

Stakeholder Tool for Assessing Radioactive Transportation (START)

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Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (Standard Contract) (10 CFR Part 961).

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Terminology

GIS = Geographic Information Systems; collection of data and software used to organize and analyze spatial data

Layer = data that can be presented in geospatial context with x, y, and/or z coordinates. Can be vector (point, line, polygon) or raster (gridded) Examples relative to START include:

- <u>rail network layer</u> adds the line features representing the US rail network to the base map
- <u>nuclear power plant layer</u> adds the point features representing the locations of nuclear power plants to the base map
- <u>Tribal area</u>- polygon layer of boundaries
- Population data

Buffer = area bounding a point or line







What is START?

DOE Office of Integrated Waste Management's web-GIS transportation decision-support tool developed to enable <u>visualization</u> and <u>analysis</u> of geospatial data relevant to planning and operating large-scale spent nuclear fuel and high-level radioactive waste transport to storage and/or disposal facilities.





START Features & Functions

Feature/Function	START	Feature/Function	START	
Program Access &	Yes	Buffer Zones	800 Meters, 2500 Meters	
Protection		Route Analysis Outputs	Summary, Detailed	
User Guide & Feedback Mechanism	Yes	Batch Processing	Yes	
Geographic Coverage	nic Coverage Continental U.S. Reporting Formats	Reporting Formats	Total Route, State, Tribal Land, County, Congressional District, Military Bases	
Transport Modes	Highway, Rail, Waterway, Intermodal		State Legislative Districts	
Base Maps	36 options	Export Capability	Reports, Shapefile, csv, kml	
Data Layers & Attributes 58 layers		Smart Mapping	Spatial Statistics, Filtering, Thematic	
	Attributes Included Within Each Layer	Route Sharing	Yes	
Origin/Destination Selection	Drop-Down Menus, User-Defined	Photographic Features	Yes	
Routing Criteria	Distance, Travel Time, Population Exposure	Measurement Tools	Area, Distance, Map Coordinates, Elevation	
Routing Constraints Ability to Avoid Locations Ability to Require Shipment to Pass Through Locations		Radiological Exposure	Dose from SNF Transport	



Radiological Estimates From Incident-Free Transportation

- Collective population dose
 - Average effective dose to an individual within a population multiplied by the number of individuals receiving dose.
 - Three population groups considered:
 - 1) people located in proximity to the shipment route (off-link public)
 - 2) people utilizing the transportation network on the shipment route (on-link public)
 - 3) the transport crew
- Maximally exposed individual (MEI)
 - Based on the distance to the cask, external dose rate from the cask, and time spent near the cask.



Radiological Exposure From Transportation Accidents

- Accident Scenarios
 - Transportation cask does not incur loss of containment or shielding
 - Shielding function of the cask is reduced
 - Cask incurs a loss of containment
- Source for modeling accident scenarios and results is Spent Fuel Transportation Risk Assessment, published by the U.S. Nuclear Regulatory Commission (NRC, NUREG 2125)





START GIS Data Layers

Shipment origin and transfer points: Potential transload sites, Nuclear reactors, Shutdown sites, DOE and other facilities	Emergency response assets: Fire departments, TEPP trained personnel, Police, Hospitals, State EOCs, Advance notification designees	Mass gathering places: Theme parks and zoos, Casinos, Performing arts centers, Stadiums and arenas, Malls, National monuments/icons, Places of worship, Airports
Educational and elderly care <u>facilities:</u> Schools, Colleges/Universities, Day care centers, Nursing homes	Transportation infrastructure and operations:Rail network, freight stations, junctions, crossings, yards, bridges, tunnels Highway: network, bridgesNavigable waterway network, locks/dams, water terminals, Coast Guard Districts, Captain of Port Zones	<u>Existing Routes:</u> Highway Hazmat Route Registry DOE WIPP Highway Routes U.S. Navy Spent Fuel Rail Routes
Environmental land uses: Parks, National forests, Federal lands, Military bases, Hazard threat urban areas, Surface water	Political jurisdictions: Tribal lands, Congressional Districts, States, State legislative districts, Counties, City limits, Urban areas	<u>Other :</u> Social vulnerability index, Transportation infrastructure photos

The availability and utilization of such an extensive array of geospatial information provides a rich platform for assessment and communication.



Program Utilization

Routing Options & Characteristics

• Rail, highway, waterway, intermodal

Training Preparations Along DOE Transport Routes

- Fire & police stations, hospitals
- DOE TEPP* trained personnel

Communications

• Visualize transportation networks relative to nuclear plants and DOE sites

Environmental Analyses

Transportation dose estimates

Integration With Systems Analysis (NGSAM)

- Routes & travel times
- Fleet requirements
- Facility throughput

*Transportation Emergency Preparedness Program (TEPP)



start.energy.gov



Stakeholder Tool for Assessing Radioactive Transportation, 3.3



Base Map Options

Select a Basemap





Labels



Dark Gray Canvas



Canvas





Terrain with Geographic

Labels

Map



USA Topo Maps



USA Population Density





Landscan Day Population

Landscan Night Population









No Basemap

Routing Analysis Options



Stops (Optional)	
Add Stop	Clear Stops
Barriers (Optional)	
Add Barrier	Clear Barriers
Criteria	Full Full Fall
Minimum	Travel Time
Minimur	n Distance
Minimum	Population
75% Travel Time	e & 25% Population
50% Travel Time	e & 50% Population
25% Travel Time	e & 75% Population
Buffer Distance	
800 Meters	s 🔵 2500 Meters
Preferred Carrier	
None	
Prohibited Carrier	
Select	



Routing Options & Characteristics: Alternative Rail Routes Using Different Criteria





Route Evaluation Results

Routing Criteria
Buffer Distance
Result:
Total Distance
Total Travel Time
Accident Likelihood (per mile)
Water Crossings
Average Track Class
Avg Rail Traffic Density
Average Population Density
Total Population (within buffer)
Mass Gathering Places
Tribal Lands
Sensitive Environmental Areas
Tunnels
Emergency Response Capability (per
mile)
Educational Institutions
Special Age Groups
Railroad Crossings (at grade)

Min. Travel Time	
800 Meters	
1608.04 miles	
2132.6 minutes	
0.000000451	
142	
3.9	
5	
389.1	
590047 persons	
1019	
0 square miles	
183.8 square miles	
2	
0.21	
336	
473	
1620	

Min. Population		
800 Meters		
1775.10 miles		
2935.7 minutes		
0.000001065		
147		
3.5		
3.8		
202.6		
323740 persons		
730		
3.58 square miles		
147.48 square miles		
5		
0.16		
238		
282		
1460		

Min. Travel Time		
(through Tulsa)		
800 Meters		
1609.38 miles		
2217.7 minutes		
0.000005		
121		
3.9		
4.9		
308.2		
462304 persons		
904		
203.43 square miles		
166.14 square miles		
3		
0.21		
285		
449		
1645		



Training Preparations Along Routes

- Identify equipment and personnel available to support a response
- Consider expected response times to reach incident scene
- Determine gaps in coverage along route where additional radiological emergency response training may be needed



Characteristics of Fire Department in Proximity to Potential Rail Route **Concentration of TEPP Responders**

TEPP Responder Coverage within

60 Minutes of Base Location

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Communication: Building Stakeholder Awareness

- Supports communication and information exchange in an inclusive, transparent and customized manner.
- Example use case
 - START used to identify and assess possible transportation modes & routes proximate to shipment origins.
 - Shipment origins may be located in areas where transportation infrastructure has clearance (size/weight) limitations, refurbishment needs, and/or regulatory route restrictions.



Barge Pier at the Port of Kewaunee

Rail Line Near Kewaunee

Low Clearance Bridge Near Big Rock Point



Example Consent-Based Siting Questions

- What does a consolidated interim storage facility (CISF) land use footprint look like?
- Are images available to help visualize the landscape around a particular location?
- What emergency response assets exist in proximity to my community?
- What gathering places are located in the vicinity?
- Do socially vulnerable populations reside in the area?
- Where are the locations of sensitive environmental lands?



CISF Reference Concept – Site Plan

CISF site



Midwest Radioactive Materials Transportation Committee, Oct. 12, 2022

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What does a consolidated interim storage facility (CISF) land use footprint look like (i.e., 14.25 sq km)?





Are images available to help visualize the landscape around a particular location? START Photograph (left) and Google Street Views (right) of Rail Line and Truck Access



Photolog of Rail Line



Google Street View of Truck Access to Rail Line



What emergency response assets exist in proximity to a community? Proximity to Police Precincts, Fire Stations and Hospitals to Example Location





What gathering places are located in the vicinity? Schools & Places of Worship Near Example Location





Do socially vulnerable populations reside in the area? Social Vulnerability Index for Counties Proximate to Where Example Location is Situated





Where are the locations of sensitive environmental lands? Environmental Land Uses in Proximity to Example Location





* Example routes and locations are for illustrative purposes only and do not reflect a selected destination site.

Questions?



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