



NUCLEAR ENERGY INSTITUTE

## **NRC INITIATIVE TO REVISE THE REGULATORY OVERSIGHT PROGRAM FOR MATERIAL LICENSEES**

STATUS REPORT AS OF OCTOBER 5, 2000

### **1. Where We Stand:**

#### **(a) Areas of Agreement and Achievements:**

- agreement on 4 Strategic Performance Areas
- agreement on 5 Cornerstones of Safety (descriptions and football diagrams)
- concluded preliminary discussions on Cornerstones of Safety for *Nuclear Material Safeguards* and *Classified Information & Materials*
- several versions of an NRC Communications Plan presented

#### **(b) Outstanding Issues:**

- How to proceed? Merits of adopting the Regulatory Oversight Program for Part 50 licensees (proceeding down the PI path and developing a new facility Inspection Program that incorporates PIs *versus* simply revising the Licensee Performance Review (LPR) in the areas of (i) timeliness, (ii) risk-informing, and (iii) public transparency
- final definition and attributes (essential and desirable) of Performance Indicators (PIs)
- identification of PIs for fuel cycle facilities (some preliminary discussions concluded)
- undue complexity of the *Nuclear Material Safeguards* and *Classified Information & Materials* cornerstones. NRC believes this is an issue of great importance necessitating meetings among the NRC, licensees and DOE. Industry does not support this level of concern or attention.
- differing focus of licensees – who recommend examination of environmental releases and radiation exposures – versus the NRC, which is more concerned with precursors to serious accidents (primarily nuclear criticalities and loss of SNM)

## 2. Strategic Performance Areas and Cornerstones of Safety

The following chart identifies areas of industry-NRC agreement and which Cornerstones of Safety require further discussion.

<u>Strategic Performance Areas</u>	<u>Cornerstones of Safety</u>	
<b>Facility Operations Safety</b>	Initiating Events	
	Safety Systems and Barriers	
	Emergency Preparedness	
<b>Radiation Safety</b> (includes chemical safety)	Occupational Safety	
	Public Safety & Environment	
	Industry Proposal	NRC Proposal
<b>Nuclear Material Safeguards</b>	<b>Physical Protection (LEU)</b>	<b>Safeguards (MCA &amp; PP): Initiating Events</b>
	<b>Physical Protection (HEU)</b>	
	<b>Material Accountability</b>	
		<b>Safeguards Prevention/Mitigation Systems/Barriers (MCA &amp; PP)</b>
		<b>Safeguards Event Response Preparedness (MCA &amp; PP)</b>
<b>Classified Information/Materials</b>	----	<b>Classified Info/Material Protection: Initiating Events</b>
	----	<b>Classified Info/Material Security: Prevention/Mitigation Systems/Barriers</b>
	----	<b>Classified Info/Material: Event Response Preparedness</b>

Descriptions of each Cornerstone of Safety and the corresponding football diagram for each (as developed by industry) are appended as Appendix A to this summary.

### 3. Performance Indicators

Industry-proposed definition of PI:

*Performance Indicator: a plant feature or process condition relied on for safety or radiological condition that can be measured and tracked to detect changes in its ability to perform its intended safety function. PIs are used by a licensee to provide reasonable assurance to the NRC that facility hazards are being promptly controlled to acceptable levels of risk in accordance with regulatory requirements and applicable license commitments.*

Essential Attributes:

- can be easily and objectively measured (easily quantifiable)
- has a logical relation to safety performance expectations
- can easily establish '*threshold values*' for it against which its performance can be judged
- capable of providing a reasonably valid and verifiable assessment of performance in the Cornerstone of Safety for which it has been selected

Desirable Attributes:

- parameter is currently being monitored by the licensee (and historical data are available)
- poses no new or undue burden to collect data (e.g. new data collection and analysis programs)
- can be trended to indicate changes (i.e. risk-significant, bi-directional changes) in performance
- not dependent upon operational changes (e.g. change in plant throughput, period of shut-down for maintenance)

Other Attributes and Comments:

- PIs are the first step in a sequence that could, in conjunction with human errors and equipment failures result in fuel facility accidents.
- PI threshold values should exceed normal operational variations
- '*double counting*' of parameters must be avoided. For example, the failure of an administrative control must not be double counted as a 'human error' and a failure of an 'item relied on for safety.'
- PI reporting should be maintained consistent with regulatory reporting requirements -- e.g. semi-annual reporting of environmental releases and annual reporting of public exposures to radiation
- 'shading' of a colored performance band (e.g. dark green ['*safer operation*'] vs. light green ['*less safe, but still acceptable, operation*']) should not be permitted

- PIs should be sought for items now inspected by NRC personnel
- creation of PIs from data now reported to the NRC is desirable. (Consult the 34-page tabulation prepared by NRC for the March 22-23 meeting 'Periodic Reports to the NRC' for current data reports to the NRC).

Other Pertinent Issues:

- normalization of PI data: need to define the type of data normalization that should be applied to PI data so as to facilitate clear public understanding of the comparative risks of different materials facilities. Possibilities include: plant throughput, total man-rems (equivalent to the 'manrems/MW' parameter used in power plants), rolling averages

(ii) Potential PIs

Plant features, process parameters or IROFS that could be considered as PIs are tabulated below:

<u>Strategic Performance Area &amp; Cornerstone</u>	<u>Potential PI</u>
FOS: Initiating Event	<ul style="list-style-type: none"> <li>• actuation of safety control (e.g. from human error, IROFS or equipment failure or deficiencies in management measures)</li> </ul>
FOS: Safety Systems	<ul style="list-style-type: none"> <li>• failure of safety system (actual failures or failures on demand of administrative or engineered controls)</li> <li>• record of abnormal events (e.g. failures of IROFS or management measures as listed in 10 CFR 70.62(a)(3) log)</li> </ul>
FOS: Emergency Preparedness	<ul style="list-style-type: none"> <li>• availability of equipment (alarms, sirens)</li> <li>• mandatory evacuations (% accountability)</li> <li>• drill and exercise participation (% of workers)</li> <li>• ERO participation</li> </ul>
RS: Occupational Safety	<ul style="list-style-type: none"> <li>• occupational dose exposure exceeding some percentage of a 10 CFR 20</li> <li>• worker performance:                             <ul style="list-style-type: none"> <li>(i) number on whom work restrictions placed</li> <li>(ii) workers having DAC exposures exceeding the mean value for a particular process <math>\pm 2\sigma</math> established for the prior 12 months</li> <li>(iii) number of times a worker in a specific plant process receives more than x% of the permissible 10 CFR 20.1201 occupational dose limit</li> </ul> </li> </ul>
RS: Public Safety & Environment	<ul style="list-style-type: none"> <li>• process effluent radiological occurrences (non-conformance with 10 CFR 20 radioactive release limits or some % of such limits)</li> <li>• public exposure:                             <ul style="list-style-type: none"> <li>(i) if the public dose computed by data annualizing data for some period of measurement exceeds the permissible annual public radiation dose</li> <li>(ii) exposure of a member of the public to some</li> </ul> </li> </ul>

	percentage of the permissible exposure limits of 10 CFR 70.61
S: Physical Protection (LEU & HEU facilities)	<ul style="list-style-type: none"> <li>• some measure of equipment availability (percent availability of alarms and barriers)</li> <li>• access control: number of reportable events (ingress of unauthorized personnel), success of periodic drills</li> <li>• response to events (success of periodic drills - employee participation)</li> <li>• security feature actuation</li> <li>• classified information protection -- some measure of performance or appraisal</li> </ul>
S: Material Accountability	<ul style="list-style-type: none"> <li>• exceed maximum error of reconciliation discrepancies between shipper and receiver of a shipment</li> </ul>

Notes: FOS: Facility Operations Safety strategic performance area  
 IROFS: Item relied on for safety  
 MOU: Memorandum of Understanding  
 RS: Radiation safety strategic performance area  
 S: Safeguards strategic performance area

## **APPENDIX A**

# **CORNERSTONE OF SAFETY TABLES**

**STRATEGIC PERFORMANCE AREA: FACILITY OPERATIONS SAFETY**

**CORNERSTONE OF SAFETY: INITIATING EVENTS**

<b>Cornerstone</b>	<b><i>Initiating Events</i></b>
<b>General Description</b>	<p>This cornerstone is designed to monitor the licensee's performance in controlling plant conditions and internal events that could initiate an accident sequence whose consequences could exceed regulatory limits. A licensee can minimize the frequency of such initiating events by ensuring the capability, reliability and availability of safety controls and equipment (including items relied on for safety) by ensuring that employees who are relied upon to perform safety functions are adequately trained and by implementing appropriate management measures. 'Initiating events' and credible 'accident sequences' are those defined in the licensee's ISA. Initiating events caused by natural phenomena (e.g. floods, earthquakes, weather, etc.) are excluded from consideration due to a licensee's inability to control them. Regulatory limits are primarily those imposed in 10 CFR 70.61 (proposed), 10 CFR 20, 10 CFR 40 and 10 CFR 76. External initiating events are discussed under the Emergency Preparedness Cornerstone of Safety.</p>
<b>Objective and Scope</b>	<p>To minimize initiating events that could prompt a licensee to exceed the regulatory limits of 10 CFR 20, 10 CFR 40, 10 CFR 70, 10 CFR 76 (including Technical Safety Requirements) and specifically the performance requirements of proposed 10 CFR 70.61(b). Avoidance of an inadvertent nuclear criticality event is a principal objective.</p>
<b>Key Attributes</b>	<ul style="list-style-type: none"> <li>• <b>human performance:</b> human errors can cause initiating events both during plant operations and maintenance (including calibration, surveillance testing and plant modifications).</li> <li>• <b>equipment performance:</b> Failure or degradation of site, structures, systems, equipment and components can constitute an initiating event for an accident sequence. The capability, availability and reliability of equipment that is important to safety (including equipment designated as an item relied on for safety) can be assured by sound preventive and corrective maintenance programs.</li> <li>• <b>management measures:</b> good management measures can minimize the frequency of initiating events. For example, proper operating and maintenance procedures and programs, configuration control, employee training, audits and assessments, etc. are essential to achieve this goal.</li> </ul>
<b>Items to Measure</b>	<p>Parameters that can be measured for each Key Attribute:</p> <ul style="list-style-type: none"> <li>• <b>human performance:</b> human errors that cause initiating events can be captured by tracking the number of actuations of safety controls or the number of off-normal plant conditions</li> <li>• <b>equipment performance:</b> equipment failures that constitute initiating events can also be measured by the number of actuations of safety controls or the number of off-normal plant conditions. Risk-informed inspections may be performed to check for possible degradation of engineered safety controls</li> <li>• <b>design deficiencies:</b> failures due to inadequacies in facility design</li> <li>• <b>management measures:</b> management measures can best be measured by risk-informed inspections. Reviews of procedure adequacy, operation of the corrective action program, inspection of worker training records and other management oversight responsibilities should be subjected to risk-informed inspection</li> </ul>

<b>Performance Indicators (PIs)</b>	PIs to measure parameters for each Key Attribute are: <ul style="list-style-type: none"><li>• <b>actuation of safety controls:</b> actuations that result from, for example, human errors, equipment failures or design deficiencies and management measure failures</li></ul>
<b>Baseline Inspection Needs</b>	Areas within the Initiating Events cornerstone that should be subject to baseline inspection include: <ul style="list-style-type: none"><li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li><li>• <b>management measures:</b> procedures, corrective action program and implementation of recommendations, maintenance records, training and qualification records, items relied on for safety (administrative and engineered controls) and their availability and reliability, configuration controls (correct equipment line-ups)</li><li>• <b>response to events:</b> review of training and qualification records, protective strategy, drill and exercise scenarios, drill critiques, etc.</li><li>• <b>off-normal events:</b> review of off-normal event occurrences, licensee analysis and corrective measures that were implemented</li><li>• <b>design deficiencies</b></li></ul>

**STRATEGIC PERFORMANCE AREA: FACILITY OPERATIONS SAFETY**

**CORNERSTONE OF SAFETY: SAFETY SYSTEMS AND BARRIERS**

<b>Cornerstone</b>	<b><i>Safety Systems and Barriers</i></b>
<b>General Description</b>	This cornerstone is designed to ensure the capability, availability and reliability of safety systems that are designed to respond to initiating events. Safety systems prevent or mitigate the hazards of accident sequences and ensure that regulatory performance requirements (or limits) are not exceeded. The capability, availability and reliability of safety systems can be assured by adequate worker training (for administrative controls), installation and proper maintenance (including calibration, surveillance testing and plant modifications) of appropriate equipment and engineered controls and implementation of appropriate management measures. Safety systems include <i>'items relied on for safety'</i> that are defined in the licensee's ISA. Regulatory limits are primarily those imposed in 10 CFR 70.61 (proposed), 10 CFR 20, 10 CFR 40, 40 CFR 190 and 10 CFR 76.
<b>Objective and Scope</b>	To assure the capability, availability and reliability of safety systems so that performance objectives of 10 CFR 20, 10 CFR 40, 10 CFR 70, 10 CFR 76 (including Technical Safety Requirements) are not exceeded. Avoidance of an inadvertent nuclear criticality event is a principal objective.
<b>Key Attributes</b>	<ul style="list-style-type: none"> <li>• <b>administrative barriers:</b> the capability, availability and reliability of safety systems whose operation depends on human intervention (administrative controls) can be assured through, for example, thorough training and use of clear, unambiguous process procedures, etc.</li> <li>• <b>engineered barriers:</b> the capability, availability and reliability of safety systems that respond either automatically or based upon fixed design features without human intervention can be assured through, for example, proper design and installation, maintenance and testing, etc.</li> <li>• <b>management measures :</b> sound management measures are important for assuring the capability, availability and reliability of safety systems. Technically adequate operating and maintenance procedures, maintenance programs, configuration control, employee training, audits and assessments, etc. are essential constituent measures.</li> <li>• <b>configuration control:</b> monitor a facility's design bases against the 'as-built' facility structure (e.g. provisions to protect against external initiating events such as weather and seismicity, equipment alignment)</li> </ul>
<b>Items to Measure</b>	Parameters that can be measured for each Key Attribute: <ul style="list-style-type: none"> <li>• <b>administrative barriers:</b> failures of administrative controls</li> <li>• <b>engineered barriers:</b> actual failures or failures on demand of engineered controls (at the systems/functions level rather than component level). Risk-informed inspections may be performed to check for possible degradation of engineered safety controls</li> </ul>
<b>Performance Indicators (PIs)</b>	PIs to measure parameters for each Key Attribute are: <ul style="list-style-type: none"> <li>• <b>failures of safety systems:</b> actual failures, or failures on demand, of administrative or engineered controls</li> <li>• <b>record of abnormal events:</b> failures of items relied on for safety or management measures entered on the licensee record mandated by 10 CFR 70.62(a)(3)</li> </ul>

<b>Baseline Inspection Needs</b>	<p>Areas within the Initiating Events cornerstone that should be subject to baseline inspection include:</p> <ul style="list-style-type: none"><li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li><li>• <b>management measures:</b> confirm that the required management measures are in place and that technically adequate procedures have been developed. Complementary risk-informed inspections will be used to review application of the management measures and their adequacy in assuring the availability and reliability of safety systems, when required. Reviews of operation of the corrective action program, inspection of worker training records and other management oversight responsibilities should be subjected to risk-informed inspection</li><li>• <b>record of abnormal events:</b> review of the licensee's record of abnormal events for completeness, corrective action disposition and accuracy</li><li>• <b>configuration control:</b> inspection of the facility design bases to the 'as-built' configuration (e.g. provisions to protect against external initiating events such as weather, fire or seismicity, equipment alignment, modifications)</li></ul>
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**STRATEGIC PERFORMANCE AREA: FACILITY OPERATIONS SAFETY**

**CORNERSTONE OF SAFETY: EMERGENCY PREPAREDNESS**

<b>Cornerstone</b>	<b><i>Emergency Preparedness</i></b>
<b>General Description</b>	<p>This cornerstone is designed to ensure that the licensee can effectively implement adequate measures to protect the public health and safety and the environment in the event of a radiological emergency. A radiological emergency includes the inadvertent release of licensed material and/or hazardous chemicals incident to the processing of licensed material. This cornerstone also addresses responses to natural, external initiating events over which the licensee has no control on their frequency, intensity or timing, but which have been incorporated into the plant's safety design basis. 10 CFR 40, 10 CFR 70 and 10 CFR 76 outline the requirements of emergency preparedness programs and the licensee commits to implement these requirements through an Emergency Plan. Emergency preparedness incorporates both on-site licensee actions and supporting actions coordinated with off-site state and local government authorities.</p>
<b>Objective and Scope</b>	<p>To ensure that the licensee is capable of implementing adequate measures to protect the public and worker health and safety and the environment in the event of a radiological emergency resulting from internal and/or external initiating events . The emergency plan must provide reasonable assurance that the public radiation exposure limits of 10 CFR 70 (70.22(i)(1), 10 CFR 40, 10 CFR 76 and 70.61(b)) will not be exceeded.</p>
<b>Key Attributes</b>	<p>Key attributes of an EP are:</p> <ul style="list-style-type: none"> <li>• <b>Emergency Response Organization (ERO) performance:</b> EROs are individuals and/or organizations that are relied upon to respond to emergencies as identified in the Emergency Response Plan. The performance of the ERO depends upon the proficiency of both individuals and the integrated team in carrying out their duties and functions. ERO proficiency is demonstrated through drills (non-training drills), exercises and events and self-assessment of performance and corrective action in areas requiring improvement. Timely and accurate classification of events, notification of off-site governmental authorities and development of appropriate protective actions for an accident scenario are additional measures of ERO performance</li> <li>• <b>ERO readiness:</b> implementation of the emergency plan depends upon the capability, availability and reliability of the ERO to respond to emergencies. Readiness is capability developed through training, participation in drills and exercises, self-assessment of performance during drills and resolution of identified deficiencies</li> <li>• <b>facilities and equipment:</b> the capability, reliability and availability of facilities and equipment to implement licensee emergency response and to support the ERO operations</li> <li>• <b>management measures :</b> management measures are important for oversight and implementation of the EP. Development of procedures for EP implementation, event classification, notification of off-site government authorities, selection and communication of appropriate protective and mitigative actions are important tasks. Other areas requiring management measures include assurance of the capability, availability and reliability of ERO facilities and equipment through appropriate</li> </ul>

	<p>maintenance programs, configuration control, employee knowledge and skills , audits and assessments, ALARA planning, etc.</p> <ul style="list-style-type: none"> <li>• <b>off-site emergency preparedness:</b> state and local government organizations are responsible for maintaining off-site Emergency Preparedness programs and implementing protective actions to protect the public and worker health and safety. Licensees may enter into an agreement with such organizations to provide off-site emergency preparedness support.</li> </ul>
<p><b>Items to Measure</b></p>	<p>Parameters that can be measured for each Key Attribute:</p> <ul style="list-style-type: none"> <li>• <b>ERO performance:</b> timely and accurate classification of events, notification of off-site government authorities, development and implementation of mitigative measures</li> <li>• <b>ERO readiness:</b> drill and exercise participation, licensee self-assessment of ERO participation in drills and exercises</li> <li>• <b>facilities and equipment:</b> availability and reliability of emergency equipment and facilities</li> <li>• <b>management systems:</b> classification of emergency events, notification of off-site government authorities and EROs, development and implementation of mitigative actions, ALARA planning</li> <li>• <b>off-site emergency preparedness:</b> agreements in place between licensees and off-site EROs</li> </ul>
<p><b>Performance Indicators (PIs)</b></p>	<p>Compliance of emergency preparedness programs with regulations is assessed through observation of a licensee's response to simulated emergencies and through routine inspection of on-site programs. Performance in exercises involving on-site and off-site EROs provides the reasonable assurance finding that the licensee can implement adequate protective measures in the event of a radiological emergency. PIs for on-site emergency preparedness draw significantly from ERO performance during simulated emergencies and actual declared emergencies. PIs that can be used for each Key Attribute are:</p> <ul style="list-style-type: none"> <li>• <b>availability of equipment (alarms, sirens, etc.)</b></li> <li>• <b>mandatory evacuations:</b> % accountability</li> <li>• <b>ERO drill and exercise participation:</b> percentage participation of ERO members in drills, exercises and actual emergency events. Participation of personnel on the emergency preparedness roster (e.g. shift personnel, security personnel) would be counted</li> <li>• <b>worker drill and exercise participation:</b> % of workers participating</li> </ul>

**STRATEGIC PERFORMANCE AREA: RADIATION SAFETY**

**CORNERSTONE OF SAFETY: OCCUPATIONAL SAFETY**

<b>Cornerstone</b>	<b><i>Occupational Safety</i></b>
<b>General Description</b>	<p>This cornerstone is designed to adequately protect the health and safety of workers from the chemical risks produced from licensed material, hazardous chemicals produced from licensed material and from plant conditions that affect the safety of radioactive materials and thus present an increased radiation risk. Such chemicals may include, for example, chlorine, uranium hexafluoride, nitric acid. The cornerstone uses the occupational dose limits specified in 10 CFR 20 and the operating principle of maintaining occupational exposures '<i>as low as reasonably achievable (ALARA)</i>' in accordance with 10 CFR 20.1101. Occupational exposures can be controlled by restricting exposures to licensed material, by adequate worker training, by strict adherence to plant procedures and by implementation of an effective ALARA program.</p>
<b>Objective and Scope</b>	<p>To ensure that occupational exposures to radiation do not exceed the regulatory exposure limits of 10 CFR 20 and to ensure that occupational exposures are maintained ALARA</p>
<b>Key Attributes</b>	<p>Key attributes that affect occupational exposure are:</p> <ul style="list-style-type: none"> <li>• <b>engineered safety controls</b> : radiation monitors and criticality alarms, shielding and equipment designed to minimize the potential for uncontrolled or unnecessary occupational exposures</li> <li>• <b>administrative safety controls</b>: human errors can significantly affect occupational exposures. Adherence to proper radiation protection practices, maintenance of radiation protection barriers and adherence to approved work procedures are essential.</li> <li>• <b>management measures</b>: management measures are essential to ensure the technical adequacy of radiation protection procedures, establishment of administrative and physical radiation protection controls, detailed work planning, accurate assessment of associated radiological conditions and establishment of adequate controls to implement an effective ALARA program.</li> </ul>
<b>Items to Measure</b>	<p>Parameters that can be measured for each Key Attribute:</p> <ul style="list-style-type: none"> <li>• <b>engineered safety controls</b>: programs for source term control (shielding, decontamination activities), maintenance and calibration of radiation monitors</li> <li>• <b>administrative safety controls</b>: training programs in health physics &amp; operations, radiation worker training and performance records</li> <li>• <b>management systems</b>: effectiveness of licensee assessment and corrective action program, radiation protection controls, proficiency of health physics technicians, radiation protection aspects of work procedures, ALARA program activities</li> </ul>

<p><b>Performance Indicators (PIs)</b></p>	<p>Licensee performance in controlling occupational radiation doses can be quantified by measuring parameters such as the number of workers placed on work restriction due to prior, elevated radiation exposure.</p> <ul style="list-style-type: none"> <li>• <b>occupational dose exposure:</b> exceed some percentage of a 10 CFR 20 value</li> <li>• <b>worker performance:</b> this PI could be measured in several ways:             <ul style="list-style-type: none"> <li>(i) number of workers on whom work restrictions have been placed</li> <li>(ii) number of instances a worker in a specific plant process receives a Derived Air Concentration-Hour (DCA) exposure that exceeds the mean value for that process <math>\pm 2\sigma</math> established for the previous 12 months</li> <li>(iii) number of instances a worker in a specific plant process receives more than x% of the permissible 10 CFR 20.1201 occupational dose limit</li> </ul> </li> </ul> <p>These PIs may identify declining performance in procedural guidance, training, radiological monitoring and in exposure and contamination control.</p>
<p><b>Baseline Inspection Needs</b></p>	<p>Areas that should be subject to baseline inspection include:</p> <ul style="list-style-type: none"> <li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li> <li>• <b>radiation protection equipment:</b> availability and reliability of radiation monitors and alarms, source reduction methods (e.g. use of shielding), maintenance records</li> <li>• <b>worker protection:</b> adequacy of worker protection during drills and exercises, adequacy of training programs</li> <li>• <b>management measures:</b> technical adequacy of procedures, worker training programs, ALARA planning</li> </ul>

**STRATEGIC PERFORMANCE AREA: RADIATION SAFETY**

**CORNERSTONE OF SAFETY: PUBLIC SAFETY & ENVIRONMENT**

<b>Cornerstone</b>	<b><i>Public Safety &amp; Environment</i></b>
<b>General Description</b>	<p>This cornerstone is designed to adequately protect public health and safety and the environment from exposure to radioactive material released from routine operations. These releases include gaseous and liquid radioactive effluent discharges and the unconditional release of solid radioactive materials and waste. The cornerstone uses as its bases the dose limits for individual members of the public specified in 10 CFR 20, the operating principle of maintaining public exposures 'as low as reasonably achievable (ALARA)' and the performance requirements of 10 CFR 70.61. Radiation doses to members of the public can be monitored and controlled by sustaining acceptable worker performance through training, by optimizing the reliability and accuracy of radioactive effluent processing and monitoring equipment (particularly IROFS) and by application of appropriate management measures. Protection of the public and the environment from inadvertent releases of licensed material and/or hazardous chemicals incident to the processing of licensed material are addressed in the Emergency Preparedness Cornerstone of Safety.</p>
<b>Objective and Scope</b>	<p>Protect members of the public and the environment from either direct exposure or releases of radioactive materials (effluents, solids) or hazardous chemicals incident to the processing of licensed material to the public domain. Ensure radiation doses to the public and environment do not exceed the limits of 10 CFR 20, 10 CFR 70.61 and 49 CFR 190. Ensure that public exposures to radiation are maintained ALARA.</p>
<b>Key Attributes</b>	<p>Key attributes that affect public exposure are:</p> <ul style="list-style-type: none"> <li>• <b>facilities, equipment and instrumentation:</b> properly installed and calibrated radiation detectors, alarms and sampling systems, radioactive waste processing equipment, effluent sampling and monitoring equipment and instrumentation are all effective in achieving the cornerstone safety goal</li> <li>• <b>worker performance:</b> human performance can significantly affect radioactive waste processing, the accuracy of radiation surveys that are precursors to the release of contaminated solid materials and the monitoring of effluents</li> <li>• <b>management measures:</b> management measures are essential to ensure the technical adequacy and correct implementation of procedures for radiological effluent processing, effluent control and the monitoring of liquid and gaseous releases. Adequate procedures for conducting radiation surveys for unconditional release of potentially contaminated materials requires appropriate policy and technical guidance.</li> </ul>
<b>Items to Measure</b>	<p>Parameters that can be measured for each Key Attribute:</p> <ul style="list-style-type: none"> <li>• <b>facilities, equipment and instrumentation:</b> monitoring and processing equipment reliability, availability and calibration</li> <li>• <b>worker performance:</b> worker training programs and performance records</li> <li>• <b>management systems:</b> review of effluent sampling quality control programs, acceptability of results, effectiveness of licensee assessment and corrective actions, radiation protection controls, radiation protection aspects of work procedures, ALARA program</li> </ul>

<p><b>Performance Indicators (PIs)</b></p>	<p>Two PIs are proposed for monitoring:</p> <ul style="list-style-type: none"> <li>• <b>process effluent radiological occurrences:</b> non-conformance with the 10 CFR 20 radioactive release limits of data collected for any sampling period that are used to prepare the semi-annual radionuclide release report. This PI may indicate declining performance in an effluent treatment system.</li> <li>• <b>public exposure:</b> this PI could be measured in one or more ways:       <ul style="list-style-type: none"> <li>(i) an annual public radiation exposure dose is computed from environmental data collected periodically over a 12-month period. If the public dose computed by annualizing data from any one period were to exceed the permissible annual public exposure dose, a precursor problem may be indicated.</li> <li>(ii) Exposure to a member of the public of some percentage of the permissible exposure limits of 10 CFR 70.61</li> </ul> </li> </ul>
<p><b>Baseline Inspection Needs</b></p>	<p>Areas of the Public Safety &amp; Environment cornerstone that should be subject to baseline inspection include:</p> <ul style="list-style-type: none"> <li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li> <li>• <b>radiation monitoring equipment:</b> availability and reliability of radiation monitors, calibration of radioactive waste processing equipment and effluent monitoring instrumentation, equipment maintenance records, adequacy of design modifications</li> <li>• <b>worker performance:</b> adequacy of training programs, worker completion of training program requirements, qualifications, training and proficiency of health physics and chemistry technicians and staff involved in effluent processing</li> <li>• <b>management measures:</b> quality control programs, technical adequacy of procedures, worker training records, operation of the corrective action program and implementation of recommendations</li> </ul>

**STRATEGIC PERFORMANCE AREA: NUCLEAR MATERIAL SAFEGUARDS**

**CORNERSTONE OF SAFETY: PHYSICAL PROTECTION**  
**CATEGORY III (NATURAL OR LEU) FACILITY**

<b>Cornerstone</b>	<b><i>Physical Protection (NATURAL U OR LEU)</i></b>
<b>General Description</b>	This cornerstone is designed to ensure that a licensee's physical protection system can detect and assess the loss, theft or diversion of Special Nuclear Material (low-enriched uranium, or LEU) or natural uranium. The cornerstone is designed to implement the material safeguard provisions of 10 CFR 73 and 10 CFR 40.
<b>Objective and Scope</b>	Ensure that a licensee's industrial security program is capable of protecting against the loss, theft or diversion of licensed material.
<b>Key Attributes</b>	<p>Key attributes that affect public exposure are:</p> <ul style="list-style-type: none"> <li>• <b>physical protection:</b> facility barriers (e.g. fences) are designed to retard the entrance of unauthorized persons or vehicles into the facility. Detecting the breach of a facility barrier prompts initiation of a response.</li> <li>• <b>access control:</b> visitor and employee identification and the inspection of personnel, packages, vehicles entering and leaving the facility are areas that can be measured for this cornerstone attribute. These activities are designed to protect against entry of unauthorized personnel into the facility and against the introduction of contraband (firearms, explosives, incendiary devices, etc.) and prohibited articles such as alcohol.</li> <li>• <b>response to events:</b> implementation of a protective strategy in the event of a loss, theft or diversion constitutes the goal of this cornerstone attribute. The protective strategy includes plans to get properly trained response personnel in place within pre-determined times in order to protect against a theft or diversion and implementation of the facility emergency response plan in the event of a plant accident.</li> <li>• <b>worker performance:</b> proper training of plant workers and security personnel to respond to a threat</li> <li>• <b>management measures:</b> design and implementation of security procedures, adequacy of guard training and proficiency in training exercises</li> </ul>
<b>Items to Measure</b>	<ul style="list-style-type: none"> <li>• <b>physical protection:</b> operability and availability of physical barriers and surveillance systems</li> <li>• <b>access control:</b> effectiveness of the personnel identification and inspection procedures</li> <li>• <b>response to events:</b> protective strategy plan implementation, response of emergency response plan</li> <li>• <b>worker performance:</b> fulfillment of responsibilities in the event of a theft, loss or diversion</li> <li>• <b>management measures:</b> adequacy of training programs, technical adequacy of procedures, corrective actions, reporting mechanisms</li> </ul>
<b>Performance Indicators (PIs)</b>	<p>Three PIs are proposed for monitoring:</p> <ul style="list-style-type: none"> <li>• <b>physical protection:</b> equipment percent availability of alarms and barriers (i.e. available and capable of performing their intended function)</li> <li>• <b>access control:</b> number of reportable events (ingress of unauthorized personnel), success of periodic drills</li> <li>• <b>response to events:</b> success of periodic drills and exercises (e.g. employee participation)</li> </ul>

<b>Baseline Inspection Needs</b>	<p>Areas of the LEU Physical Protection cornerstone that should be subject to baseline inspection include:</p> <ul style="list-style-type: none"><li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li><li>• <b>physical protection:</b> limited baseline Inspection no longer required</li><li>• <b>access control:</b> effectiveness of personnel identification and inspection procedures depends upon the quality of implementation of the tasks. Baseline Inspection continues to confirm acceptable implementation, reporting thresholds, etc.</li><li>• <b>response to events:</b> review of training and qualification records, protective strategy, drill and exercise scenarios, drill critiques, etc.</li><li>• <b>worker performance:</b> training records</li><li>• <b>management measures:</b> technical adequacy of procedures, corrective actions, security organization and adequacy of security plans</li></ul>
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**STRATEGIC PERFORMANCE AREA: NUCLEAR MATERIAL SAFEGUARDS**

**CORNERSTONE OF SAFETY: PHYSICAL PROTECTION**  
**(CATEGORY I (HEU) FACILITY)**

<b>Cornerstone</b>	<b><i>Physical Protection</i></b>
<b>General Description</b>	<p>This cornerstone is designed to ensure that a licensee's physical protection system can protect against radiological sabotage and protect public health and safety from releases of strategic special nuclear material (or Strategic Special Nuclear Material, HEU). The cornerstone is designed to implement the material safeguard provisions of 10 CFR 73. It is also designed to address requirements for the protection and control of classified information at HEU and Gaseous Diffusion Plant facilities. A licensee must be able to protect against internal and external threats. A licensee's physical protection system is evaluated through the periodic conduct of structured drills and exercises designed to demonstrate the licensee's ability to meet the critical elements of a facility's integrated contingency response program.</p>
<b>Objective and Scope</b>	<p>Protect against design-based threats of theft or diversion of strategic special nuclear material and radiological sabotage and against the unauthorized disclosure, modification or loss of classified information..</p>
<b>Key Attributes</b>	<ul style="list-style-type: none"> <li>• <b>physical protection system:</b> facility barriers, intrusion detection systems and alarms. For a potential sabotage act the intrusion detection system identifies the existence of the threat, the barriers provide a delay to the person(s) posing the threat and the alarm system notifies management and security personnel of the scope of the threat</li> <li>• <b>classified information protection system:</b> management structure, risk management, security and control systems to prevent the unauthorized access to, and disclosure of, classified information, procedures to test the effectiveness of safeguards, system of graded protection (in view of asset valuation, threat analysis, vulnerability assessment), etc.</li> <li>• <b>access authorization:</b> personnel screening, fitness-for-duty and behavioral observation program are designed to assure the trustworthiness of security and employee personnel</li> <li>• <b>access control:</b> visitor and employee identification and the inspection of personnel, packages, vehicles entering and leaving the facility These activities are designed to protect against entry of unauthorized personnel into the facility and against the introduction of contraband (firearms, explosives, incendiary devices, etc.) and prohibited articles such as alcohol.</li> <li>• <b>response to events:</b> implementation of a protective strategy in the event of a sabotage event constitutes the goal of this cornerstone attribute. The protective strategy includes protection of pre-identified safety equipment that is required for the safe shut-down of the facility, plans to get properly trained response personnel (with appropriate armaments) in place within pre-determined times in order to protect against the threat, and implementation of the facility emergency response plan in the event of a plant accident.</li> <li>• <b>management measures:</b> design and implementation of security procedures, adequacy of an acceptable safeguard contingency plan, evaluation of Tactical Response Team and guard participation in drills and exercises (personnel participation, success of defensive strategy, communications,</li> </ul>

<p><b>Items to Measure</b></p>	<p>team tactics, physical protection plan effectiveness</p> <p>Parameters that can be measured for each Key Attribute:</p> <ul style="list-style-type: none"> <li>• <b>physical protection:</b> operability and availability of intrusion detection systems, alarms and barriers, performance of access detection and surveillance systems to detect safeguards events</li> <li>• <b>access control:</b> effectiveness of the personnel identification and inspection procedures</li> <li>• <b>response to events:</b> operability of safety equipment for plant shutdown, protective strategy plan implementation, response of emergency response plan, evaluation of structured drills and exercises and contingency response plans</li> <li>• <b>worker performance:</b> fulfillment of responsibilities in the security organization</li> <li>• <b>classified information performance assurance appraisals:</b> status and availability of safeguards and security, cyber security, emergency support, adequacy of policies and their implementation, adequacy of corrective actions</li> <li>• <b>management measures:</b> adequacy of training programs, technical adequacy of procedures, corrective actions, reporting mechanisms, oversight of Safeguards Contingency Plan</li> </ul>
<p><b>Performance Indicators (PIs)</b></p>	<p>Four PIs may be used to monitor the effectiveness of the physical protection program:</p> <ul style="list-style-type: none"> <li>• <b>organization drill participation:</b> participation of security organization personnel in periodic drills and exercises and in actual events</li> <li>• <b>physical protection system:</b> percent of the time all components of the physical protection system are available and capable of performing their intended functions</li> <li>• <b>security force performance:</b> some quantitative measurement of the performance of security personnel (e.g. ingress/egress control, surveillance, intrusion detection, drill performance. etc.)</li> <li>• <b>classified information protection:</b> instances of violation of safeguards or security systems, loss of cyber security provisions</li> </ul>
<p><b>Baseline Inspection Needs</b></p>	<p>Areas of the Physical Protection cornerstone that should be subject to baseline inspection include:</p> <ul style="list-style-type: none"> <li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li> <li>• <b>physical protection:</b> operability and availability of intrusion detection systems, alarms and barriers, performance of access detection and surveillance systems</li> <li>• <b>access control:</b> effectiveness of personnel identification and inspection procedures, self-assessment reviews</li> <li>• <b>response to events:</b> drill and exercise scenarios, drill critiques, etc.</li> <li>• <b>worker performance:</b> training records, correction of training deficiencies by means of ongoing training programs, tracking of deficiencies by means of licensee's corrective action program</li> <li>• <b>classified information protection:</b> adequacy of procedures to test safeguards and security systems, training programs for individuals handling classified information, results of performance assurance appraisals</li> <li>• <b>management measures:</b> technical adequacy of procedures, Safeguards Contingency Plan, corrective actions, security organization and adequacy of security plans, review of training, drill and exercise self-assessment</li> </ul>

**STRATEGIC PERFORMANCE AREA: NUCLEAR MATERIAL SAFEGUARDS**

**CORNERSTONE OF SAFETY: MATERIAL ACCOUNTABILITY**

<b>Cornerstone</b>	<b><i>Material Accountability</i></b>
<b>General Description</b>	This cornerstone is designed to ensure that a licensee's material control and accounting (MC&A) procedures are adequate to account for licensed material in the licensee's possession. 10 CFR 74 specifies the requirements for MC&A systems applicable to uranium enrichment facilities and licensees handling both special nuclear material (LEU) and strategic special nuclear material (HEU). This cornerstone also applies to the MC&A practices for 10 CFR 76 licensees and for Part 40 licensees who convert natural uranium
<b>Objective and Scope</b>	Detect the loss, theft or diversion of licensed material
<b>Key Attributes</b>	Key attributes that affect material accountability are: <ul style="list-style-type: none"> <li>• <b>management measures:</b> overall MC&amp;A planning, coordination and administration, procedure development, revision, implementation and enforcement oversight, assignment and training of personnel, program audits and assessments, oversight of measurement performance, employee training and qualification programs</li> <li>• <b>equipment:</b> maintenance and calibration of measurement systems based on reference standards, reliability of laboratory and analytical equipment</li> </ul>
<b>Items to Measure</b>	Parameters that can be measured for each Key Attribute: <ul style="list-style-type: none"> <li>• <b>item control:</b> items that are lost or unaccounted for and that may have to be reported to the NRC</li> <li>• <b>measurement control:</b> accuracy of the accounting and licensed material measurement system</li> <li>• <b>material balance reports:</b> periodic reports that track the receipt, inventory, disposal, acquisition and transfer of licensed material, accuracy of accounting for licensed material as expressed by the Standard Error of the Inventory Difference (SEID), statistical control system for program measurements (bias corrections, random error variances, systematic errors), sampling methodologies</li> <li>• <b>shipment tracking:</b> achievement of Estimated Times of Arrival (ETA) by shippers, potential and actual missing shipments</li> <li>• <b>missed ETA:</b> the number of shipments that fail to meet the ETA</li> </ul>
<b>Performance Indicators (PIs)</b>	Three PIs are proposed for monitoring material accountability: <ul style="list-style-type: none"> <li>• <b>item control:</b> two components are to be considered: (i) number of items that are lost, and (ii) number of items that are lost and whose losses are reportable to the NRC</li> <li>• <b>measurement control:</b> accuracy of the measurement system as measured by the number of times the measurement systems are found to be out of acceptable set calibration ranges</li> <li>• <b>missed ETA:</b> the number of shipments originating at the licensed facility whose Estimated Time of Arrival (ETA) falls outside the permissible time bounds</li> </ul>
<b>Baseline Inspection Needs</b>	Areas of the Material Accountability cornerstone that should be subject to baseline inspection include: <ul style="list-style-type: none"> <li>• <b>accuracy of reported PI data:</b> verification of the collection of PI data and that data gathering is in compliance with NRC guidelines</li> <li>• <b>MC&amp;A program:</b> review of procedures, written records on licensed material receipt, inventory, disposal and acquisition, fulfillment of program</li> </ul>

	<p>objectives, accuracy of material balance reports and timeliness of filings, measurement systems and controls, achievement of acceptable standard errors of inventory differences</p> <ul style="list-style-type: none"><li>• <b>program components:</b> examination of the MC&amp;A's management structure, measurement program, measurement control program, physical inventory program, item control program, detection program, shipper-receiver resolution program and MC&amp;A assessment program</li><li>• <b>corrective action:</b> review of corrective action program and implementation of recommended actions</li><li>• <b>HEU nuclear material control plan:</b> review of program components for monitoring and tracking internal transfers, storage and processing of SSNM, unit process detection capability, item monitoring and quality assurance programs (management structure, personnel qualifications, measurement system, measurement control, physical inventory, record keeping, internal shipping and receiving control)</li></ul>
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## **APPENDIX B**

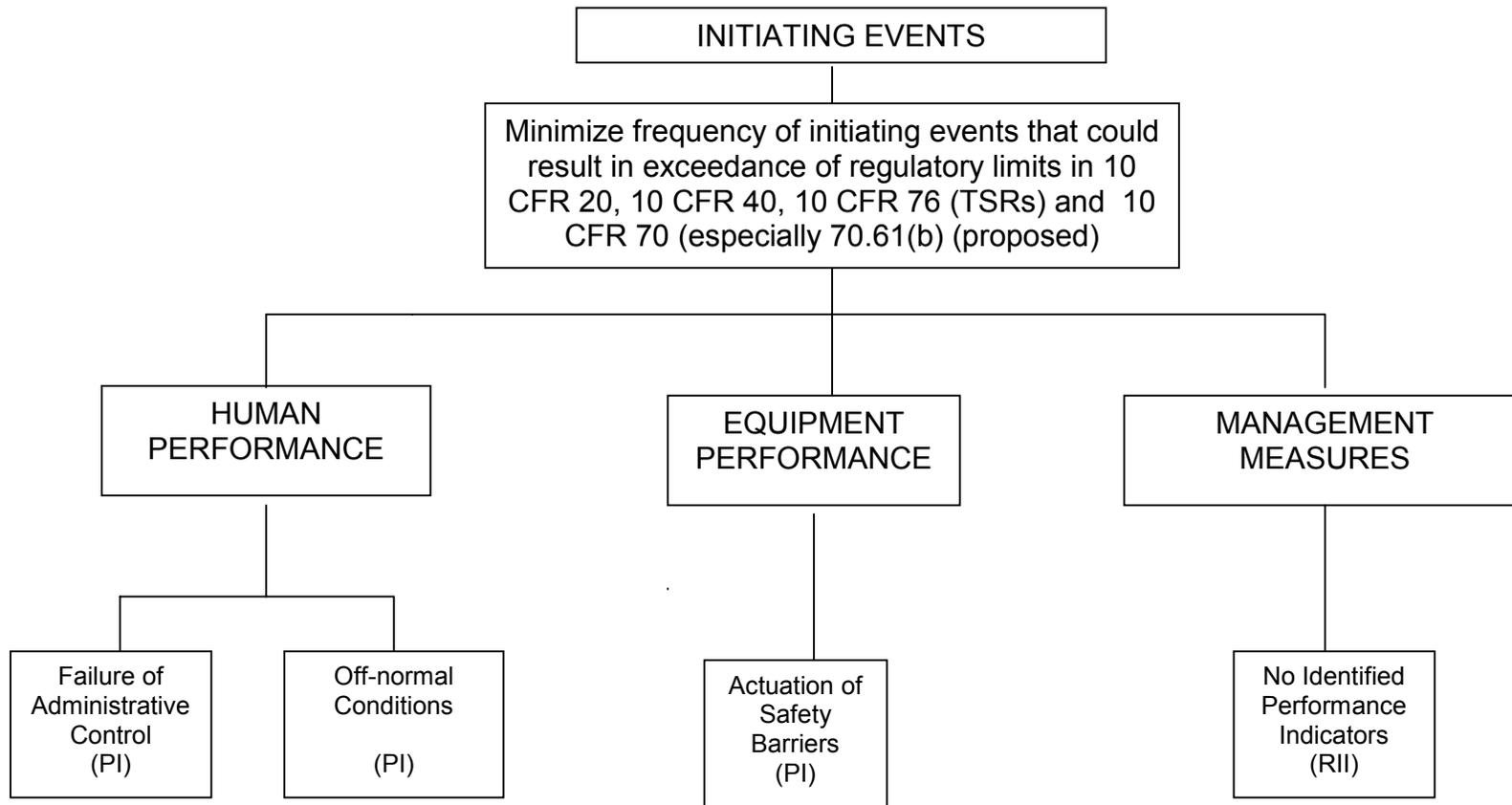
# **FOOTBALL DIAGRAMS FOR CORNERSTONE OF SAFETY**

**(Industry Proposal)**



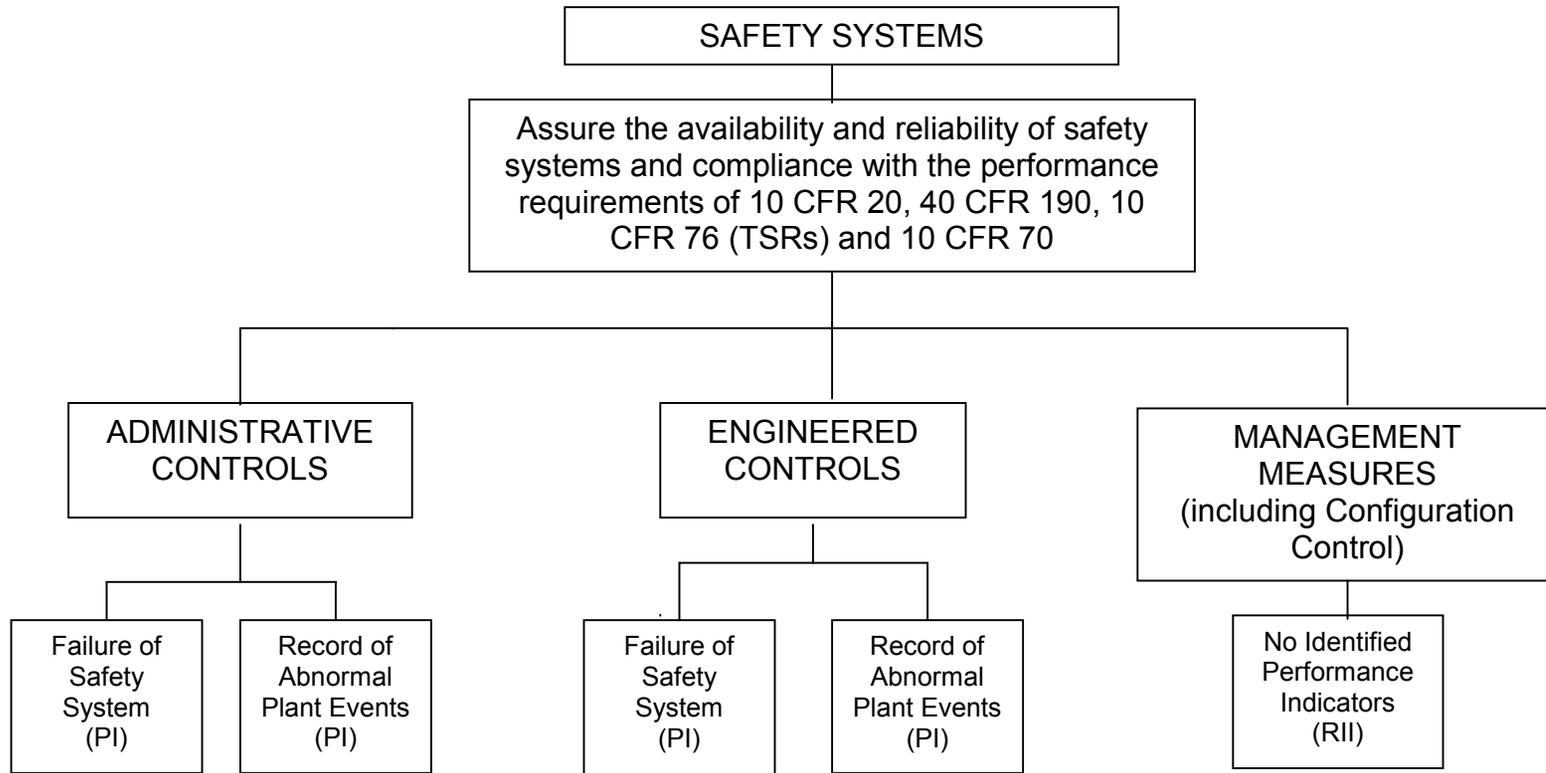
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### INITIATING EVENTS



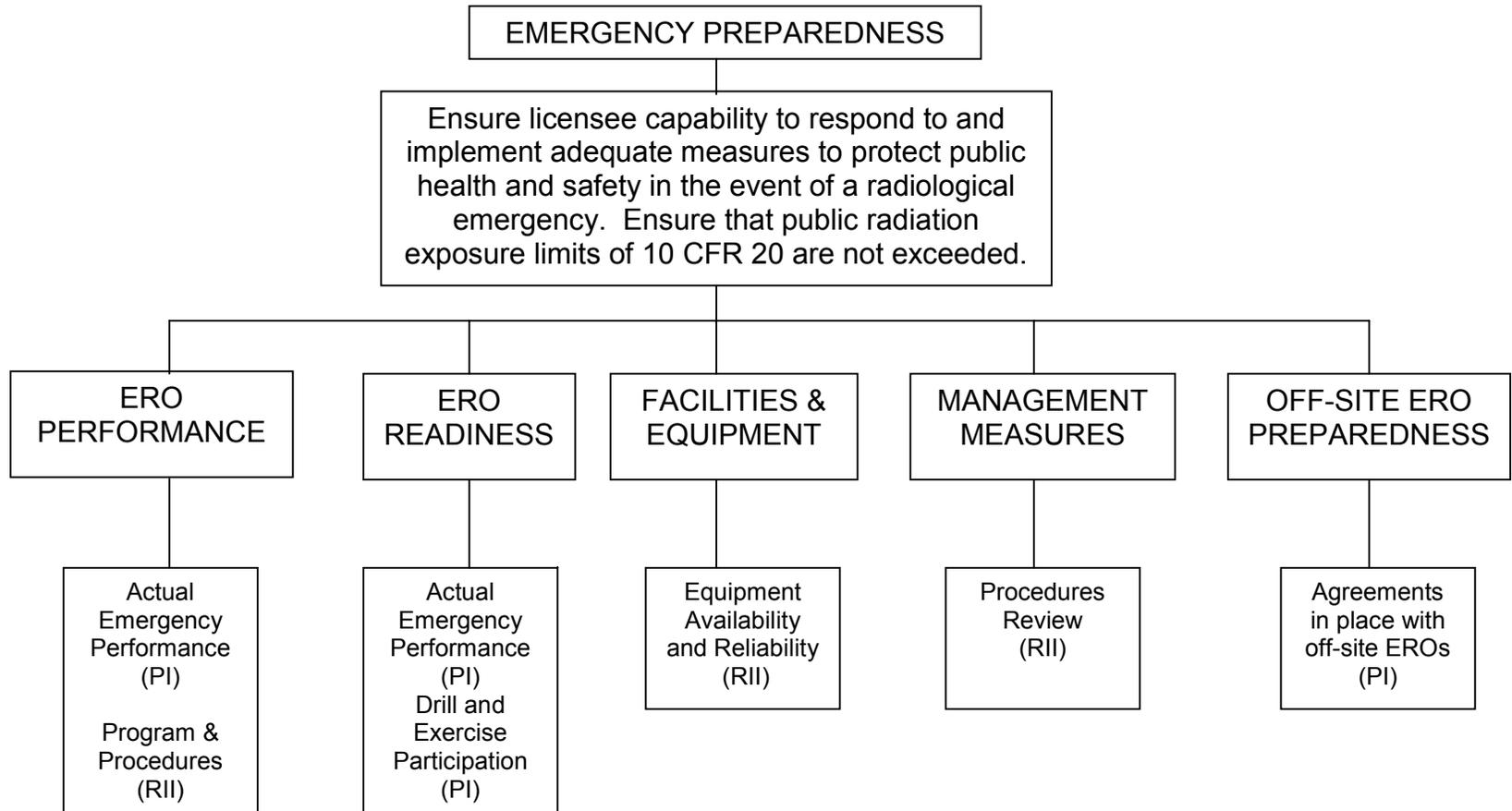
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### SAFETY SYSTEMS AND BARRIERS



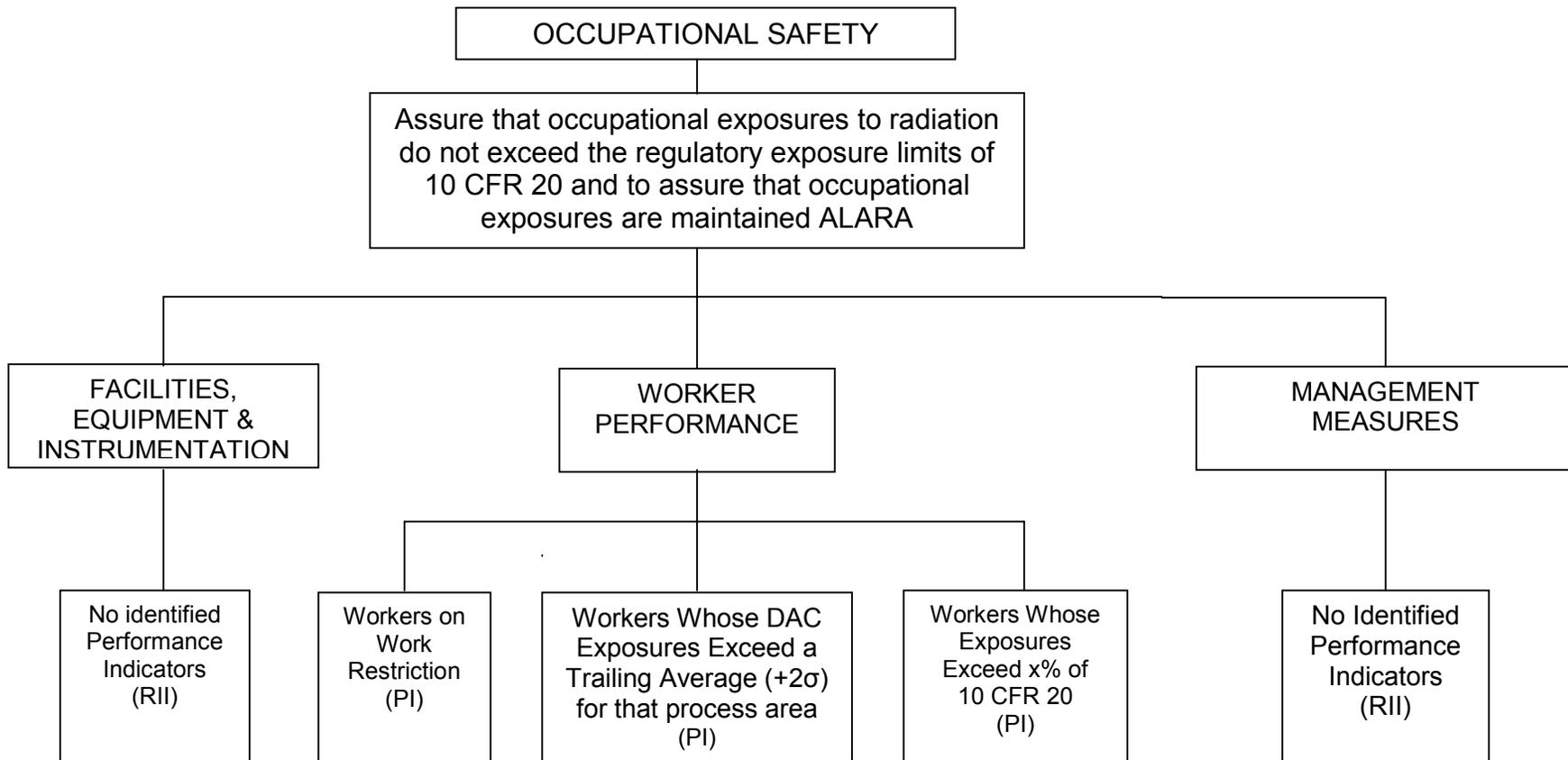
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### EMERGENCY PREPAREDNESS



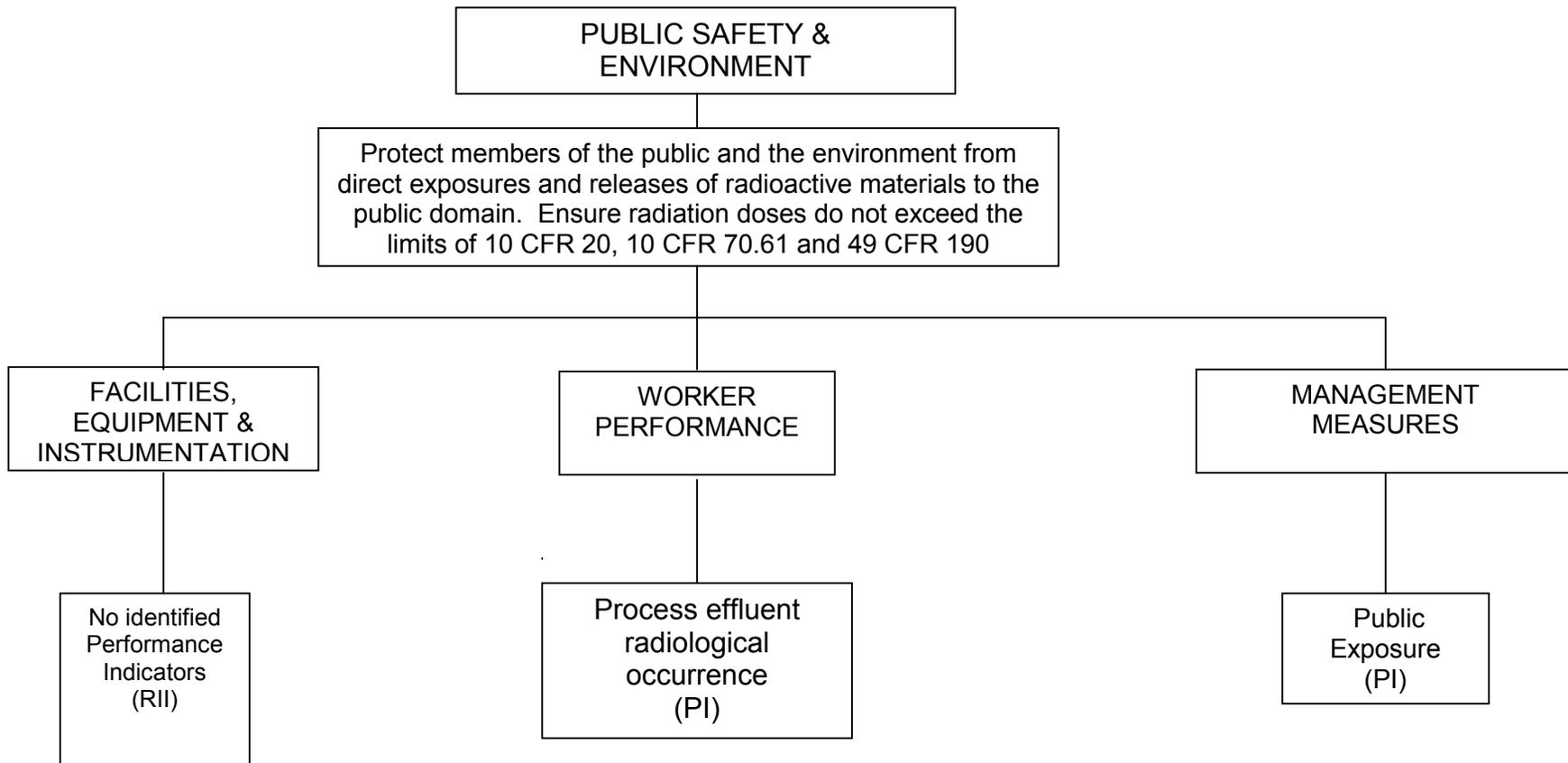
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### OCCUPATIONAL SAFETY



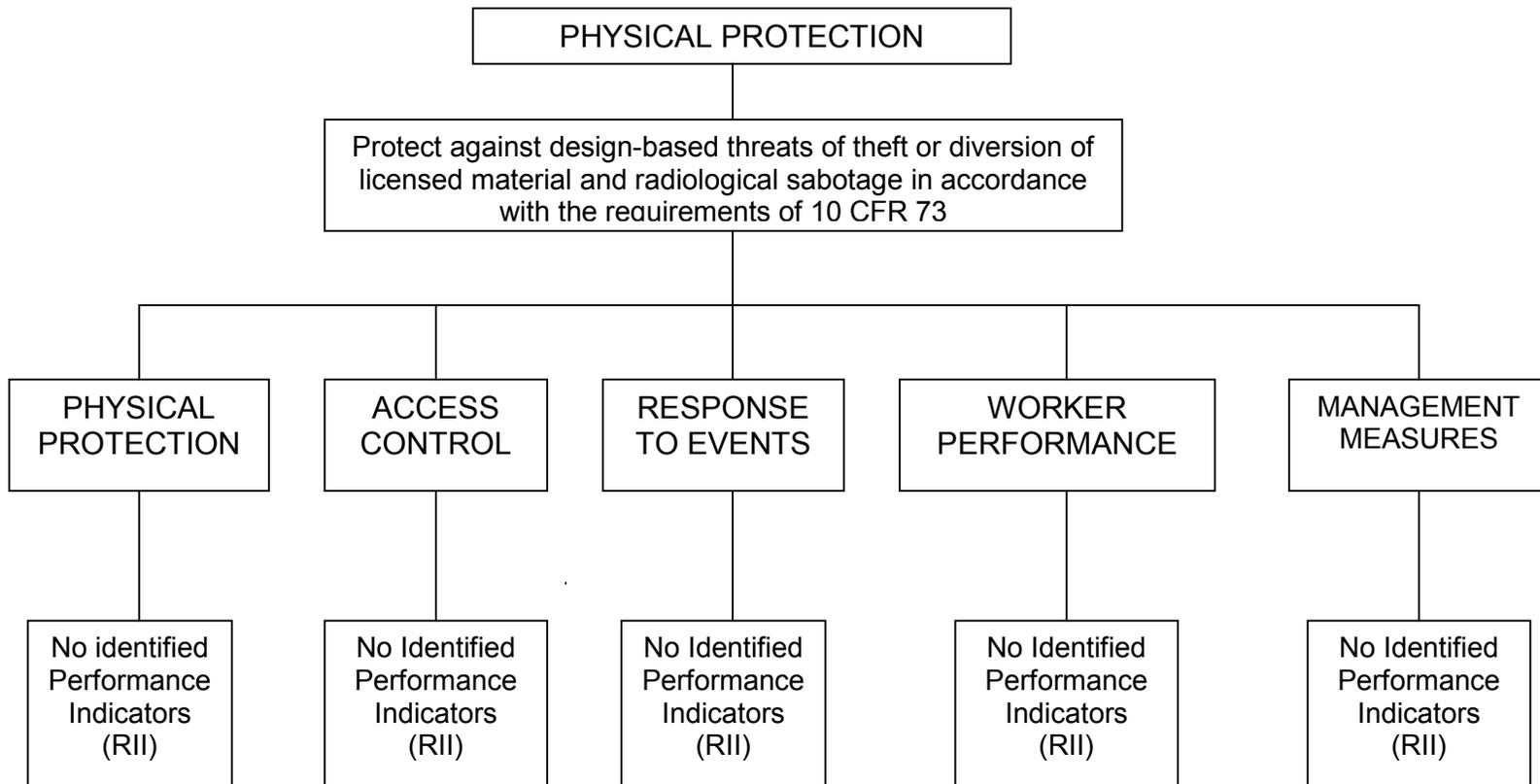
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### PUBLIC SAFETY & ENVIRONMENT



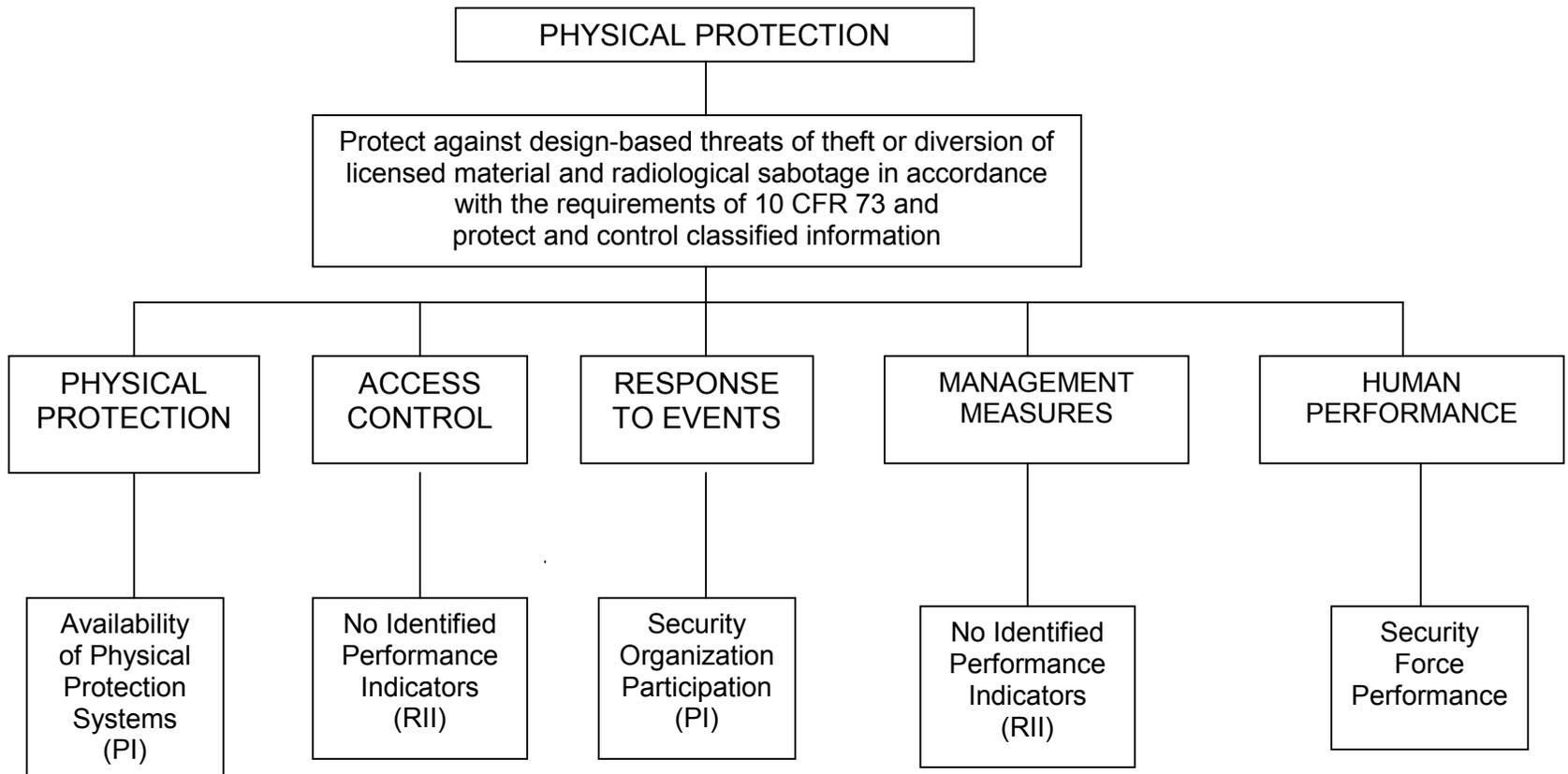
## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### PHYSICAL PROTECTION (CATEGORY 3 (LEU) FACILITY)



## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### PHYSICAL PROTECTION (CATEGORY I (HEU) FACILITY)



## CORNERSTONE OF SAFETY FOOTBALL DIAGRAMS

### MATERIAL ACCOUNTABILITY

