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Design of a reliable multi-modal multi-commodity model for hazardous materials transportation under uncertainty

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Highlights:

- We provide models for hazardous material transportation network under uncertainty
- Disruptions at hubs and re-allocating non-hub nodes to backup hubs are considered
- We propose a queuing system at hubs to analyze and decrease disruption probability
- Our models minimize the total risk exposed to the population of the regional areas
- We provide an approximate lower bound approach to find near optimal solutions

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