Canada's Nuclear Regulator

Minimum Staff Complement
Safety in Numbers

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Outline

- CNSC Mission
- Regulatory Oversight of Human Factors
- Minimum Staff Complement (MSC)
- Regulatory Guide G323
- Experience

Canadian Nuclear Safety Commission

Mission:

- Protect the health, safety and security of persons and the environment; and implement Canada's international commitments on the peaceful use of nuclear energy

The CNSC Regulates All Nuclear-Related Facilities and Activities in Canada

- uranium mines and mills
- uranium fuel fabricators and processing
- nuclear power plants
- waste management facilities
- nuclear substance processing
- industrial and medical applications
- nuclear research and education
- export/import control

Human Factors

- Regulatory Policy Statement:
  - "The Canadian Nuclear Safety Commission recognizes that human factors can affect the performance of the facilities and activities that it regulates." (P-119, 2000)

- Human Factors are the factors that influence human performance as it relates to the safety of a nuclear facility or activity over all phases, from design to decommissioning.

CNSC Human and Organizational Performance Review Areas

Human Performance

Human Factors in Design

Human Actions in Safety Analysis

Work organization & Job design
Minimum Staff Complement

HUMAN FACTORS GOAL
Minimize potential for human error by addressing factors that may adversely influence human performance

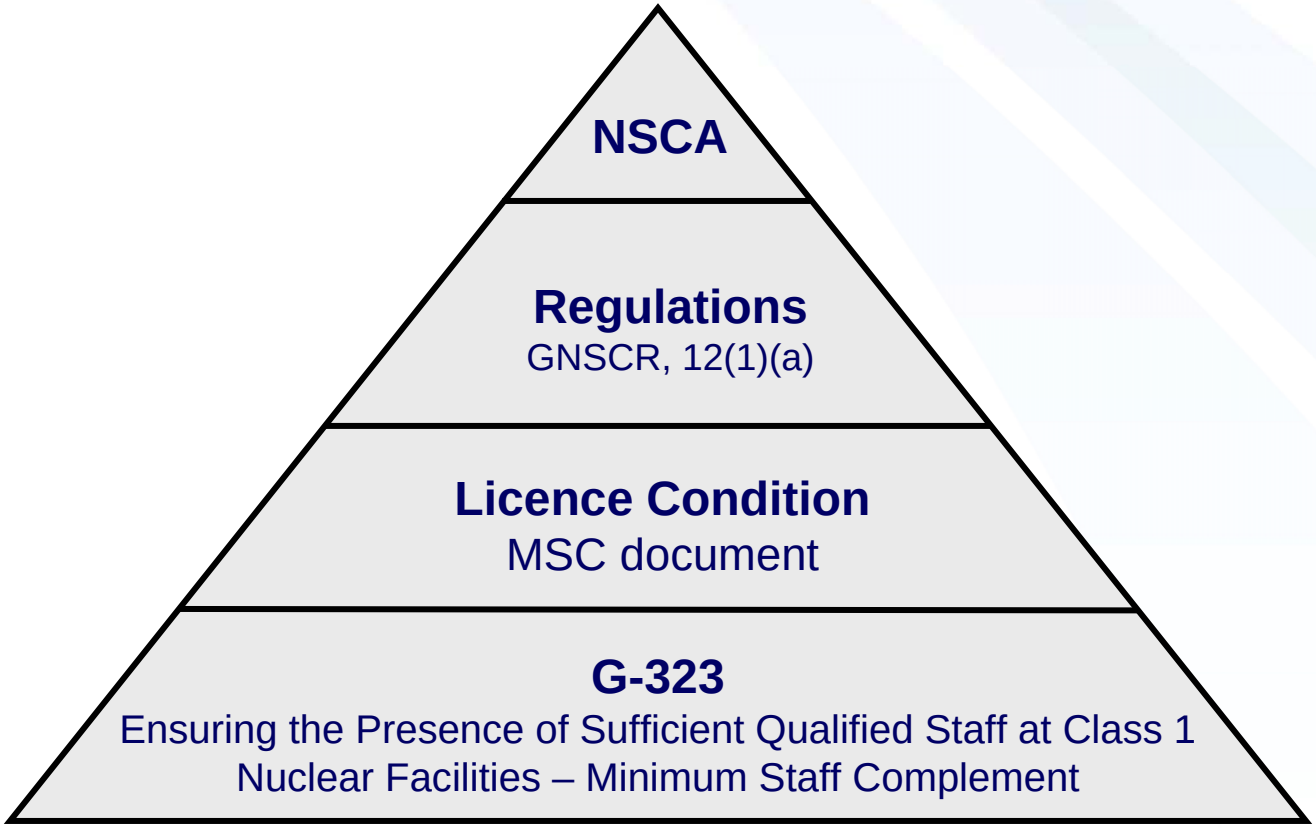
Procedures and Job Aids

Organizational Performance

Fitness for Duty

Performance Monitoring and Improvement

CNSC's Regulatory Framework with respect to MSC



CNSC Regulatory Requirements

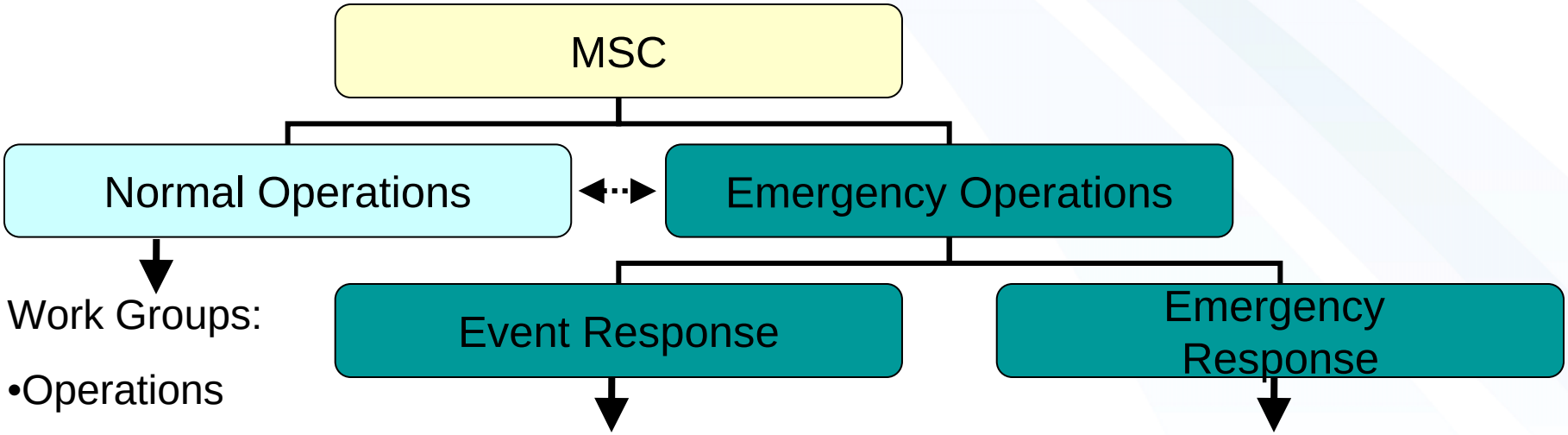
- *General Nuclear Safety and Control Regulations* 12 (1)(a) require licensees to "*ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely*"

CNSC Regulatory Guide G-323:

Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities - Minimum Staff Complement

Minimum Staff Complement is “minimum number of qualified workers who must be present at all times to ensure the safe operation of the nuclear facility and to ensure adequate emergency response capability”

Minimum Staff Complement



Work Groups:

- Operations
- Maintenance
- Fuel Handling
- Chemistry
- Stores

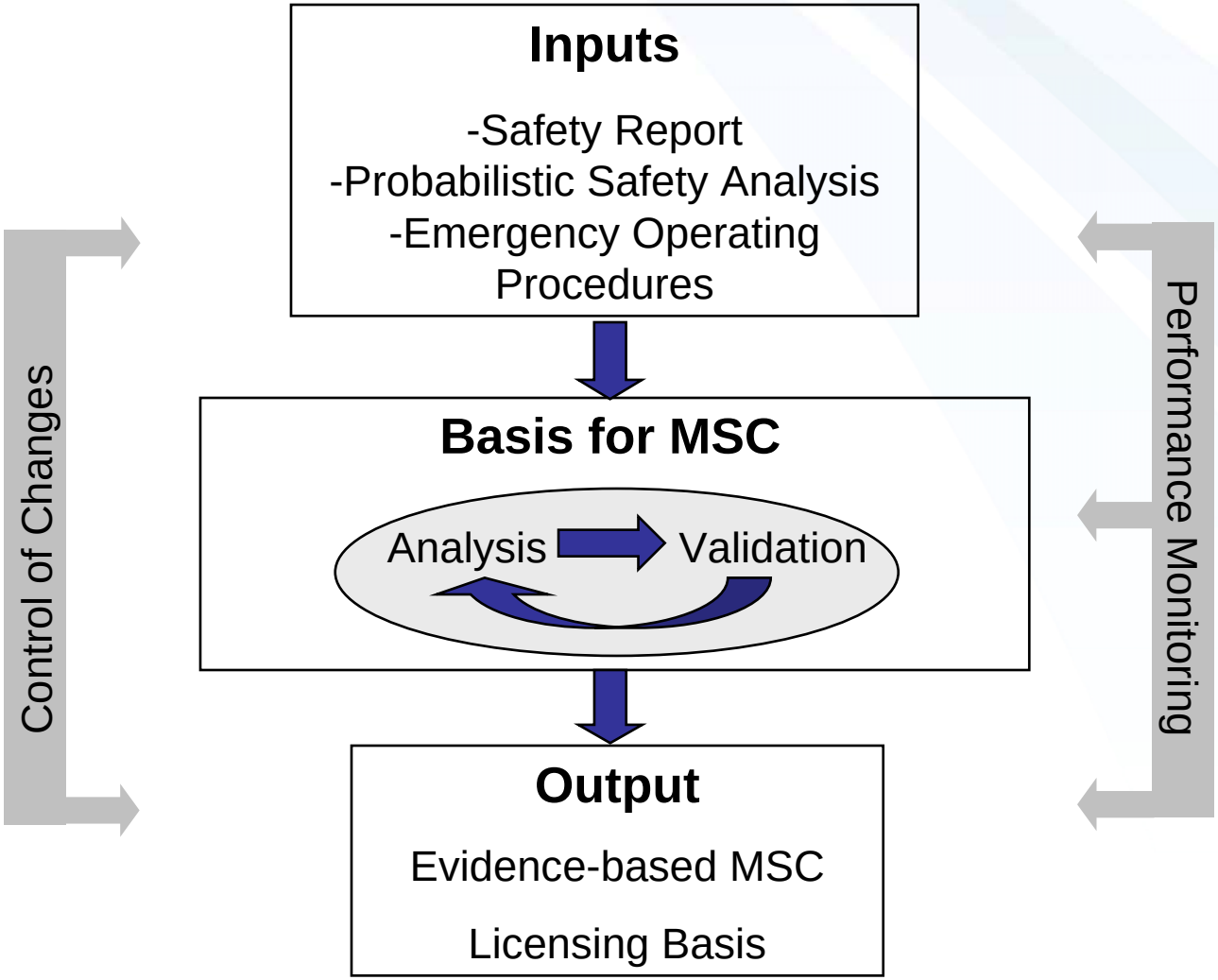
Response is dependent upon the specific event:

- operations
- MSLB, seismic event, pump failure

Independent of the specific event:

- off-site survey, source term survey, fire,
- emergency entry repair

Conceptual Framework of G-323



MSC Systematic Analysis

- Identify the most resource-intensive conditions under all operating states, design basis accidents and emergencies
- Information is derived from
  - Events identified in safety report
  - Credited operator actions
  - Credible events in the PSA
  - Emergency operating procedures
  - Operating strategies
- Determine the number and qualifications of staff required

MSC Systematic Analysis - Considerations

Single unit stations

- Single unit events

Multi-unit stations

- Single unit events
- Single unit events that affect other units
- Common mode events

A site

B site

Multi-unit / Multi-station

- Single unit events
- Single unit events that affect other units
- Common mode events
- Events which affect multiple stations

Validation

- MSC numbers and qualifications are validated
- An iterative process using methods with progressively higher degrees of fidelity to confirm and refine analysis
  - Table top exercises
  - Field walk-downs
  - Integrated validation exercises
- CNSC G-278 Human Factors Verification and Validation Plans

Validation (continued)

- Integrated System Validation: "an evaluation using performance-based tests to determine whether an integrated system design meets performance requirements and acceptably supports safe operation of the plant." (NUREG 0711)
- Scenarios should include the most resource intensive and credible events for all operating states
- G-323 identifies a number of objectives to be demonstrated during the validation exercises

Output of Analysis and Validation

- Evidence-based MSC forms part of the licensing basis for the nuclear facility
- Documentation of method and results;
  - Knowledge management tool for licensee & regulatory staff
  - Basis for changes

MSC Performance Monitoring

- Compliance with MSC is a licence condition
- Ensure adequacy of numbers and qualifications of the MSC is based on a continuing review of performance information

Control of Changes to MSC

- A documented MSC based on a systematic analysis and validation is the foundation for future changes to MSC
  - operating experience, events, changes to the safety report, new equipment, modified procedures, or training issues should prompt a review of MSC
  - proposed changes to MSC must be evaluated to ensure basis remains valid

Importance of MSC

- MSC enables the execution of critical safety functions during normal operations through to emergency response;
  - assess the state of the plant
  - confirm automatic actions
  - perform actions required to control the reactor, cool the fuel, and ensure the integrity of containment
- Adequate staffing is integral part of a licensee's approach to event mitigation and is an important safety barrier

Implementation of G-323

- Design basis seismic event
- Multi-unit/multi-station event with main control room uninhabitable at one station
- Loss of all classes of power and equipment not seismically qualified
- Operation with MSC for 8 hours
- Integrated validation exercise involved MCR and field staff
- Simulation of emergency response organization

MSC Analysis Experience

- MSC is the combined total of resource intensive events for each work group
- A multi-disciplinary approach is necessary to ensure a thorough understanding of event progression
- The station resource-limiting event was different than originally assumed
- The project identified the need to safeguard the MSC analysis to ensure that it remains valid

MSC Validation Experience

- Validation has advantages over training for identifying areas for system improvement
- Field validation work
  - discovered a credited field action which could not be completed within the time frame identified in the safety report
  - identified procedural inadequacies, accessibility issues and plant configuration discrepancies
- Integrated validation exercise identified issues not discovered during lower fidelity validation or procedure reviews

Conclusion

- Minimum staff complement is an integral part of a licensee's approach to normal operations and event mitigation
- A systematic analysis and validation demonstrate that a licensee has sufficient staff on-site at all times to control, cool and contain the reactor
- G-323 provides guidance to meet the requirements of the regulations and the operating licence

Thank you!

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