



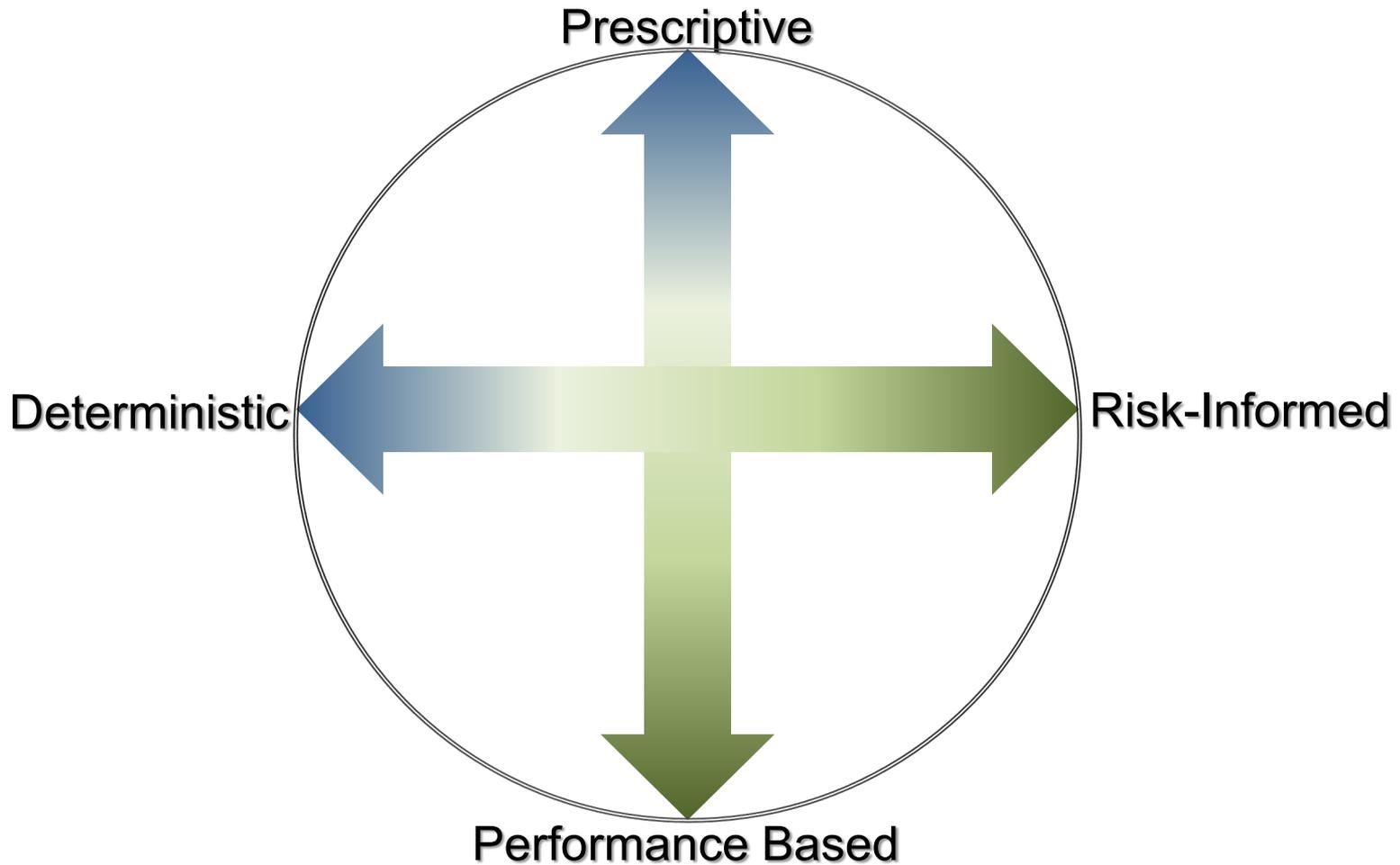
NRC Standards Forum

Risk-Informed, Performance-Based

September 26, 2017



Regulatory Approaches



- **Deterministic:**
 - Establishes requirements for engineering margin and for quality assurance in design, manufacture, and construction.
 - Assumes that adverse conditions can exist and establishes a specific set of design-basis events and related acceptance criteria based on historical information, engineering judgment, and desired safety margins.

Generally supports the design process and establishing specifications for structures, systems and components

Background / Terminology

- **Risk Informed:**

- Explicit consideration of a broader set of potential challenges to safety,
- Logical means for prioritizing these challenges based on risk significance, operating experience, and/or engineering judgment,
- Consideration of a broader set of resources to defend against these challenges,
- Explicitly identifying and quantifying sources of uncertainty in the analysis
- Better decision-making by providing a means to test the sensitivity of the results to key assumptions.

"Risk-informed" approaches lie between the "risk-based" and purely deterministic approaches. The details of the regulatory issue under consideration will determine where the risk-informed decision falls within the spectrum.

Background / Terminology

- A prescriptive requirement specifies particular features, actions, or programmatic elements to be included in the design or process, as the means for achieving a desired objective.
- A performance-based requirement relies upon measurable (or calculable) outcomes (i.e., performance results) to be met, but provides more flexibility to the licensee as to the means of meeting those outcomes.

Background / Terminology

A performance-based regulatory approach is one that establishes performance and results as the primary basis for regulatory decision-making, and incorporates the following attributes:

- 1) measurable (or calculable) parameters (i.e., direct measurement of the physical parameter of interest or of related parameters that can be used to calculate the parameter of interest) exist to monitor system, including facility and licensee, performance,
- 2) objective criteria to assess performance are established based on risk insights, deterministic analyses and/or performance history,
- 3) licensees have flexibility to determine how to meet the established performance criteria in ways that will encourage and reward improved outcomes; and
- 4) a framework exists in which the failure to meet a performance criterion, while undesirable, will not in and of itself constitute or result in an immediate safety concern.

NUREG/BR-0303, "Guidance for Performance-Based Regulation"

NGNP Concepts

Plant Capability

Defense-in-Depth reflects the decisions made by the designer in the selection of functions, structures, systems, and components for the design that assure defense-in-depth in the physical plant.

Programmatic

Defense-in-Depth reflects the decisions made regarding the processes of manufacturing, constructing, operating, maintaining, testing, and inspecting the plant and the processes undertaken that ensure plant safety throughout the lifetime of the plant.

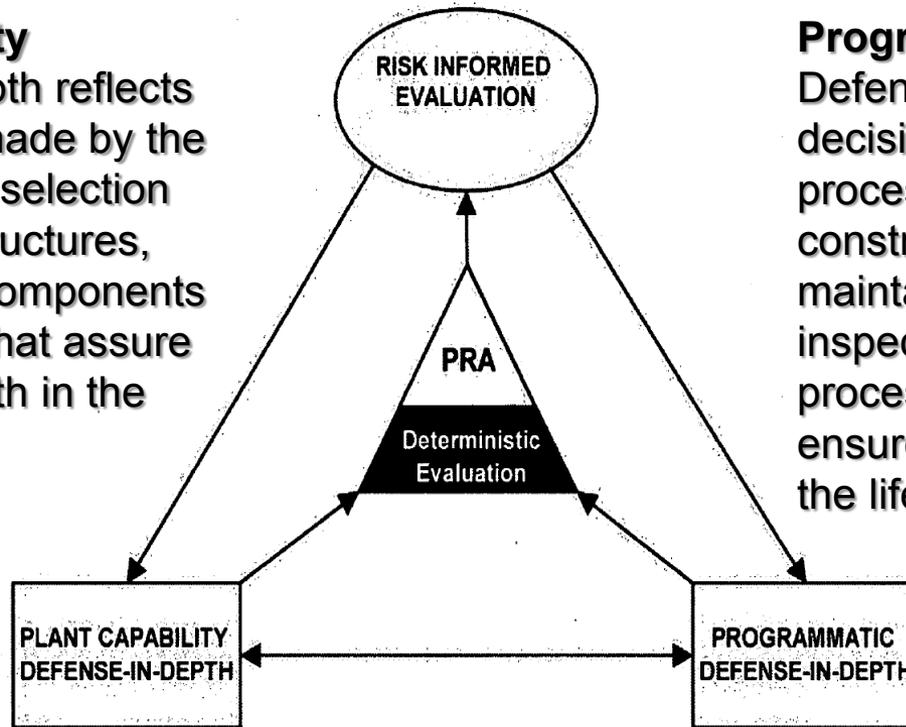


Figure E-1. Illustration showing the three major elements of the NGNP framework.

INL/EXT-09-17139
 Next Generation Nuclear Plant
 Defense-in-Depth Approach

NRC Initiatives

- **SRP Introduction, Part 2 (Light-Water SMR)**

The NRC requirements that must be met by an SSC do not change under the SMR framework. Under the graded approach, the NRC staff may rely on the applicant's submittal with selected requirements to demonstrate satisfaction of performance-based acceptance criteria in lieu of detailed independent analyses ...

- **Starting Point for non-LWR Approaches**

Goal to develop framework that meets NRC requirements in a manner commensurate with the risks posed by the technology, that maximizes regulatory certainty, and that considers the business needs of potential non-LWR applicants. Safety-focused reviews from SMR activities with additional consideration of appropriate use of integrated review of design and operational programs, including performance-based testing, inspections, and surveillances during design, construction, startup, and operations.

Standards Development

- Risk-informed, Performance-based approaches can be considered for consensus codes and standards but require a coordination of design-oriented standards and testing- and inspection-oriented standards
- Performance-based approaches might be useful to address limited operating experience for some technologies/designs