Risk Based Approach to Regulating Fuel Facilities in Canada

Workshop on Fuel Cycle Safety
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Henry Rabski
Director
Processing and Research Facilities Division
MANDATE UNDER THE NSCA

The *Nuclear Safety and Control Act* obliges the CNSC to:

- Regulate the development, production and use of nuclear energy in Canada;
- Regulate the production, possession, use and transport of nuclear substances, prescribed equipment and prescribed information;
- Implement measures to respect Canada’s international commitments on the peaceful use of nuclear energy; and
- Disseminate scientific, technical and regulatory information concerning the activities of the CNSC.

*To Protect Health, Safety, Security and the Environment*
NUCLEAR FACILITIES IN CANADA
REFINING IN CANADA

In Blind River, yellowcake is processed to uranium trioxide (UO$_3$).

It then continues on to Port Hope, where the conversion facility produces uranium dioxide (UO$_2$) for use in CANDU reactors and uranium hexafluoride (UF$_6$) for use in light water reactors.

These products continue on to fuel fabrication facilities in Canada, the United States or Europe, for example.
FUEL FABRICATION IN CANADA

Zircatec Precision Industries – Port Hope, Ontario

GE Hitachi Nuclear Energy Canada Inc. - Toronto (Pellet Production) & Peterborough, Ontario (Bundle Assembly)
The CNSC is a federal agency, and is subject to the Canadian Environmental Assessment Act.

For each stage:
- Application
- CNSC Assessment
  - Environmental Assessment
  - Licensing Assessment
- Licensing
- Compliance
- Financial Assurance

CNSC LICENSING PROCESS
LIFE CYCLE LICENSING

1. Site Preparation
2. Construction
3. Operation
4. Decommissioning
5. Abandonment
REGULATORY COMPLIANCE

- *Nuclear Safety and Control Act*
- Regulations
- Facility licence
- Guides and standards
RISK BASED APPROACH TO REGULATION

Status  88 Facilities to Regulate

Challenges
• Diversity of facilities
• Location / accessibility
• Limited resources
• Consistency

Solution
• Develop an approach to minimize regulatory risk
## RISK MATRIX

<table>
<thead>
<tr>
<th>Impact</th>
<th>Considerable impact</th>
<th>Management effort</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Significant</strong> impact</td>
<td>Considerable management of risk is required</td>
<td>Must manage and monitor risk with occasional control</td>
<td>Extensive management is essential. Constant monitoring and control</td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td><strong>Moderate</strong> impact</td>
<td>Accept risks with occasional monitoring</td>
<td>Management effort is worthwhile but not essential</td>
<td>Management effort and control is required</td>
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<td>2</td>
<td></td>
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</tr>
<tr>
<td><strong>Minor</strong> impact</td>
<td>Acceptable risks Random monitoring</td>
<td>Accept risks with monitoring (no management)</td>
<td>Manage and monitor risks</td>
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<td>1</td>
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</tbody>
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**Probability**
- Unlikely to occur ($L$)
- Might occur ($M$)
- Expected to occur ($H$)
TECHNICAL RISK AREAS

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Operating Organization</td>
</tr>
<tr>
<td>2.</td>
<td>Facility Design and Condition</td>
</tr>
<tr>
<td>3.</td>
<td>Emergency Preparedness</td>
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<tr>
<td>4.</td>
<td>On-site Personnel Protection</td>
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<tr>
<td>5.</td>
<td>Environmental Protection</td>
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</tbody>
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RISK TOLERANCE

Risk is characterized by:

Probability X Consequence X Tolerance
CONSIDERATIONS IN DETERMINING TOLERANCE

- Magnitude of the hazard
- Safety significance
- Geographic considerations
- Consequence of failure
- Probability of failure
- Knowledge / familiarity of the risk
- Impact on the environment
- Importance to the key risk areas
- Public and staff perception of risk
CONSIDERATIONS IN DETERMINING TOLERANCE (cont’d)

- Level of complexity
- Licensee ability to meet regulatory requirements
- Performance and safety history
- Defence-in-depth
- Uncertainty
- Precautionary principle
- Impact on resources
- Impact on achievement of objectives
- Impact on commitments
- Impact on values and ethics
RISK RANKING – EXAMPLE

- **Uranium Conversion Facility**
  
  Overall Ranking  H2
  
  Six inspections  Type II (minimum)
  
  Audits – radiation protection, environment and quality assurance

- **Fuel Fabrication Facility**
  
  Overall Ranking  M2
  
  Four inspections  Type II
  
  Audits – quality assurance
CONCLUSION

• Risk ranking assists in distribution of resources

• Useful when facilities are diverse

• Excellent tool for establishing baseline compliance program

• Approach needs periodic validation
CANADIAN NUCLEAR SAFETY COMMISSION

More information at website:
http://www.nuclearsafety.gc.ca
RISK LEVELS / RANKING

Using expert judgment:

• A risk level of Low, Moderate or High was assigned for each facility (or group of similar facilities) for each risk area using the pre-determined risk factors

• Comparisons were made among all the facilities within the same risk level (and in a risk area) to rank them from 3 to 1 level

Using knowledge of past performance:

• A performance rate was assigned to each facility for each risk area using the pre-determined performance indicators