



Canadian Nuclear  
Safety Commission

Commission canadienne  
de sûreté nucléaire

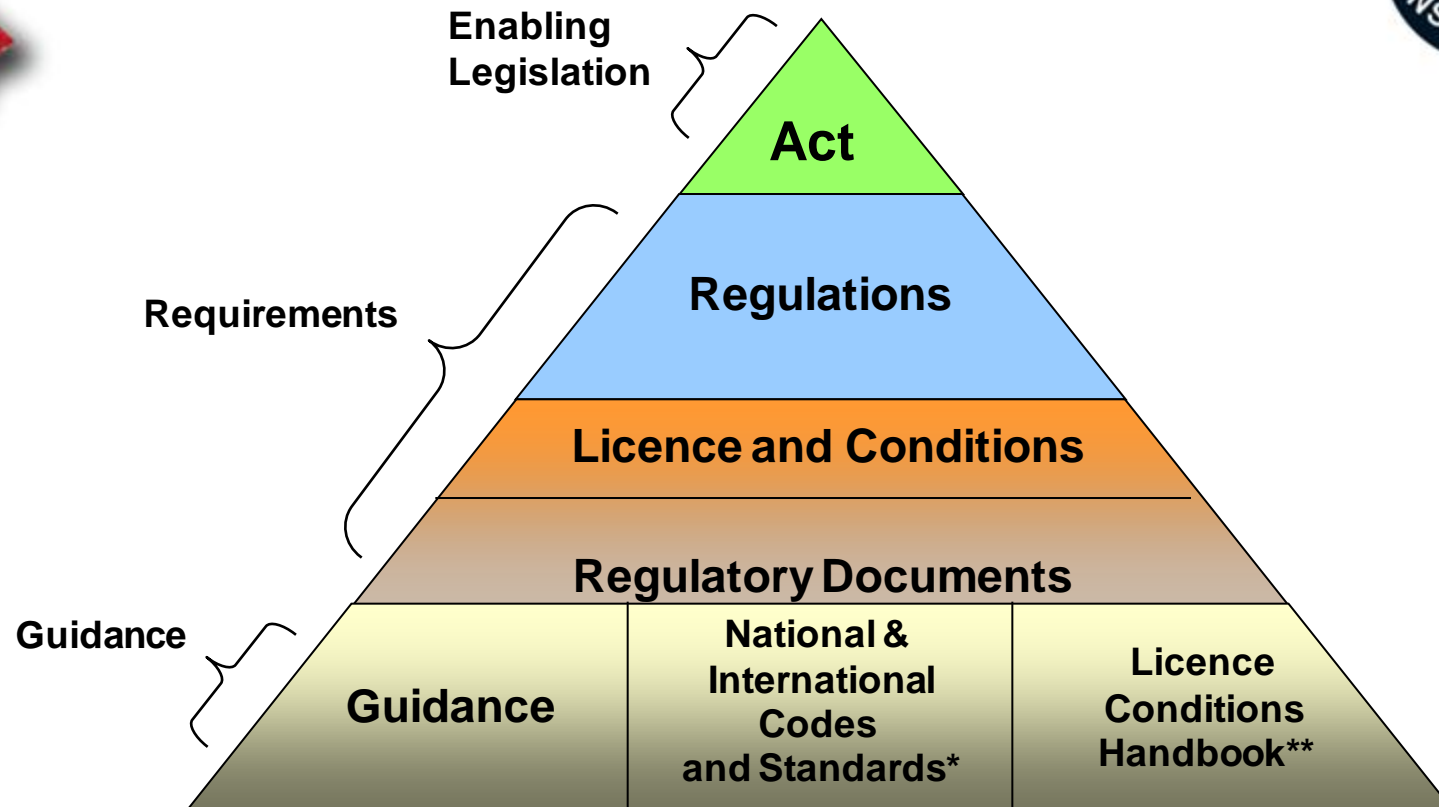


# ***Lessons Learned From Canadian Pre-Project Design Review***

## ***Quality Assurance of Design***

[nuclearsafety.gc.ca](http://nuclearsafety.gc.ca)

# Canadian Legislative & Regulatory Framework



\* Requirements if referred to in the licence

\*\* In addition to regulatory requirements, LCH defines the licensee-produced documents forming the licensing basis

# *Nuclear Safety and Control Act*



26. Subject to the regulations, no person shall, except in accordance with a licence,
- a) possess, transfer, import, export, use or abandon a nuclear substance, prescribed equipment or prescribed information;
  - b) mine, produce, refine, convert, enrich, process, reprocess, package, transport, manage, store or dispose of a nuclear substance;
  - c) produce or service prescribed equipment;
  - d) operate a dosimetry service for the purposes of this Act;
  - e) prepare a site for, construct, operate, modify, decommission or abandon a nuclear facility; or
  - f) construct, operate, decommission or abandon a nuclear-powered vehicle or bring a nuclear-powered vehicle into Canada.

# *Class I Nuclear Facilities Regulations*



“Class IA nuclear facility” means any of the following nuclear facilities:

- a) a nuclear fission or fusion reactor or subcritical nuclear assembly; and
- b) a vehicle that is equipped with a nuclear reactor.

Class I Licences:

- a) Licence to Prepare Site requires:
  - the proposed quality assurance program for the design of the nuclear facility;
- b) Licence to Construct requires:
  - a description of the proposed design of the nuclear facility ...;
- c) Licence to Operate;
- d) Licence to Decommission;
- e) Licence to Abandon.

# Pre-Licensing Review



- What is a pre-licensing review?
  - Also known as a vendor design review;
  - Not required as part of the licensing process;
  - An optional service that the CNSC provides for the assessment of a vendor's design for a nuclear power plant or small reactor;
  - Provides the early identification and resolution of potential regulatory or technical issues in the design process;
  - Evaluates whether the vendor understands Canadian regulatory requirements and expectations;
  - Evaluates compliance with, as applicable, CNSC regulatory documents RD-337, *Design of New Nuclear Power Plants* or RD-367, *Design of Small Reactor Facilities* and related regulatory documents and national standards.

# *Pre-Licensing Review*



- **GD-385:** Pre-licensing Review of a Vendor's Reactor Design
- **Phase 1** – Determines if, at an overall level, the design intent complies with CNSC design requirements.
- **Phase 2** – Goes into further detail, with a focus on identifying potential fundamental barriers to the licensing of the vendor's design for nuclear power plant or small reactor in Canada.
- **Phase 3** – Vendor can choose to follow up on certain aspects of Phase 2 findings by:
  - seeking more information or clarification from the CNSC about a Phase 2 topic, and/or
  - asking the CNSC to review activities undertaken towards design readiness, following the completion of Phase 2



# Typical Review Topics



1. General NPP description - defence-in-depth, safety goals and objectives, and dose acceptance criteria
2. Classification of systems, structures & components
3. Reactor core nuclear design
4. Fuel design and qualification
5. Control system and facilities (main control systems, instrumentation and control, control facilities, emergency power systems)
6. Means of reactor shutdown
7. Emergency core cooling and emergency heat removal systems
8. Containment and safety important civil structures
9. Beyond Design Basis Accidents (BDBA) and severe accident prevention and mitigation
10. Safety Analysis (Deterministic and Probabilistic) and internal and external hazards
11. Pressure boundary design
12. Fire protection
13. Radiation protection
14. Out-of-core criticality
15. Robustness, safeguards and security
16. Vendor research and development program
17. Management system of design process and quality assurance in design and safety analysis
18. Human factors
19. Incorporation of decommissioning into design considerations

# *Quality Assurance for Design*



- Identified directly by the Regulations;
- Identified by numerous Regulatory Documents;
- QA requirements specified by CSA N286 standard and RD-337/367;
- RD-337/367 includes additional design management requirements;
- Safety Analysis a sub-set of design.



# ***Lessons Learned From Design Reviews***



- CSA N286 standard published in 1992;
- QA regulatory requirement introduced in 2000;
- RD-337 issued in 2008;
- Current fleet of Canadian reactors are CANDUs;
- Canadian utilities considering other reactor designs.

# *Lessons Learned From Design Reviews*



1. Each reactor design runs as an autonomous project;
2. Project QAP incomplete or not aligned with governance;
3. Design management process not defined;
4. Lack of implementing procedures;
5. Interfaces not clearly defined;
6. Control of design non-conformances;
7. Design verification;
8. Use of previously finished and verified design ;

# *Lessons Learned From Design Reviews*



9. Processes to ensure compliance with the RD-337 Management of Design requirements;
10. Design Authority function;
11. Proven Design;
12. Safety Analysis.

