Risk Analysis in Transport of Radioactive Material

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Transport risk

- Regulations result in high degree of safety, proven by outstanding safety record
- Regulatory tests were not developed using formal risk analysis approaches
- Risk analysis is a relatively recent add-on:
  - A1/A2, Q system
  - radionuclide specific exemption values

Risk Analysis

- Risk analysis starts with asking
  - What can happen
  - How likely is it
  - What are the consequences
- Transport Risk
  - Incident free and accident risk
  - Radiological and nonradiological risk
- Not required by TS-R-1, but can be a good practice and useful tool

Risk Analysis can:

- Put the relationship between the regulatory requirements and real-world situations in context
- Show equivalent safety for routine, unique shipments, or special arrangements
- Help inform decisions on complex technical issues (routing, response preparations)
- Help communicate with the public

Risk Analysis Limitations

- Uncertainty of input values, results are estimates
- Users must be highly trained
- Tendency to focus on comparing/ranking risk estimates, rather than on the overall small magnitude of risk
- Several ways to report results
  - per shipment, per year, per campaign, etc
  - Need benchmarks, comparison points
  - Population versus individual dose
- Can be overly conservative
- Does not consider societal/perceived risk

Input variables/assumptions

- Shipment information
- Radiological, physical, chemical characteristics of contents
- Physical characteristics of packaging and conveyance
- Routing data, population density
- Traffic accident frequencies
- Release fractions and severity fractions

Software & Studies

- Available Software: Intertran2, RADTRAN5, RISKIND
- Past generic studies in U.S. - NUREG-0170, Modal Study, Reexamination study
- Risk of maritime transport - IAEA TECDOC 1231
- Facility environmental reviews

Conclusion

- There is a large and growing amount of experience in risk assessment of radioactive material transport
- Risk analyses have affirmed the high levels of safety provided by following TS-R-1
- Risk analysis is a strong tool for evaluating transport decisions and regulatory changes
- Ongoing review and refinement of risk analyses approaches as technologies improve supports strong safety