U.S.NRC
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Presentations for August 21, 2018 Public Meeting
Licensing Modernizatoin Project Guidance Document

In order of discussion, the meeting included the following topics and presentations

1) NRC Slides
2) Licensing Modernization Project Slides
3) Draft Glossary

Advanced Reactor Program

Enclosure 3

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Advanced Reactor Guidance Documents

August 21, 2018

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LMP, Rev M – ADAMS ML18150A344

DG-1353 working draft – ADAMS ML18226A212

Discussion

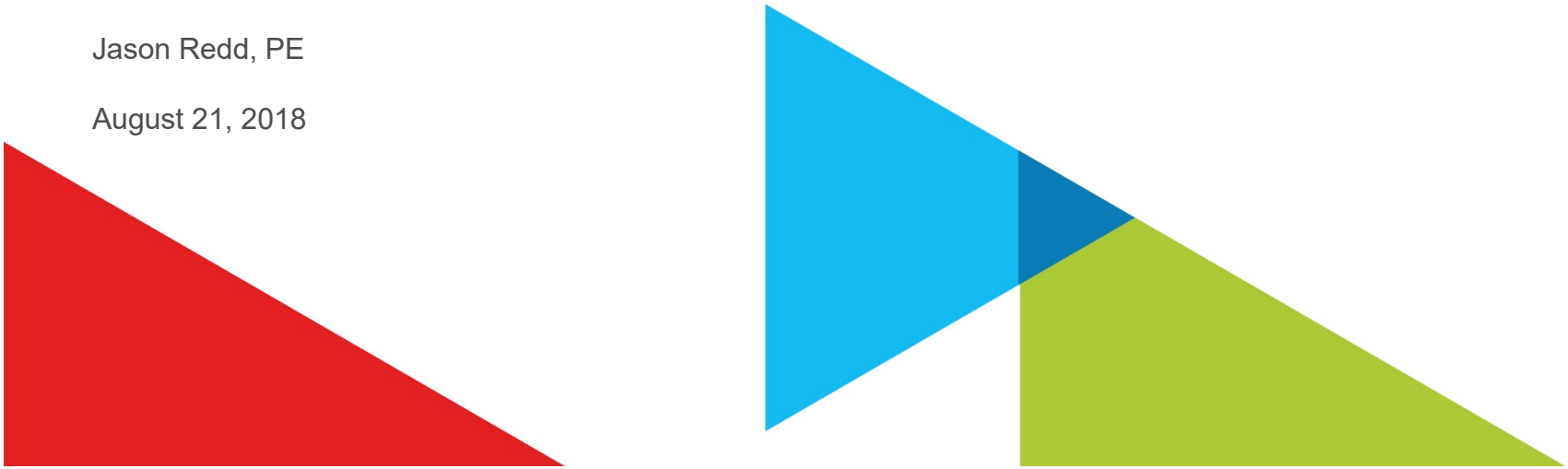
Southern Nuclear

NRC-Industry Public Workshop

Licensing Modernization Project (LMP) Guidance Document Updates

Jason Redd, PE

August 21, 2018



LMP Guidance Document Introduction

- The LMP Guidance Document represents a framework for the efficient licensing of advanced non-light water reactors (non-LWRs).
- It is the result of the LMP led by Southern Company and cost-shared by the U.S. Department of Energy (DOE).
- The LMP prepared this document for establishing licensing technical requirements to facilitate risk-informed and performance-based (RIPB) design and licensing of advanced non-LWRs.
- Such a framework acknowledges enhancements in safety achievable with advanced designs and reflects current states of knowledge regarding safety and design innovation, creating an opportunity for reduced regulatory complexity with increased levels of safety.

LMP Guidance Document Upcoming Meetings and Milestones

- August 21 – NRC Public Workshop on LMP Guidance Document. Agenda focused on resolution of June NRC and ACRS comments.
- September 13 – NRC advanced reactors stakeholder meeting. LMP team to provide update on LMP progress to date.
- October 30 – ACRS Future Plants Subcommittee meeting to review and discuss the working draft of the LMP Guidance Document and draft NRC Regulatory Guide DG-1353 addressing the LMP Guidance Document.
- December 6-8 – Full ACRS meeting to review and discuss the working draft of the LMP Guidance Document, draft NRC SECY, and draft NRC Regulatory Guide DG-1353 addressing the LMP Guidance Document.

Notable Proposed Changes from Guidance Document Rev. M to Rev. N

- Clarified language and acronyms.
  - Comments on previous versions of the LMP GD communicated that some terms such as “design function” and “safety function” appeared to have multiple meanings – updates better define and consistently employ such terms.
  - Glossary added to provide easy reference to the precise meanings of terms within the context of the LMP GD.

- Clarification that the LMP GD addresses identification of Licensing Basis Events, classification of SSC, and determination of Defense-in-Depth adequacy only. Designers and Applicants are responsible for appropriately addressing all applicable laws and regulations pertaining to their proposed activity.
  - The insights from the application of RIPB process can support the basis to demonstrate achievement of other regulatory requirement performance objectives and yield greater consistency in application content compared to historical practices.

Notable Proposed Changes from Guidance Document Rev. M to Rev. N

- Clarification that dose consequences considered in Figure 3-1 (F-C Target) are TEDE over 30 days at the Exclusion Area Boundary.
- Numerous Figures updated for clarity and consistency.
- Clear statements that activities in the identification of Licensing Basis Events, classification of SSC, and determination of Defense-in-Depth adequacy are not necessarily serial in nature and that repeated iterations of the processes are expected as the design matures.
- More specific discussion of external hazards in Section 3.2.2 regarding LBE selection.
- Further explanation of the role of physical barriers within layers of defense.

Notable Proposed Changes from Guidance Document Rev. M to Rev. N

- Figure 4-2 *Definition of Risk Significant and Safety Significant SSCs* flow diagram format replaced by Venn diagram on the same subject.
- Extensive editorial revisions to align document with guidance purpose.
  - "Shall" to "should", "will" to "may", etc.
- Table 3-1 *Definitions of Licensing Basis Events* updated to clarify definitions of LBEs.

Questions?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Initial Discussion Points from LMP on DG-1353 draft of August 16, 2018

Jason Redd, PE

August 21, 2018

Acknowledgement and Thanks

- LMP recognizes the extensive work by Bill Reckley and Amy Cubbage, along with the contributions and oversight from the NRC Staff and management, to prepare this first draft of DG-1353 *Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Approach to Inform the Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors.*

- We fully understand that the August 16, 2018 draft is a first draft of the proposed document and look forward to continued opportunity to provide input as an interested stakeholder as the document is further developed.

Initial Discussion Points from LMP on DG-1353

- No gross deltas have been identified between the process proposed by the draft LMP Guidance Document and the draft DG-1353.

- Due to the content and purpose of DG-1353, there are obvious similarities with Regulatory Guide (RG) 1.206 *Combined License Applications for Nuclear Power Plants* and its proposed Revision 1, DG-1325 *Applications for Nuclear Power Plants*. LMP seeks to understand the following:
  - Any intentional linkages by the Staff between DG-1353 and RG 1.206 / DG-1325;
  - Any NRC management expectations or direction to link these documents;
  - What differences the Staff expects between DG-1353 and RG 1.206 / DG-1325, including expected approval paths / timelines for each;
  - Is a communication plan needed to provide clarity to the Staff, NRC management, public, and industry on this topic?

Initial Discussion Points from LMP on DG-1353

- Application technical content guidance.
  - Does DG-1353 intend to provide complete technical content guidance, OR
  - Does DG-1353 intend to provide an outline of the application?

- LMP sees the starting point for non-LWR application content as being defined at a high level in the “Intended Use” section on page 7:

> “The NRC staff has determined that the methods described in the NEI 18-04, Rev. 0, constitute one acceptable means to identify licensing basis events, classify SCCs, and assess defense in depth. As described below, these activities also define a methodology for applicants to identify and provide the appropriate level of information needed to satisfy parts of the regulatory requirements in 10 CFR 50.34, 10 CFR 52.47, 10 CFR 52.79, 10 CFR 52.137, and 10 CFR 52.157.”

Initial Discussion Points from LMP on DG-1353

- Format and content guide repository.
  - NUREG-1537 *Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors* variant;
  - Non-LWR SRP variant;
  - Design Specific Review Standard (DSRS) variants;
  - Revision of NUREG-0800 *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition*, or
  - Other ideas?

- Format and structure.
  - Considerations of non-LWR, LWR, and nonpower facilities having unique format structures for their applications.
    - Pros / Cons

Initial Discussion Points from LMP on DG-1353

- Establishment of guidance for determining when “enough is enough”.
  - Application content;
  - Defense-in-depth.

- Lower frequency cutoff for event sequences and how the “cliff-edge” and “safety terrain” reviews are conducted and concluded.

- Terminology clarifications.
  - “Safety importance” and “risk importance”;
  - “Layers of defense (including barriers)”;
  - “Risk significant functions”;
  - “Functional Design Criteria”.

- External events treatment.
  - Potential delta between LMP GD update and draft DG-1353.
  - Expectations for “a full set of internal and external events” PRA scope.

Initial Discussion Points from LMP on DG-1353

- Multi-module treatment.
  - Comparison with current LWR requirements.

- Lower frequency cutoff
  - LMP has concerns about text under Licensing Basis Events - Staff Position b). LMP would like to discuss further to improve understanding.

LMP continues to review the draft DG-1353 and looks forward to continuing discussions with the Staff.

Questions?


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LMP Term	Acronym	Definition	Source
Terms associated with Functions			
Fundamental Safety Function	FSF	Safety functions common to all reactor technologies and designs. Includes control heat generation, control heat removal and confinement of radioactive material	IAEA-TECDOC-1570
PRA Safety Function	PSF	Reactor design specific SSC functions modeled in a PRA that serve to prevent and/or mitigate a release of radioactive material or to protect one or more barriers to release. In ASME/ANS-Ra-S-1.4-2013 these are referred to as "safety functions." The modifier PRA is used in the LMP GD to avoid confusion with safety functions performed by Safety Related SSCs.	LMP, ASME/ANS-Ra-S-1.4-2013
Prevention Function	-	An SSC function that, if fulfilled, will preclude the occurrence of an adverse state. The reliability of the SSC in the performance of such functions serves to reduce the probability of the adverse state.	LMP
Mitigation Function	-	An SSC function that, if fulfilled, will eliminate or reduce the consequences of an event in which the SSC function is challenged. The capability of the SSC in the performance of such functions serves to eliminate or reduce any adverse consequences that would occur if the function were not fulfilled.	LMP
Required Safety Function	RSF	A PRA safety function that is required to be fulfilled to maintain the consequence of one or more DBEs or the frequency of one or more high consequence BDBEs inside the F-C Target	LMP
Required Functional Design Criteria	RFDC	Reactor design-specific functional criteria that are necessary and sufficient to meet the Required Safety Functions	LMP
Safety Related Design Criteri	SRDC	Design criteria for SR SSCs that are necessary and sufficient to fulfill the RFDCs for those SSCs selected to perform the RSFs	LMP

LMP Term	Acronym	Definition	Source
Terms Associated with Licensing Basis Events			
Anticipated Operational Occurrence	AOO	Anticipated event sequences expected to occur one or more times during the life of a nuclear power plant, which may include one or more reactor modules. Event sequences with mean frequencies of 1×10^{-2}/plant-year and greater are classified as AOOs. AOOs take into account the expected response of all SSCs within the plant, regardless of safety classification.	LMP
Design Basis Event	DBE	Infrequent event sequences that are not expected to occur in the life of a nuclear power plant, which may include one or more reactor modules, but are less likely than AOOs. Event sequences with mean frequencies of 1×10^{-4}/plant-year to 1×10^{-2}/plant-year are classified as DBEs. DBEs take into account the expected response of all SSCs within the plant regardless of safety classification. The objective and scope of DBEs form the safety design basis of the plant.	LMP
Beyond Design Basis Event	BDBE	Rare event sequences that are not expected to occur in the life of a nuclear power plant, which may include one or more reactor modules, but are less likely than a DBE. Event sequences with frequencies of 5×10^{-7}/plant-year to 1×10^{-4}/plant -year are classified as BDBEs. BDBEs take into account the expected response of all SSCs within the plant regardless of safety classification.	LMP
Design Basis Accident	DBA	Postulated accidents that are used to set design criteria and performance objectives for the design of Safety Related SSCs. DBAs are derived from DBEs based on the capabilities and reliabilities of Safety-Related SSCs needed to mitigate and prevent accidents, respectively. DBAs are derived from the DBEs by prescriptively assuming that only Safety Related SSCs classified are available to mitigate postulated accident consequences to within the 10 CFR 50.34 dose limits.	LMP
Licensing Basis Event	LBE	The entire collection of event sequences considered in the design and licensing basis of the plant, which may include one or more reactor modules. LBEs include normal operation, AOOs, DBEs, BDBEs, and DBAs.	LMP
Frequency-Consequence Target	F-C Target	A target line on a frequency-consequence chart that is used to evaluate the risk significance of LBEs and to evaluate risk margins that contribute to evidence of adequate defense-in-depth	LMP
Risk Significant LBE	-	An LBE whose frequency and consequence meet a specified risk significance criterion. In the LMP framework, an AOO, DBE, or BDBE is regarded as risk significant if the combination of the upper bound (95%tile) estimates of the frequency and consequence of the LBE are within 1% of the F-C target AND the upper bound 30-day TEDE dose at the EAB exceeds 25mrem	LMP

LMP Term	Acronym	Definition	Source
Terms Associated with Plant Design and Structures, Systems, and Components (SSCs)			
Design Basis External Hazard Level	DBEHL	A design specification of the level of severity or intensity of an external hazard for which the Safety Related SSCs are designed to withstand with no adverse impact on their capability to perform their RSFs.	LMP
Plant		The collection of site, buildings, radionuclide sources, and SSCs seeking a license under the LMP framework. The plant may unclude a singe reactor unit or multiple reactor modules as well as non-reactor radionuclide sources.	LMP
Multi-module Plant	-	A plant comprising multiple reactor modules that are designed and constructed using a modular design approach. . Modular design means a nuclear power plant that consists of two or more essentially identical nuclear reactors (modules) and each module is a separate nuclear reactor capable of being operated independent of the state of completion or operating condition of any other module co-located on the same site, even though the nuclear power plant may have some shared or common systems.	Multi-module plant adapted from ASME/ANS-Ra-S-1.4-2017, modular design from 10CFR52.1

LMP Term	Acronym	Definition	Source
Safety Related SSCs	SR SSCs	SSCs that are credited in the fulfillment of RSFs and are capable to perform their RSFs in response to any Design Basis External Hazard Level	LMP
Non-Safety Related with Special Treatment SSCs	NSRST SSCs	Non-safety related SSCs that perform risk significant functions or perform functions that are necessary for defense-in-depth adequacy	LMP
Non-Safety Related with No Special Treatment SSCs	NST SSCs	All SSCs within a plant that are neither Safety Related SSCs nor Non-Safety Related SSCs with Special Treatment SSCs.	LMP
Risk Significant SSC	-	An SSC that meets defined risk significance criteria. In the LMP framework, an SSC is regarded as risk-significant if its PRA safety function is: a) required to keep one or more LBEs inside the F-C Target based on mean frequencies and consequences; or b) if the total frequency LBEs that involve failure of the SSC PRA safety function contributes at least 1% to any of the LMP cumulative risk targets. The LMP cumulative risk targets include: (i) maintaining the frequency of exceeding 100mrem to less than 1/plant year; (ii) meeting the NRC Safety Goal QHO for individual risk of early fatality; and (iii) meeting the NRC Safety Goal QHO for individual risk fo latent cancer fatality .	LMP
Safety Significant SSC	-	An SSC that performs a function whose performance is necessary to achieve adequate defense-in-depth or is classified as risk significant (see Risk Significant SSC).	LMP
Safety design approach		The strategies that are implemented in the design of a nuclear power plant that are intended to support safe operation of the plant and control the risks associated with accidental releases of radioactive material and protection of the public and plant workers. These strategies normally include the use of robust barriers, multiple layers of defense, redundancy, and diversity, and the use of inherent and passive design features to perform safety functions	LMP
Terms Associated with Risk-Informed and Performance Based Regulation and Decision Making			
Defense-in-Depth	DID	An approach to designing and operating nuclear facilities that prevents and mitigates accidents that release radiation or hazardous materials. The key is creating multiple independent and redundant layers of defense to compensate for potential human and mechanical failures so that no single layer, no matter how robust, is exclusively relied upon. Defense-in-depth includes the use of access controls, physical barriers, redundant and diverse key safety functions, and emergency response measures."	NRC Glossary
Layers-of-defense	-	Layers of defense are those plant capabilities and programmatic elements that provide, collectively, independent means for the prevention and mitigation of adverse events.	LMP

LMP Term	Acronym	Definition	Source
		The actual layers and number are dependent on the actual source and hazard posing the threat. See Defense-in-Depth	

LMP Term	Acronym	Definition	Source
Performance-based decision making	PB	An approach that focuses on desired objective,calculable or measurable, observable outcomes, rather than prescriptive processes, techniques, or procedures. Performance-based decisions lead to defined results without specific direction regarding how those results are to be obtained. At the NRC, performance-based regulatory actions focus on identifying performance measures that ensure an adequate safety margin and offer incentives and flexibility for licensees to improve safety without formal regulatory intervention by the agency.	Adapted from NRC Glossary definition of performance-based regulation in order to apply to both design decisions and regulatory decision making
Risk-informed decision making	RI	An approach to decision making, in which insights from probabilistic risk assessment are considered with other engineering insights.	Adapted from NRC Glossary definition of performance-based regulation in order to apply to both design decisions and regulatory decision making
Terms Associated with Probabilistic Risk Assessment			
Initiating Event	IE	A perturbation to the plant during a POS that challenges plant control and safety systems whose failure could potentially lead to an undesirable end state and/or radioactive material release. An initiating event could degrade the reliability of a normally operating system, cause a standby mitigating system to be challenged, or require that the plant operators respond in order to mitigate the event or to limit the extent of plant damage caused by the initiating event. These events include human-caused perturbations and failure of equipment from either internal plant causes (such as hardware faults, floods, or fires) or external plant causes (such as earthquakes or high winds). An initiating event is defined in terms of the change in plant status that results in a condition requiring shutdown or a reactor trip (e.g., loss of main feedwater system, small RCPB breach) when the plant is at power, or the loss of a key safety function (e.g., DHR) for non-power modes of operation. A specific type of initiating event may be identified as originating from a specific cause as defined in terms such as “flood-induced transient” or “seismically induced RCPB breach.”	ASME/ANS-Ra-S-1.4-2013

LMP Term	Acronym	Definition	Source
Event Sequence	ES	A representation of a scenario in terms of an initiating event defined for a set of initial plant conditions [characterized by a specified plant operating state (POS)] followed by a sequence of system, safety function, and operator failures or successes, with sequence termination with a specified end state (e.g., prevention of release of radioactive material or release in one of the reactor-specific release categories. An event sequence may contain many unique variations of events (minimal cut sets) that are similar in terms of how they impact the performance of safety functions along the event sequence.	ASME/ANS-Ra-S-1.4-2013
Event Sequence Family	-	A grouping of event sequences with a common or similar POS, initiating event, hazard group, challenges to the plant safety functions, response of the plant in the performance of each safety function, response of each radionuclide transport barrier, and end state. An event sequence family may involve a single event sequence or several event sequences grouped together. Each release category may include one or more event sequence families. Event sequence families are not required to be explicitly modeled in a PRA. Each event sequence family involving a release is associated with one and only one release category.	ASME/ANS-Ra-S-1.4-2014
PRA Terms (Cont'd)			
End State		The set of conditions at the end of an Event Sequence that characterizes the impact of the sequence on the plant or the environment. In most PRAs, end states typically include success states (i.e., those states with negligible impact) and Release Categories.	ASME/ANS-Ra-S-1.4-2014
PRA Technical Adequacy	-	A set of attributes that define the technical suitability of a PRA capability to provide "fit for purpose" insights to risk-informed decision making. It includes consideration of realism, completeness, transparency, PRA model-to-plant as-designe d and as-built fidelity state, identification and evaluation of uncertainties relative to risk levels. Strategies to achieve technical adequacy include conformance to consensus PRA standards, performance of PRA peer reviews, and structured process for PRA model configuration control, maintenance and updates, and incorporation of new evidence that comprises the state of knowledge reflected in the PRA model development and its quantification.	LMP

LMP Term	Acronym	Definition	Source
Plant Operating State	POS	A standard arrangement of the plant during which the plant conditions are relatively constant, are modeled as constant, and are distinct from other configurations in ways that impact risk. POS is a basic modeling device used for a phased-mission risk assessment that discretizes the plant conditions for specific phases of an LPSD evolution. Examples of such plant conditions include, e.g., core decay heat level, primary coolant level, primary temperature, primary vent status, reactor building status, and DHR mechanisms. Examples of risk impacts that are dependent on POS definition include the selection of initiating events, initiating event frequencies, definition of accident sequences, success criteria, and accident sequence quantification.	ASME/ANS-Ra-S-1.4-2014
Mechanistic Source Terms	MST	A source term that is calculated using models and supporting scientific data that simulate the physical and chemical processes that describe the radionuclide inventories and the time-dependent radionuclide transport mechanisms that are necessary and sufficient to predict the source term.	ASME/ANS-Ra-S-1.4-2016
Additional Terms			
Implementation Guidance		???	