HEALTH PHYSICS SELF-ASSESSMENT AND THE NUCLEAR REGULATORY OVERSIGHT PROCESS AT A NUCLEAR POWER PLANT

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Abstract:
The U.S. Nuclear Regulatory Commission has developed improvements in their Nuclear Power Plant inspection, assessment and enforcement practices. The objective of these changes was to link regulatory action with power plant performance through a risk- informed process which is intended to enhance objectivity. One of the Strategic Performance Areas of focus by the U.S. NRC is radiation safety. Two cornerstones, Occupational Radiation Safety and Public Radiation Safety, make up this area. These cornerstones are being evaluated through U.S. NRC Performance Indicators (PI) and baseline site inspections.

Key to the U.S. NRC's oversight program is the ability of the licensee to implement a self-assessment program which proactively identifies potential problems and develops improvements to enhance management's effectiveness. The Health Physics Self-Assessment Program at San Onofre Nuclear Generating Station (SONGS) identifies radiation protection-related weakness or negative trends. The intended end result is improved performance through rapid problem identification, timely evaluation, corrective action and follow-up effectiveness reviews.

A review of the radiation protection oversight process and the SONGS Health Physics Self-Assessment Program will be presented. Lessons learned and management tools, which evaluate workforce and Health Physics (HP) staff performance to improve radiological practices, are discussed.

U.S. Nuclear Regulatory Oversight Program Background:

The U.S. NRC has developed a more objective process for assessing a Nuclear Power Plant licensee's regulatory and safety performance (NEI, March 2000). This new process uses a risk-informed work process and focuses on three Strategic Performance Areas:

-Reactor Safety
-Radiation Safety
-Safeguards

Seven cornerstones were identified by the NRC to capture these three strategic areas for which Performance Indicators (PIs) were established to monitor and assess a licensee's performance, Figure 1. U.S. NRC inspection modules are used to supplement the performance indicators. The overall mission of the U.S. NRC in the implementation of these PIs is based upon protecting the health and safety of the public and occupational radiation workers.

Radiation Safety Cornerstone and Performance Indicators:

The Radiation Safety Cornerstones are broken down into two areas: Occupational Radiation Safety and Public Radiation Exposure. Performance Indicators were established for each of these areas. The Performance Indicators were selected based upon their ability to provide an objective measure and be readily identifiable based on industry experience. The dose criteria employed does not represent levels of dose that are risk significant and represent criteria generally at or below U.S. NRC regulations. These PIs seek to protect the health and safety of workers involved with exposure from licensed and unlicensed radioactive materials during routine operations at nuclear power plants, Figure 2.

The Occupational Radiation Safety performance indicators are:

-Technical specification high radiation area (>0.01 Sv/hr, >1 Rem/hr) occurrences
-Very high radiation area occurrences
-Unintended exposure occurrences

The Performance Indicator is determined by summing the reported number of occurrences for each of the three above indicators over the previous four quarters for:
-a loss of radiological control over access or work activities within a high radiation area (>0.01 Sv per hour at 30 cm, >1 Rem/hr at 30 cm) or very high radiation area (>5 grays, in one hour at one meter, >500 Rads in one hour at one meter), or;
-a degradation or failure of one or more safety barriers which results in an unintended

occupational exposure equal to or exceeding:

-0.001 Sv, (100 mrem) TEDE
-0.05 Sv, 5 rem CEDE
-0.015 Sv, (1.5 rem) LDE
-0.05 Sv, (5 rem) SDE
-0.001 Sv, (100 mrem) minors or declared pregnant worker
-0.50 Sv, (50 rem) SDE from a discrete radioactive particle

The U.S. NRC's decision to move to a risk-informed regulatory program was in part driven by the U. S. nuclear power industry's maturation. The marked improvements in the nuclear industry's safety and reliability caused the U.S. NRC Commission to re-evaluate their inspection programs and the licensee's role to assess themselves.

SONGS Self-Assessment Program:
Self-Assessment has been a normal way of doing business at SONGS for a long time.

It was very centralized with the Nuclear Oversight Division (Quality Assurance, Internal Safety Evaluation Group) performing assessments and evaluations of other divisions.
Today, Self-Assessment at SONGS is driven by line management. The site has established Division Self-Assessment Leaders, a Self-Assessment Forum and a Self-Assessment Steering Committee, Figure 3 (SONGS, November 1998).

Divisional Self-Assessment leads focuses on internal performance and engage staff to participate in the program. The lead individuals apply common station self-assessment procedures and guidelines. They oversee the implementation and effectiveness of self-assessment activities within their division and participate in the station's Self-Assessment (SA) Forum.

The SONGS' SA forum mission is to lead, coordinate and promote a consistent station Self-Assessment approach. The forum consists of SA leads from each division. The Vice-President of Nuclear Generation is the Executive Sponsor. The forum meets quarterly and reviews, proposes or discusses Self-Assessment activities. The SONGS VP has challenged the Forum to engage employees, focus on results and become an industry leader. The Forum also takes direction from the station Self-Assessment Steering Committee.

The SA Steering Committee consists of senior managers who assess the overall effectiveness of the self-assessment activities and identify targets for improvement.

Health Physics Self-Assessment Program:
The Health Physics Department Self-Assessment Program (HPD SA) complies with the Station SA elements outlined in Figure 4. It employs several unique work practices to assess Health Physics and radiation worker performance. As Figure 4 indicates, the station program consists of Planning, Implementation/Evaluation and Reporting.

HP Self-Assessment Planning:
The Health Physics Department Self-Assessment Planning (HPD SA) includes the scheduling of directed or focused assessments. Health Physics management reviews self-assessment identified problem areas. Work is scheduled collectively and HP management determines topics and team members to conduct self assessments (audits) a year in advance. The HPD typically conducts four focused assessments annually.

Many of the HP employee training topics are selected based on SA identified performance issues. Each quarter, the HPD teams with the station Training Department and conducts operating or industry experience training where off-normal radiological events are discussed and examined for applicability at SONGS. These industry events are distributed by INPO via their INPO web page and the new ISOE Level 3 database.

Divisional annunciator panels with associated metrics are established to monitor fundamental work practices. These annunciators permit management to evaluate divisional performance against prescribed metrics for key Health Physics work activities.

Several approaches are employed to engage employees in SA activities. A Self-Assessment team composed of union and management employees meets approximately three times a quarter to review performance results and recommend actions to improve performance. Team members rotate on an approximately 18-month basis. The team is responsible for communicating performance results and actions to HP staff as well. These quarterly communications are conducted in a face-to-face manner during shift turnovers or management staff meetings by a union HP employee presents the SA report. An HPD web site is used to complement these HP SA presentations.

Station management encourages employees to participate in self-assessment by identifying and reporting problem areas or off-normal events. Employee's report such events in an electronic-based "action request" computer based system. The HPD initiates about 400 action requests per quarter.

HP management expectations are communicated in Divisional Performance Standards. Thirty-two HP standards have been prepared which capture divisional business practices. These standards are controlled and electronically available on the HP web site. These standards inform employees of their responsibilities beyond procedural or regulatory requirements. In this manner, management is positioned to hold employees accountable for their performance. Examples of performance standard subject matter includes: Health Physics posting, container labeling, reactor mode change radiological checklists, industrial safety and tailboard conduct. The HP SA program is responsible for the standard development and content.

HPD Self-Assessment Implementation and Evaluation:
HP SA program implementation and evaluation consists of Employee Leadership Observations, Cause Evaluations, Precursor Trending, Focused Assessments, Industry Experience Reviews and Benchmarking, and External Assessment Reviews.

Employee Leadership Observations:
HP management and voluntary union employees conduct monthly Leadership Observations (LOs). These observations call for employees to perform walkdowns in designated areas of the plant observing work and area conditions. Pre-established LO questions are answered by employees and submitted as an "action request". Leadership observations correct problems in the field, reinforce good worker practices, and serve as a trending mechanism to identify precursor problems. The Health Physics Department completes approximately 150 leadership observations a quarter.

Cause Evaluations:
Significant radiological events are investigated and evaluated for cause. Station procedures establish threshold criteria and requirements for the conduct of such an evaluation. Cause evaluations and corrective actions are captured in the "action request" system and discussed with Health Physics management leads. Significant results are captured as required reading on the HP web page. The Health Physics Deparment conducts approximately 5-10 cause evaluations per quarter.

Focused Assessments:
The Health Physics Department conducts approximately four radiological-focused assessments per year. These assessments are performed in accordance with station guidelines and documented in the "action request" system. Past assessment topics have included:

-radiation worker readiness for refueling outages
-Health Physics employee training effectiveness
-Health Physics employee qualification manual work process
-receipt of radioactive materials work process

Additionally, the Health Physics Department participates in a U.S. NRC Region IV "round robin" industry peer radiation protection focused assessment of utilities. San Onofre Nuclear Generating Station's (SONGS) Health Physics Department hosted an industry peer focused assessment in which an eight-member team (five industry peers) evaluated the station's radiation protection work practices and performance. Results were informative and recommendations were presented to the SONGS Vice-President and site managers.

Industry Experience:
The HPD evaluates radiological industry events (Operating Experiences) routinely. Industry events are evaluated for applicability and corrective actions taken as necessary to minimize the likelihood of a similar occurrence at San Onofre Nuclear Generating Station. Significant events are communicated to employees as "required reading" on the HP web site. Some events are discussed in the quarterly Industry Experience training conducted by HP SA and the training division. Events are documented on the HP web site and used as lessons learned for radiological work planning and discussed in tailboards with site employees. The division evaluates approximately 10 industry events per quarter.

External Assessment Reviews:
External radiation protection assessments such as audits or inspections from Nuclear Oversight (QA), the Nuclear Regulatory Commission, Institute of Nuclear Power (INPO), National Voluntary Laboratory Accreditation Program (NVLAP) or World Association of Nuclear Operations (WANO) are included in the Self Assessment program.

Trending Precursor Events:
All of the above self-assessment activities are trended by the division using the "action request" (AR) system. Low level events which do not fall into the above categories are captured as simple trend "action requests" and collectively evaluated. Evaluations which identify commonalties or are viewed as continuing problem areas are investigated in further detail. The division initiates about 50 trend Action Requests per quarter.

Quarterly Assessment and Reporting:
The HP SA team meets quarterly to review trends and assess divisional performance. Commonalties or significant precursor events are identified and recommendations made for further action. The radiation protection manager documents the HP SA team and recommendations and submits a quarterly report to the station Vice-President. As mentioned previously, the HP SA team communicates performance results and actions to staff members.

Health Physics Assessment of NRC Performance Indicators:
An assessment of the Occupational Radiation Safety Cornerstone was completed by a Health Physics team. The assessment's objectives were to review programmatic controls and employee work practices/behaviors associated with the radiological PIs to minimize the likelihood of occurrence at SONGS. The team examined employee training, HP procedures, work planning, industry events, HP standards and jobsite work practices. Several enhancements were identified by the assessment and will further reduce the station's likelihood of a PI related infraction. Below are some of the actions taken by the PI assessment team.

High Radiation Key Controls:

-management expectations were clarified in a new key control HP standard
-capture key locks were installed for Tech Spec (>(0.01 Sv)/(1R) hr) areas
-electronic HRA key inventories were developed vs. hard copy inventories
-key tags identifying multiple HRAs controlled by one HRA key were instituted

High Radiation Area Controls:

-shiftly walkdowns of Tech Spec HRAs (>(0.01 Sv)/(<1R/hr) areas were required
-electronic HRA inventories were developed vs. hard copy inventory
-operator instructions were clarified for multiple entries into HRAs

Unintended Exposure Controls:

-revised work planning radiological risk assessments
-included internal dose estimates for workers in TEDE ALARA evaluations
(i.e., in addition to collective dose estimates required by 10CFR20)
-included High Noise Areas evaluations in HRA job planning
-routinely evaluated worker accumulated dose vs. anticipated dose
-developed performance standards and mock-up training for HP employees using SONGS remote radiation monitoring system
-emphasized PI controls in HP contractor training

The division also implemented a practice of identifying radiological PI precursor events and evaluating them for lessons learned. Figure 5 shows the San Onofre Nuclear Generating Station's Occupational Radiation Safety Cornerstone Performance Indicator profile for the past several quarters. Note the station has been in the upper band continuously, however this doesn't reflect precursor events or "close calls" which can inform management of degrading controls or human behaviors. Figure 5 shows precursor events which are associated with PI HP work practices. Although the pre-cursor events do not represent PI occurrences, they are helpful in assessing program controls. The table depicts off-normal events which the HPD has evaluated and taken additional action as warranted. The events on this table were generally attributed to HRA access control problems for areas < (0.01 Sv)/1R/hr but >(0.001 Sv)/100 mr/hr. The insights gained from evaluating these PI precursor events have benefited management's proactive decision making process.

Results:

Several positive actions have been taken as a result of self-assessment activities. The radioactive material control program was strengthened by reconfiguring the containment equipment hatch controlled area during refuelings, implementing RCA tool control program changes and more stringent employee accountability measures. RCA access control measures were enhanced by installing an electronic dosimeter activated turnstile at the HP control points. Focused assessments drew the division's attention to improve the station's ALARA communications by conducting routine ALARA reports and ALARA briefings to better inform station management and employees of their dose minimization performance. Industry events are reviewed routinely for lessons learned during job planning and quarterly industry events training promotes employee discussion of the industry problems applicable at San Onofre Nuclear Generating Station.

The most recent WANO/INPO SONGS evaluation recognized the Health Physics Department self-assessment program for "effective assessment of Health Physics related activities to detect indications of declining performance." (INPO, August 2000).

Benefits of Self-Assessment:

The benefits of a successful SA program are manifold and include the following:

-increased safety margin
-increased regulatory confidence
-improved performance
-improved position in a competitive marketplace

Regulatory confidence in a nuclear power plant licensee is essential. A successful self-assessment program will generate regulator confidence by implementing the elements of a program such as those described above. The U.S. NRC doesn't have the resources to perform assessments as the licensee nor do they have the station experiences or knowledge base of the licensee. Licensees who demonstrate sound self-assessment programs will likely receive credit from the U.S. NRC in the form of fewer inspections, favorable enforcement discretion, recognition of a healthy nuclear safety culture and the safe/consistent operations of the plant (Zimmerman, R. P., December 1998).

The U.S. NRC evaluates self-assessment programs using several Inspection Procedures. IP 40501 – Licensee Self-Assessments Related to Team Inspections calls for the U.S. NRC to examine the licensee's capability to manage self-assessment and to conduct technically creditable self-assessments. IP 40500 – Effectiveness of Licensee Process to Identify, Resolve and Prevent Problems calls for the U.S. NRC to examine the licensee's corrective action program, root cause analysis, self-assessments and operating experience feedback (Johnson, J. R., September 2000).

Self-Assessment is a good business practice in that it requires management to establish business expectations. These business expectations are captured as standards of conduct for which performance metrics are established and monitored. Self-assessment also requires management to be proactive by identifying and resolving precursors to prevent significant problems from occurring. In this manner self-assessment protects the company's investment. Lastly, self-assessment programs improve employee morale and accountability through their participation/contribution in the self-assessment process, recognition of management's responsiveness to employee observations and the positive results attributed to an active self-assessment program.

Future Self-Assessment Challenges:
The nuclear power industry will continue to change. Successful organizations will be led by continuously improving Self-Assessment programs. Self-Assessment Programs should focus on three key elements to promote continuous improvement (Krieger, R. W., September 2000).

The first is emphasizing ongoing assessments by employees and management who continuously engage themselves in assessing human behavior and work process. The goal is to ensure employees are receptive to identifying and resolving problem areas; ensure management's expectations are understood; routinely review and apply lessons learned from operating experiences; and implement a structured management/employee coaching and observation program.

The second is to further develop pre-emptive (forward-looking) indicators that use predictive rather than reactive approaches to assess performance. Typical station indicator or annunciator panels react to historical problems (rear view mirror approach) instead of anticipating or predicting problems.

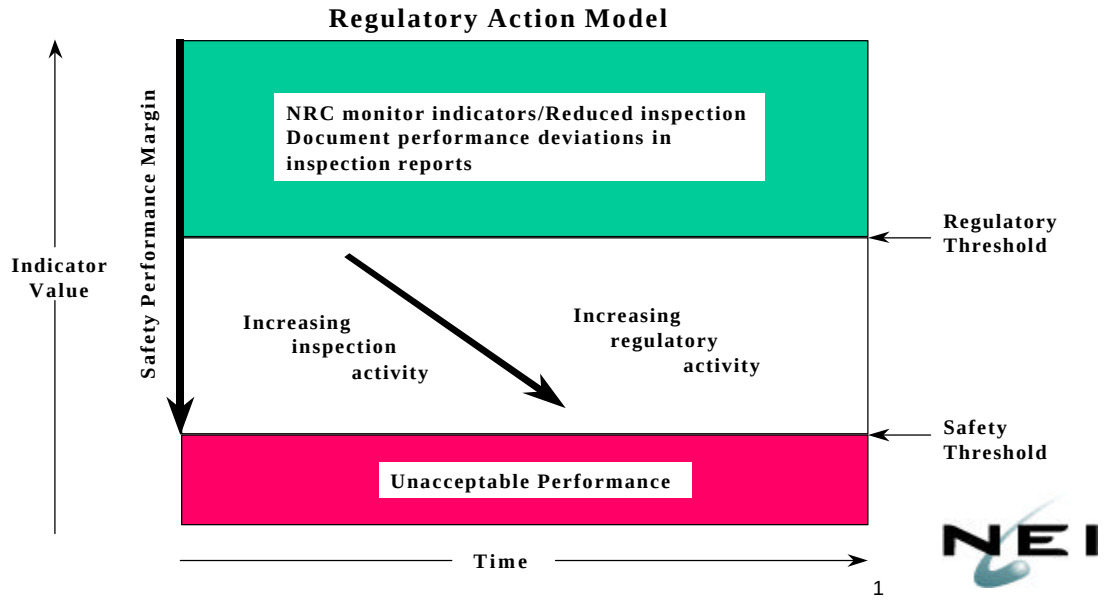
The third is to routinely evaluate self-assessment program effectiveness and adjust program content as necessary. INPO has identified that reviews of self-assessment program effectiveness were weak. Better tools to evaluate program effectiveness and the value added need to be developed (INPO, December 1999).

References:

1. Institute of Nuclear Power Operations (INPO), WANO Peer Review, San Onofre Nuclear Generating Station, August 2000.
2. Institute of Nuclear Power (INPO), Principles for Effective Self-Assessment and Corrective Action Programs, December 1999.
3. Johnson, J. R., Associate Director for Inspections and Program, Office of Nuclear Reactor Regulation; Self-Assessments; ANS Workshop on Self-Assessment, September 2000.
4. Krieger, R. W., Vice President, San Onofre Nuclear Generating Station; The Value of Self-Assessment; ANS Workshop on Self-Assessment, September 2000.
5. Nuclear Energy Institute (NEI), Regulatory Assessment Performance Indicator Guideline, NEI 99-02, Rev. 0, March 2000.
6. San Onofre Nuclear Generating Station; Self-Assessment Program, Revision 1, November 1998.
7. Zimmerman, R. P., Deputy Director, Office of Nuclear Reactor Regulation; "Self-Assessment" Not a Program – A Way of Life; ANS Self-Assessment Executive Conference, December 1998.

A NEW REGULATORY OVERSIGHT PROCESS

Risk-Informed, Performance Based Assessment, Inspection and Enforcement



CORNERSTONE CHART

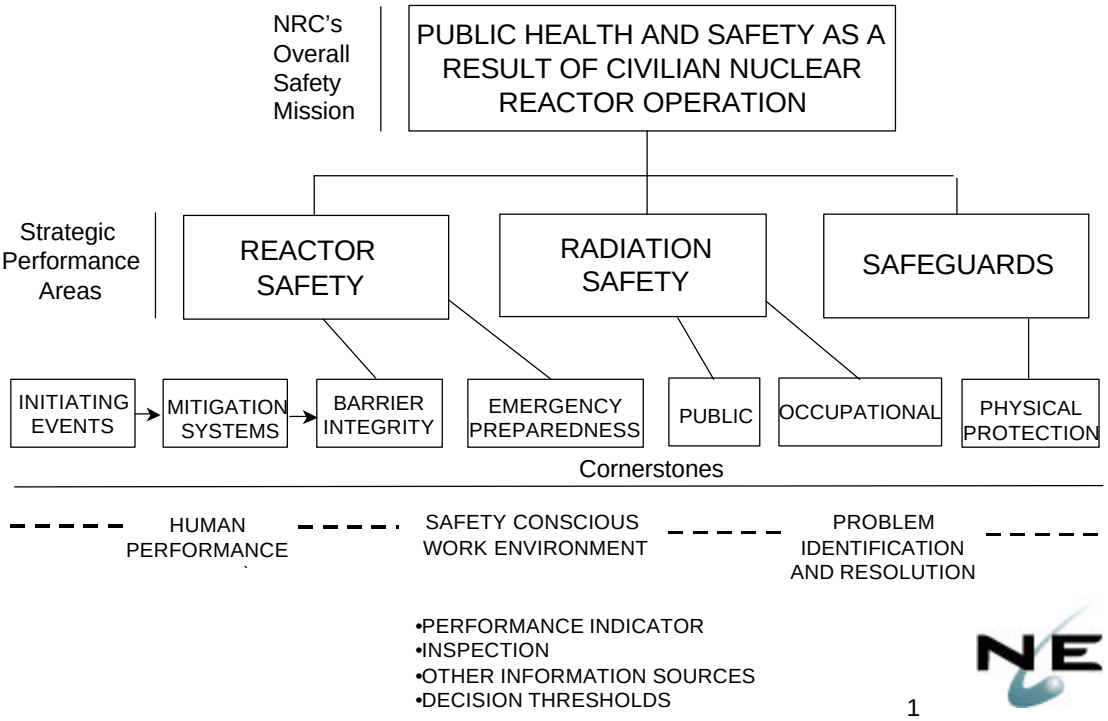


Figure 1. NRC Regulatory Oversight Framework

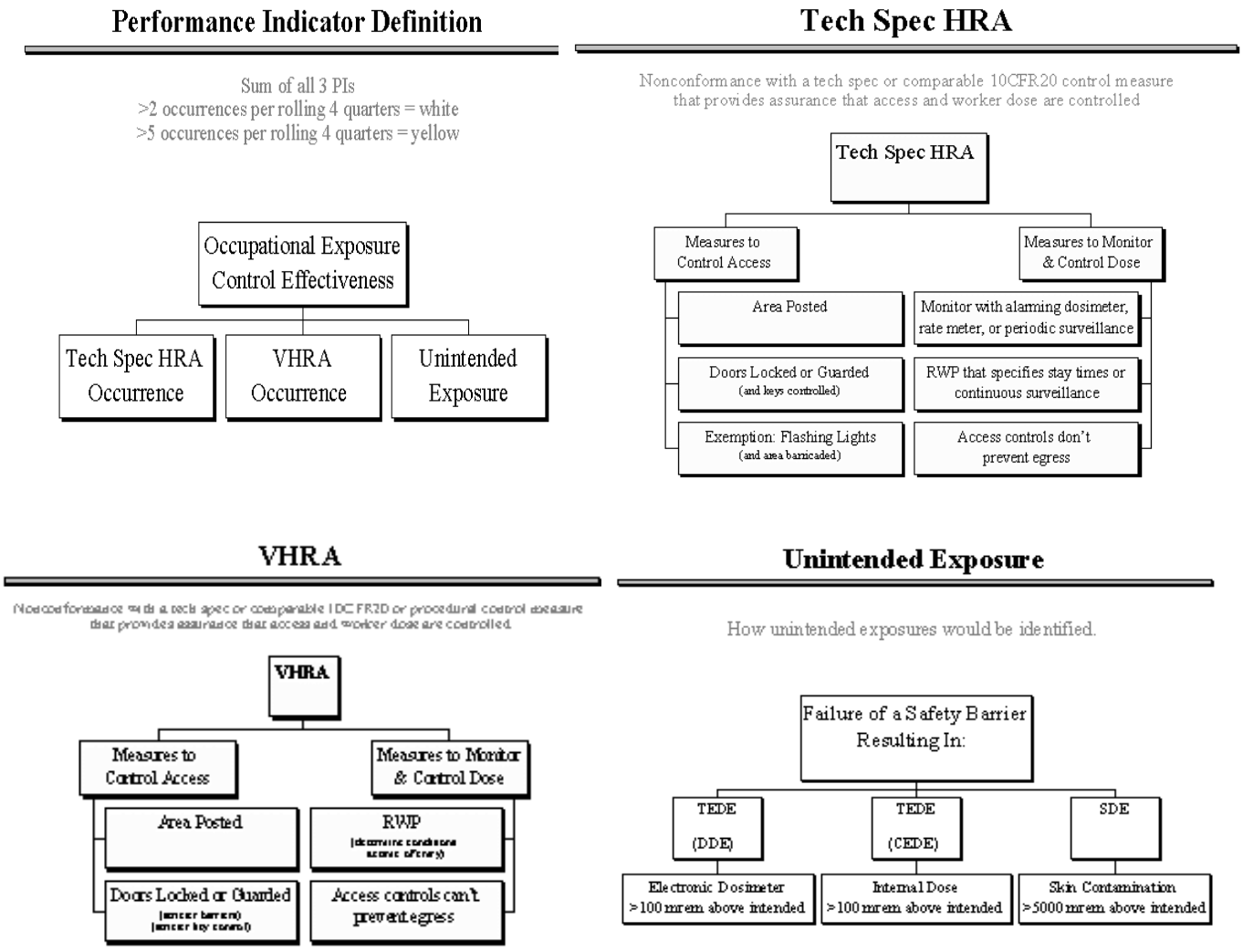


Figure 2. Occupational Radiation Safety Cornerstones and Performance Indicators

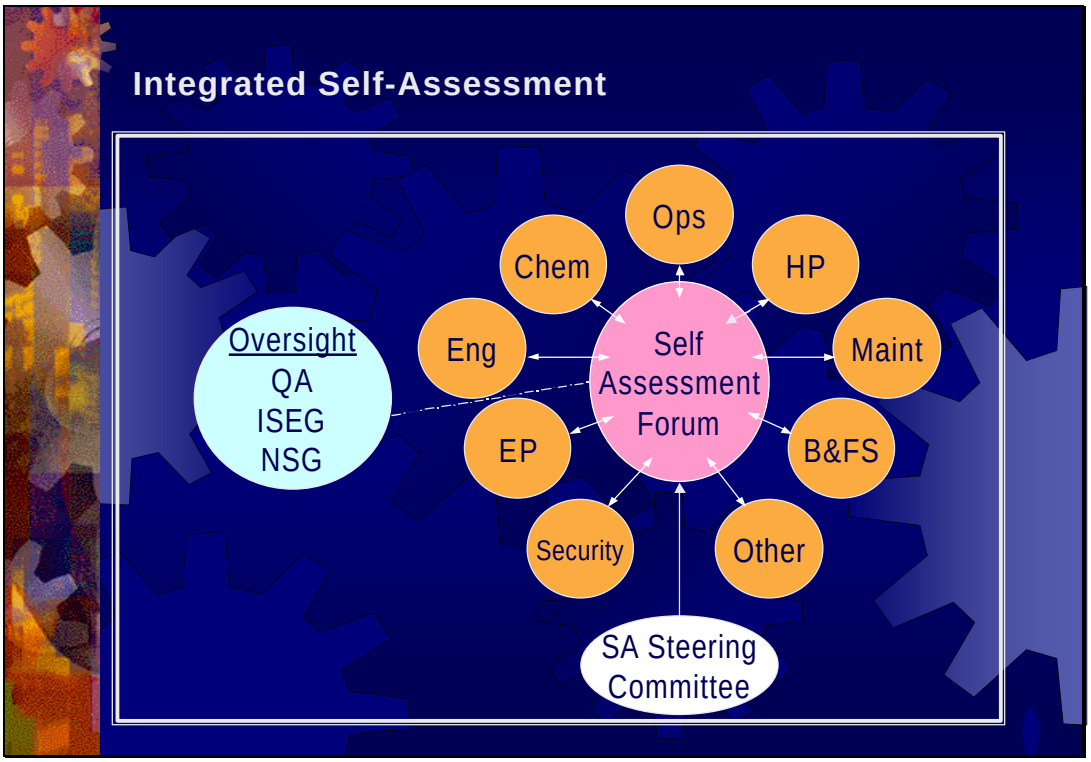


Figure 3. SONGS Integrated Self-Assessment Program

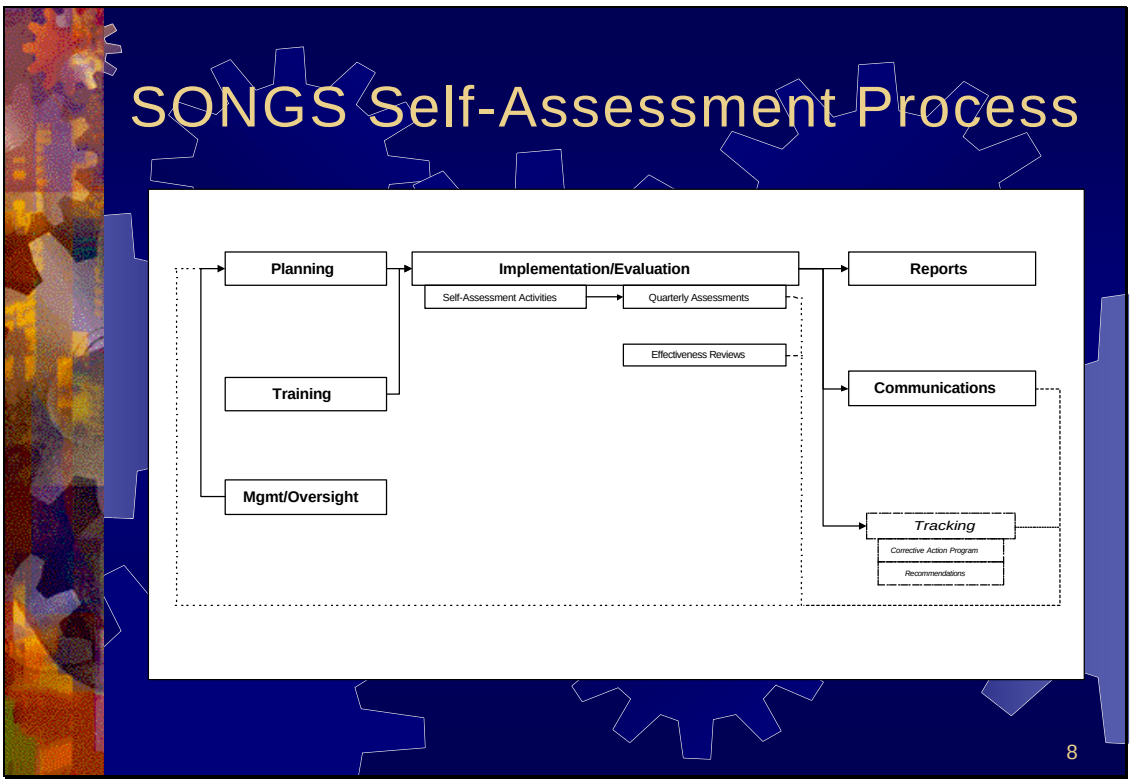
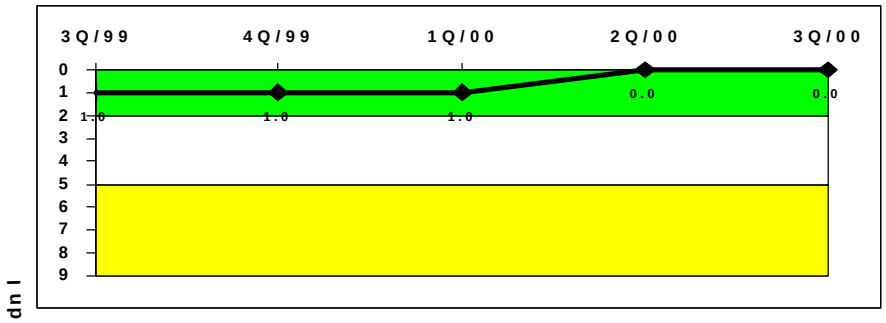


Figure 4. SONGS Self-Assessment Program

OCCUPATIONAL RADIATION SAFETY CORNERSTONE

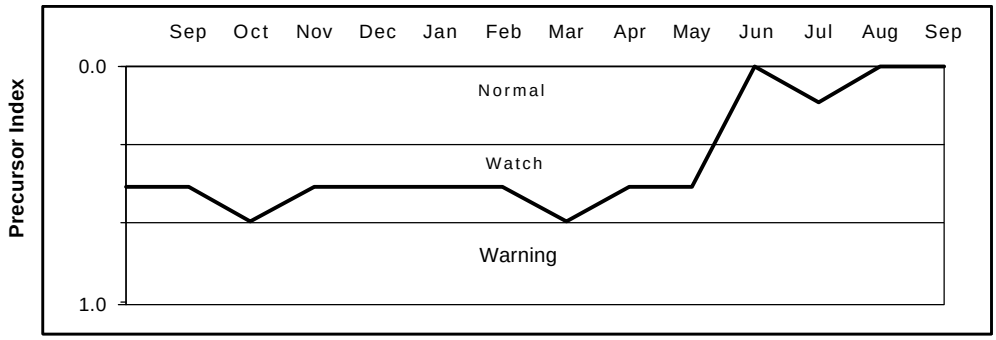
NRC PI: Occupational Exposure Control Effectiveness



Occupational Exposure Control Effectiveness	1Q/99	2Q/99	3Q/99	4Q/99	1Q/00	2Q/00	3Q/00	4Q/00
TS/VHRA/UE Occurrences	0	1	0	0	0	0	0	
Indicator value	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**

OCCUPATIONAL RADIATION SAFETY CORNERSTONE

Precursor



INDEX VALUES	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
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ROR/ACE	0.00	0.15	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.15	0.00	0.00
PI Event	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00	0.00

INDEX VALUES:
Low Level Precursor = 0.06 **ROR/ACE = 0.15** **PI Event = 0.50***
***** Running 12 month period**

Figure 5. SONGS Occupational Radiation Safety Cornerstone and Precursor results