also misunderstood the ATC instruction, begun their descent, and barely missed the mountain. Although that airline had quickly warned its flight crews of the problem, other airlines were not informed. It was "an accident waiting to happen." During this investigation, the aviation industry and the government agreed that the country required a reporting system for near misses.

XXVII.2. Steps taken to resolve the issue

The FAA and NASA established the voluntary, confidential and non-punitive reporting programme entitled the Aviation Safety Reporting System (ASRS). The FAA provided immunity to aviation personnel who agreed to report to NASA under the new programme (FAA, AC 00-46D). Since that time, ASRS has accepted almost 580 000 reports from pilots, air traffic controllers, flight attendants, maintenance technicians and others describing aviation safety events that they experienced or witnessed. ASRS has processed this information and contributed to the improvement of aviation safety throughout the USA and abroad. In aviation, ASRS has been recognized, both domestically and internationally, as a model for collecting unique safety data from frontline personnel. Currently, seven countries besides the USA are operating aviation safety reporting systems modelled after the original ASRS, and many other countries are working to establish systems.

XXVII.3. Results/benefits

The value of confidentiality, contributions to aviation safety and the ability to gather information often not reported through other avenues, was quickly recognized by the United Kingdom and soon after by Canada and Australia. ASRS meets annually with these countries to coordinate and compare information concerning worldwide aviation safety through the International Confidential Aviation Safety Systems (ICASS), a group formed in 1988 that has since been recognized by the International Civil Aviation Organization (ICAO). In the ICAO documents, member countries throughout the world are encouraged to initiate and operate systems similar to those used by ICASS countries. New countries are referred to ICASS for assistance in designing and implementing new systems.

XXVII.4. Application to nuclear industry organizations

The nuclear power industry has a similar need for effective reporting of near misses and has both national systems and international systems for event reporting, operated and maintained by WANO and the IAEA. However, there are likely to be lessons learned through benchmarking the systems and experiences of the two industries.

XXVII.5. Further information

www.asrs.arc.nasa.gov

APPENDIX XXVIII. A COMPANY´S MISSION, VISION AND STRATEGY: THE BALANCED SCORECARD (3.6)

XXVIII.1. Issue/challenge

A standard challenge in organizations that are planning to streamline their organization is the problem of combining the top level mission and vision to the detailed executive map to success.

XXVIII.2. Steps taken to resolve the issue

A proven method to translate a company's mission and vision into a detailed strategy map is a balanced scorecard. A balanced scorecard starts with a conceptual model outlining the factors that drive performance. Next, specific objectives and measures are developed and balanced across financial, customer, internal process, and learning and growth perspectives. Those objectives are then used to drive strategy specific actions across the organization.

The Gallup Organization, a management consulting company, has observed that when companies implement a balanced scorecard approach, four elements are vital — and too often, missing. The article referred to in Section 5 of this appendix discusses these four elements.

XXVIII.3. Results/benefits

According to the Balanced Scorecard Collaborative, no less than 60% of Fortune 500 companies use the balanced scorecard in some form. Some surveys suggest it is working. The Institute of Management Accountants conducts an annual Performance Management Survey among users and non-users of the balanced scorecard approach. The data suggest that users are far more pleased than non-users with the effectiveness of their performance management process — specifically when it comes to their ability to support management's business objectives and initiatives and to communicate strategy to their employees. Still, a word of caution: many companies are not seeing the impact they desire. They try the balanced scorecard approach but do not see the expected returns — or worse, the organization becomes more bureaucratic instead of more focused.

XXVIII.4. Application to nuclear industry organizations

The prevalent use of a balanced scorecard approach in industry suggests that it may also have value for NPP operating organizations, particularly when they are streamlining their organizations.

XXVIII.5. Further information

http://gmj.gallup.com/

See, in particular, the 8 July 2004 edition of the online Gallup Management Journal, *Making the Balanced Scorecard Work (Part 1) — The key elements many companies overlook*, by G.M.J. de Koning.

APPENDIX XXIX. APPRECIATIVE INQUIRY AS A PROCESS IMPROVEMENT TOOL (3.6, 4.0)

XXIX.1. Issue/challenge

By only looking at those things that go wrong in some way, the opportunity is usually forfeited to learn from those things that happen in a manner consistent with — or, often, exceeding — expectations. Since such positive occurrences are typically given little (if any) attention, identifying such positive learning opportunities is often very difficult. In short, taking only a problem oriented approach to process improvement ignores all of the non-problematic behaviour and activities that intra-organizational benchmarking of good practices could produce.

XXIX.2. Steps taken to resolve the issue

In the late 1980s, David Cooperrider was the first to use the terms "appreciative inquiry" (AI) to denote the extrapolation of the best of an organization into a form that could be used to improve performance. Through asking positively oriented questions of employees, the highlights of individual and organizational life were brought to light. Julie Lewis and Darlene Van Tiem explain AI as follows: "AI seeks not to view the causes stemming from a problem or problems affecting performance issues, but to sustain processes and practices that provide optimum productivity on a continuous basis. AI is not a problem-based intervention, though initially it may be used to remedy a gap within an organization. AI is ultimately a culture-based approach that provides a renewed outlook on how to achieve optimal performance within and throughout the entire organization."

AI techniques approach situations by asking questions such as the following:

- What do you really want?
- What did we do right?
- What can we do better?
- What are your expectations?

Lewis and Van Tiem describe the basic AI process as a "four D" cycle that includes:

- Discovery: What takes place when an organization is performing at its best?
- Dream: Based on what has worked well in the past, what might the organization aspire to do in the present and in the future?
- Design: How might strengths be converted to concrete plans to achieve dreams?
- Destiny: The who, what, where and how of converting dreams to actions.

Research has demonstrated that perceived goal attainment can be altered, depending on participants' belief in achieving the goal(s) set forth, and that individuals and/or groups are more prone to attaining goals when feedback is positively versus negatively framed. Through the use of AI, an organization opens itself to new ways of thinking as a business.

XXIX.3. Results/benefits

By changing the focus of an organization from fixing what is wrong to building on accomplishments and processes that work well, AI helps to articulate the potential of the organization at optimal performance. There is empirical evidence that an AI focus produces quantifiable results. Lewis and Van Tiem cite the following company specific examples:

- Wendy's Hamburgers: reduction of management turnover.
- British Broadcasting Company (BBC): improved programmeming and reduced costs.
- British Airways: an exceptional "arrival experience", including one's luggage.

Other areas in which successes were reported included team building, strategic planning, human resources practices and diversity. The reported successful applications of AI transcended organizational types: non-profit, business, medical, religious, public service, higher education and military.

XXIX.4. Application to nuclear industry organizations

Traditionally, the nuclear industry has placed great reliance on the use of tools such as quality assurance audits, root cause analyses, exception reports and other methods that focus on what happened that was not expected — in other words, a negative deviation from procedures or anticipated results. Indeed, it is and will remain imperative that such examinations be conducted in order to determine what changes could be made to prevent recurrence of the abnormalities. However, the AI approach is potentially an excellent complement to these tools in order to also learn from the countless positive experiences that occur on a daily basis in the nuclear field. In addition to potentially improving plant performance, there are parallel possibilities for improving employee pride, ownership, morale, retention and recruitment.

XXIX.5. Further information

- LEWIS, J., VAN TIEM, D., "Appreciative inquiry: A view of a glass half full", Performance Improvement **43** 8 (Sept. 2004).

- Julie Lewis, Dorsey Business Schools, 15755 Northline Road, Southgate, MI 48195, USA; e-mail: jlp8211987@aol.com
- Darlene Van Tiem, PhD, School of Education, University of Michigan – Dearborn, 4901 Evergreen Road, Dearborn, MI, USA; e-mail: dvt@umich.edu.

- Wendy's Hamburgers: http://www.wendys.com/w-6-0.shtml
- BBC: http://www.fact-index.com/b/br/british_broadcasting_corporation.html
- British Airways: http://www.britishairways.com/travel/aboutba/public/en_gb

APPENDIX XXX. EMPLOYEE INVOLVEMENT IN PERFORMANCE IMPROVEMENT MEASURES (3.7, 3.8)

XXX.1. Issue/challenge

It is clear that the person who generally knows most about the causes of problems in a process and how to improve the performance of a process is the person who is closest to it and knows the most about it. However, many organizations are not very good at tapping this very valuable source of information. The Toyota Motor Company has for some time been very effective in learning from its employees how to improve its processes.

XXX.2. Steps taken to resolve the issue

The Toyota Motor Corporation has over 264 000 employees. Recognizing that those employees are closest to and best understand the automobile company's business processes, Toyota instituted extensive input and feedback systems to secure ideas for improvement and innovation from its employees. Other companies, such as Sun Microsystems, have found that weblogs, or blogs as they have come to be called, provide a forum for debate, free association and collecting inputs/results about projects. These blogs are maintained on company servers and are open to the public. More than 1000 of Sun's 32 000 employees blog about their work (most at blogs.sun.com).

XXX.3. Results/benefits

In 2004, Toyota received 540 000 ideas for improvement from its employees (on average, about two ideas per employee). The company was quoted in the 9 May 2005 issue of *Newsweek* as having reported that 90% of those ideas had been implemented. The same article indicated that since 1999 Toyota has completely reconfigured all of its basic production processes — welding, painting and assembly. Its products continue to enjoy quite favourable industry reviews and customer satisfaction rankings. The company's share of the automotive market continues to rise even as its competitors struggle.

XXX.4. Application to nuclear industry organizations

This is a dramatic illustration of how employees can become involved in a business and can help lead it towards continuous improvement (*Kaizen*). Incorporating methods of gaining and acting on employee suggestions and ideas into the day-to-day routines of nuclear facilities could pay significant dividends. One important aspect of the Toyota experience that should be kept in mind by nuclear industry operating organizations is that 90% of the suggestions received were implemented. With such a high implementation rate, it is clear to employees that their suggestions are both listened to and valued, leading to a sustainable causal assessment and improvement process. Too many organizations implement a suggestion programmeme and don't provide feedback to employees regarding actions taken in response to their suggestions. The organizations then wonder why the suggestions dry up after a short time.

XXX.5. Further information

Toyota Motor Corporation at http://www.toyota.com/about/contact/index.html.

For an example of a blog being used for sharing information and knowledge, see: www.blogs.sun.com

APPENDIX XXXI. USING CASE STUDIES TO COMMUNICATE LESSONS LEARNED (3.7, 3.9)

XXXI.1. Issues/challenge

Organizational related events continue to occur at NPPs with consequences that can result in reduced safety, loss of public confidence and high costs to the organization. The challenge is to learn from the events of other organizations in order to identify similar weaknesses and potential causes.

XXXI.2. Steps taken to resolve the issue

Organizations can use the reports from events experienced in other industries as a tool to educate their workers and prevent similarly caused mishaps. In the example below, the NPP can provide an abbreviated report of the event to the students. The students can be asked to read the report and identify the causes and lessons learned. The results of the students can then be compared to the formal findings. The space shuttle Columbia accident investigation is provided as an example.

The Columbia Accident Investigation Board Report of August 2003, Chapter 7, is entitled "The accident's organizational causes". In this chapter the Board identified the following considerations as critical to an explanation of the accident's causes:

- *Commitment to a safety culture*. NASA's safety culture has become reactive, complacent and dominated by unjustified optimism.
- *Ability to operate in both a centralized and decentralized manner*. The ability to operate in a centralized manner when appropriate, and operate in a decentralized manner when appropriate, is the hallmark of a high-reliability organization.
- *Importance of communication*. At every juncture of STS-107 (the last flight of Columbia), the Shuttle Program's structure and processes, and therefore the managers in charge, resisted new information.
- *Avoiding oversimplification*. The Columbia accident is an unfortunate illustration of how NASA's strong cultural bias and its optimistic organizational thinking undermined effective decision-making.
- *Conditioned by success*. Even after it was clear from the launch videos that foam had struck the Orbiter in a manner never before seen, Space Shuttle Program managers were not unduly alarmed. They could not imagine why anyone would want a photo of something that could be fixed after landing.
- *Significance of redundancy.* The Human Flight Space Flight Program has compromised the many redundant processes, checks and balances that should identify and correct small errors.

XXXI.3. Results/benefits

The benefits that can be experienced through the use of case studies can be as significant as preventing similarly caused events or identifying additional barriers to prevent error. Specific to the Columbia case study, "when causal chains are limited to technical flaws and individual failures, the ensuing responses aimed at preventing a similar event in the future are equally limited: the aim to fix the technical problem and replace or retrain the individual responsible. Such corrections lead to a misguided belief that the underlying problem has been solved. The Board did not want to make these errors."

XXXI.4. Application to nuclear industry organizations

All of the organizational considerations identified above can be applicable to NPPs, the regulators and support organizations. For example, the Columbia case study results in many lessons learned for NASA, the Federal Aviation Administration (FAA) and the supporting organizations to NASA.

XXXI.5. Further information

Columbia Accident Investigation Board Report of August 2003 (www.nasa.gov).

APPENDIX XXXII. HPI: FOCUS ON THE ORGANIZATION RATHER THAN THE INDIVIDUAL (3.7, 3.8)

XXXII.1. Issue/challenge

The traditional way in the US Navy to treat human performance problems had been to focus only on the individual, and the usual answer was more training. The assumption was that poor performance was simply a result of poor knowledge or skill that could easily be fixed by sending the sailor back to the schoolhouse. What the US Navy found was that more training historically solves the problem less than 20% of the time. More often than not, a number of different factors contribute to poor performance. These other factors typically include processes, incentives, tools and equipment, human resources and clarity of goals.

XXXII.2. Steps taken to resolve the issue

In September 2003, the US Navy established its Human Performance Center (HPC). The establishment of the HPC was a direct result of a determination that the US Navy was not explicitly managing human performance improvement.

The HPC addresses a performance deficiency by systematically analysing the specific tasks, the individuals involved, the processes and policies governing the activity, and the overarching environment and the organization, to diagnose the entire performance system. The focus is on the performance, not the performer.

HPC personnel are located throughout the Navy's operational, training and acquisition communities. These professionals are the best and brightest that the Navy has to offer in the field of human performance and process improvement.

XXXII.3. Results/benefits

The HPC has only been in existence for a very short time, thus long-term benefits cannot yet be confirmed. However, the HPC currently has over 25 human performance detachments throughout the Navy's operational, training and acquisition communities. HPC has completed more than 20 pilot projects, with teams focusing on areas such as improving weapons handling, flight deck safety and air intercept controller performance, as well as reducing training costs. One of the early results is an increase in teaming to work on projects and address issues. More often than not, these are cross-functional teams aligning themselves across disciplines to improve performance.

XXXII.4. Application to nuclear industry organizations

Both the military and the nuclear power industry have high-reliability organizations where the consequences of errors can potentially be great, and multiple barriers are in place to both reduce errors and mitigate the consequences of errors having significant consequences. Thus, the lessons learned from the military can potentially have direct applicability for the nuclear power industry. Certainly the US Navy's shift in emphasis from training solutions to a broader focus on human performance improvement has potential applicability to the nuclear power industry.

XXXII.5. Further information

The US Navy Human Performance Center (HPC) at http://www.hpc.navy.mil/. The "HPC Spider" at this URL provides access to a variety of human performance related information.

APPENDIX XXXIII. PUNISHING PEOPLE OR LEARNING FROM FAILURE? (3.8)

XXXIII.1. Issue/challenge

Human error can be viewed in two different and almost totally irreconcilable ways: (1) human error as the cause of failure, and (2) human error as a symptom of failure. The first view of human error is the one that the nuclear industry has primarily taken. Its characteristics include the following:

- Human error is the cause of many incidents/accidents.
- The system in which people work is basically safe; the chief threat to safety comes from the inherent unreliability of people.
- Progress on safety can be made by protecting the system from unreliable humans through selection, proceduralization, automation, training and discipline.

The second view of human error is being used in aerospace human factors and has been proposed for overall use in the aviation industry. It has the following characteristics:

- Human error is a symptom of trouble deeper inside the system.
- Safety is not inherent in systems. The systems themselves are contradictions between multiple goals that people must pursue simultaneously. People have to create safety.
- Human error is systematically connected to features of people's tools, tasks and operating environment. Progress on safety comes from understanding and influencing these connections.

The first view of human error generally emphasizes a search for causes (who should be blamed/punished for the error) while the second view emphasizes understanding and describing the mechanisms by which failure succeeds. Said another way, the second view suggests that it is counterproductive to say what people failed to do or should have done, since none of that explains why people did what they did. Much of the information in this case study is taken from work done through a grant from the Swedish Flight Safety Directorate (see the first paper in Section XXXIII.5).

XXXIII.2. Steps taken to resolve the issue

The basic characteristic of the second view of human error is a focus on probing the systematic connections between human error and the engineered environment that people do their work in (a focus on fundamental "fixes" to the system). This is in contrast to the first view that often leads to two results:

(1) an emphasis on human error classification (e.g., inadequate training, non-compliance with procedures) being the product of the causal analysis; and

(2) a bias towards using this information to punish the individuals who made the errors (finding the "bad apple" who was the cause of the incident).

Stopping a causal analysis with these results can be counterproductive in helping to understand why people did what they did, particularly if the result is that people either not report incidents for fear of punishment, or are not open and honest regarding the reasons why they acted as they did. None of this discussion is intended to suggest that people who willfully and knowingly perform malicious acts should not be punished. Rather it suggests that the vast

majority of human errors, whether in the aviation or nuclear industries, are not malicious acts, but rather logical actions that make complete sense when viewed from inside the situation.

The first paper identified in Section XXXIII.5 provides an example of applying the second view of human error to the Valuejet 592 accident involving a crash after take-off from Miami airport because oxygen generators in its hold caught fire. The paper also compares the results of this view with the results obtained from the first view.

XXXIII.3. Results/benefits

The author of the first paper identified in Section XXXIII.5 provides evidence supporting his view that it is counterproductive to say what people failed to do or should have done, since none of that explains *why* people did what they did (classification of errors is not an analysis of errors). The second view of human error has a fundamental premise that safety is something that people, at all levels of an organization, create through their actions. Examples are provided where the entire aviation industry has made changes in the system based upon the second view.

XXXIII.4. Application to nuclear industry organizations

The most visible example in the nuclear industry of the pursuit of causes of system failure is the use of probabilistic safety assessment (PSA). However, PSA primarily builds fault trees and event trees based upon system and equipment functions. Human errors are primarily modelled in a PSA based upon their probability. However, PSAs generally do not consider how or why people's tools, tasks and operating environment would cause them to make these errors. PSAs could, however, be refined to help understand the reasons why errors are made, and to then to use this information to help redesign the system to either prevent the error or mitigate its consequences.

XXXIII.5. Further information

(1) S. DEKKER, Human contribution to accidents: The new view of human error and performance, Journal of Safety Research 33 (2003) 371–385, http://www.hufag.nl/archief/huf03_dekker.pdf.

(2) J. REASON, Human error: models and management, BMJ 320 (2000) 768–770 (available at www.bmj.com).

APPENDIX XXXIV. GALLUP: 12 QUESTIONS TO DETERMINE WORKER ENGAGEMENT (4.0)

XXXIV.1. Issue/challenge

As a tool to support industry and business generally, the Gallup Organization, a management consulting company, wanted to develop a method for identifying the elements of worker engagement.

XXXIV.2. Steps taken to resolve the issue

Gallup conducted hundreds of focus groups and many thousands of worker interviews in all kinds of organizations, at all levels, in most industries and in many countries. From these inquiries researchers pinpointed, out of hundreds of variables, 12 key employee expectations that, when satisfied, form the foundation of strong feelings of engagement. The result was a 12-question survey in which employees are asked to rate their response to each question on a scale of one to five.

- Do you know what is expected of you at work?
- Do you have the materials and equipment you need to do your work right?
- At work, do you have the opportunity to do what you do best every day?
- In the last seven days, have you received recognition or praise for doing good work?
- Does your supervisor, or someone at work, seem to care about you as a person?
- Is there someone at work who encourages your development?
- At work, do your opinions seem to count?
- Does the mission/purpose of your company make you feel your job is important?
- Are your associates (fellow employees) committed to doing quality work?
- Do you have a best friend at work?
- In the last six months, has someone at work talked to you about your progress?
- In the last year, have you had opportunities at work to learn and grow?

XXXIV.3. Results/benefits

Results have shown a strong link between high survey scores and worker performance.

XXXIV.4. Application to nuclear industry organizations

All of the questions identified above have applicability for NPP operating organizations.

XXXIV.5. Further information

http://gmj.gallup.com/content/

APPENDIX XXXV. FINANCIAL INTEGRITY AND RISK MANAGEMENT INITIATIVE (5.0)

XXXV.1. Issue/challenge

A new era of regulated fiduciary responsibility has begun, with profound implications for CFOs and CEOs. This is, at least partially, in response to highly publicized corporate fraud cases in companies such as Enron, WorldCom and Parmalat. CEOs and CFOs, in a substantial way, must now stand up and be personally accountable for the actions of their subordinates, as well as for their own. Thus, financial regulators and business advisors are now calling for companies to implement much stronger "bottom up" control systems that ensure accuracy and integrity.

XXXV.2. Steps taken to resolve the issue

First of all, it is recognized that not all financial missteps that can bring regulatory scrutiny in this "hair trigger" environment are motivated by unethical behaviour. Indeed, most are likely to be simple mistakes reflecting a lack of employee awareness of evolving legislation, errors in judgment in applying accepted business practices, or misunderstandings of how decisions made in one part of the organization affect the overall business. Professional staffs — business and financial — in most large companies today, while very competent in their functional specialties, often lack a sound end-to-end view of how shareholder value is created. Management must ensure that all decision-makers see the broader business perspective and take a real interest in how value is created and accounted for properly. One solution to these problems has been to develop a training regime, called Financial Integrity and Risk Management (FIRM), that leverages performance simulation technology to deliver "hands-on" experience in simulated business scenarios to improve the knowledge, decision-making skills and confidence of staffs involved in finance and accounting activities.

XXXV.3. Results/benefits

The FIRM programme focuses on four key elements — policies, practices, people and programmes — to ensure a company's workforce is ready to play by the new rules. Benefits have included:

- Improving productivity of the finance and accounting function, including their shared services organizations ("be able to run a company double its present size with the same F&A headcount while reducing risk"*).
- Becoming "champions of change"*, not viewed as being obstacles to progress.
- Becoming better business partners with their peers in other functions ("become engines of productivity, not just gauges measuring it"*).
- Keeping their staffs current with the rapid pace of change caused by product proliferation, diversity and globalization.
- Enabling their accounting staffs to gain "hands-on" simulated experience not otherwise available in a world of highly automated information systems.
- Ensuring the overall integrity of its accounting and financial reporting.

* Quotes from CEOs.

XXXV.4. Application to nuclear industry organizations

This overall approach should be directly applicable. If the simulated experiences included realistic situations addressing nuclear safety considerations, they could be even more valuable in ensuring coherence between safety and financial decisions.

XXXV.5. Further information

www.accenture.com

APPENDIX XXXVI. 10 STRATEGIES FOR SUCCESSFUL KNOWLEDGE SHARING (5.0)

XXXVI.1. Issues/challenge

The management of knowledge within a large organization can be very difficult. Silos can develop between work groups, and "clay layers" can develop between levels in the organization that can impede communication and the transfer of knowledge.

XXXVI.2. Steps taken to resolve the issue

The Ford Motor Company has demonstrated multiple successes in the area of knowledge sharing. The initial steps taken are to develop the following strategies, which have formed the foundation for their success:

(1) Culture of knowledge sharing must exist.
(2) System must have automatic feedback.
(3) Hi-tech only works if there is also hi-touch.
(4) Provide peer recognition of people who share knowledge.
(5) The system must be available to the grass-roots level.
(6) Senior leadership sponsorship is necessary, but not sufficient.
(7) The system must be able to capture the value of the practice.
(8) If you build it they will not come. Push the knowledge to users.
(9) Establish a process for filtering out trivial, low value practices.
(10) Tell stories, with sufficient details.

The following is the history of Ford Motor Company's Best Practice Replication (BPR) approach:

- June 1995: Informal process of faxing practices amongst vehicle operations.
- June 1996: Launched BPR across vehicle operations — 53 plants globally.
- February 2000: Derivative of process for Health and Safety for communicating concerns and incidents. Developed and launched BPR version 2.0.
- December 2000: Derivative of the process for Environmental application.
- February 2001: Adapted process for replicating key findings of 6-sigma projects.

During this time frame, Ford launched 53 Communities of Practice, in areas as diverse as: Product Development, Ford Land, HR, Quality, Service, Finance, MP&L, Ford Production System, Recruiting, Plant IT, Paint, Final Area, Body, Machining, Facilities Engineering, and Engine Design.

XXXVI.3. Results/benefits

2800+ active high value practices have resulted in:

- $1.5+ billion of identified value;
- $1 billion of actual value added to the company.

Health and Safety and Environmental derivates of the process proactively distribute information about incidents and corrective actions.

XXXVI.4. Application to NPP operating organizations

The ten strategies identified by Ford have direct relevance to NPP operating organizations. Extensive detail is associated with each strategy, which should be acquired and associated lessons understood prior to implementing a similar strategy.

XXXVI.5. Further information

www.ford.com

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Sanjay Swarup (sswarup@ford.com), Specialist: Process Reengineering & Knowledge Management

Robyn Valade (rvalade@ford.com), Best Practice Integration Manager

APPENDIX XXXVII. COMMUNITIES OF PRACTICE (5.0)

XXXVII.1. Issue or challenge

To increase the overall capacity of the organization to share knowledge and consequently to become more responsive, innovative and productive.

XXXVII.2. Steps taken to resolve the issue

In the face of ever-growing pressures for improved performance and enhanced shareholder value, many executives instinctively try to exert more and more control over the organizations they lead. This reaction may not only be ineffective, it may also be counterproductive. Indeed, many successful companies are finding that *relinquishing* some control — specifically by creating the conditions that enable employees to self-organize in virtual communities — is an effective strategy for responding to market pressures. These informal communities — commonly referred to as "communities of practice" or "communities of interest" — are steadily proliferating in the workplace today. The characteristics of organizations in which communities of practice thrive include the following:

- A strong vision,
- Entrepreneurial drive and empowered employees,
- A strong cultural identity,
- Constructive conflict,
- Results orientation,
- Visible trust,
- Continuous learning environment.

Organizations that create an environment that supports their formation are gaining significant benefits in the areas of knowledge transfer, response times and innovation — not a bad return for executives who know when and how to loosen the reins. Companies such as Chevron, Royal Dutch/Shell, Oracle and National Semiconductor have witnessed impressive results, from shortened cycle times to drastically reduced operation costs. Unlike many initiatives, however, virtual communities cannot be mandated into action if they are to be effective.

In simple terms, communities of practice are groups of people working together outside conventional organizational structures but "informally bound together by shared expertise and passion for a joint enterprise". When linked electronically into collaborative knowledge networks (CKNs), these communities enable rapid knowledge sharing that accelerates many important business processes: they can help companies rapidly respond to new and changing customer needs, improve supply chain efficiency, streamline product development processes and facilitate a wide range of special projects. Taking advantage of connectivity throughout the extended enterprise, CKNs make it possible for people and communities to collaborate freely across geographical and organizational boundaries. What's more, CKNs have the potential to drive key processes faster and more effectively than traditional structures. Centralized deployment/control does not work with virtual communities. In their most powerful form, these communities are self-organized and organic in their nature. They evolve as needs and opportunities arise. They are also non-hierarchical; members earn their right to participate by bringing relevant expertise and knowledge to bear.

The key to successful collaboration and knowledge transfer lies not in technology, but in allowing people to build social networks connected by technology. Network building is relationship building… you really cannot build relationships through a Web site alone.

XXXVII.3. Results/benefits

By linking 13 communities of practice, encompassing more than 10 000 users, Shell's Exploration and Production business estimates that it has seen benefits of at least $200 million per year from community-driven knowledge sharing initiatives.

XXXVII.4. Application to the nuclear industry

The value of promoting communities of practice is directly applicable to the nuclear industry in a wide variety of discipline areas (e.g. engineering, maintenance, project management). The possibility of having communities of practice across disciplines could also be considered where there are significant interactions and interdependences (e.g. between engineering and maintenance).

XXXVII.5. Further information

www.deloitte.com

Deloitte research report: Collaborative Knowledge Networks: Driving Workforce Performance Through Web-enabled Communities, 2001.

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Consultants Meetings

Vienna, Austria: 10–13 May 2004

Technical Meeting

Vienna, Austria: 6–9 December 2004