Community Readiness Assessment Framework for Transportation (CRAFT) for Spent Fuel by Rail

SOUTHWEST RESEARCH INSTITUTE®

Amy Minor and Osvaldo Pensado

Midwestern Radioactive Materials Transportation Committee (MRMTC) Meeting at the National Transportation Stakeholders Forum May 25, 2023



ADVANCED SCIENCE. APPLIED TECHNOLOGY.







Project Background

- Interest in SNF transportation and stakeholder focus
- WIEB project thru DOE-NE cooperative agreement funding Fall 2021
 - Identified indicators, developed indicator weights and grade system
 - Developed an executable tool using Excel
- Internal R&D improvements completed Feb. 2022
 - Automated half of the indicators using Visual Basic for Applications
 - Reviewed indicators, weights, and grades for U.S.
- WIEB case study (Salt Lake City, UT) completed March 2022
- CSG-Midwest benchmarking and ground-truthing work started Jan. 2023
- WIEB ground-truthing work planned FY23







Framework Overview

A community-focused decision framework that incorporates various community descriptors that identify and characterize preparedness along SNF transportation routes.

- Based on experience with stakeholder concerns
- Does not replace or duplicate other performance-based tools
- Facilitates:
 - Targeted decision-making
 - **Resource** allocation
 - Communication strategies



Framework Indicators

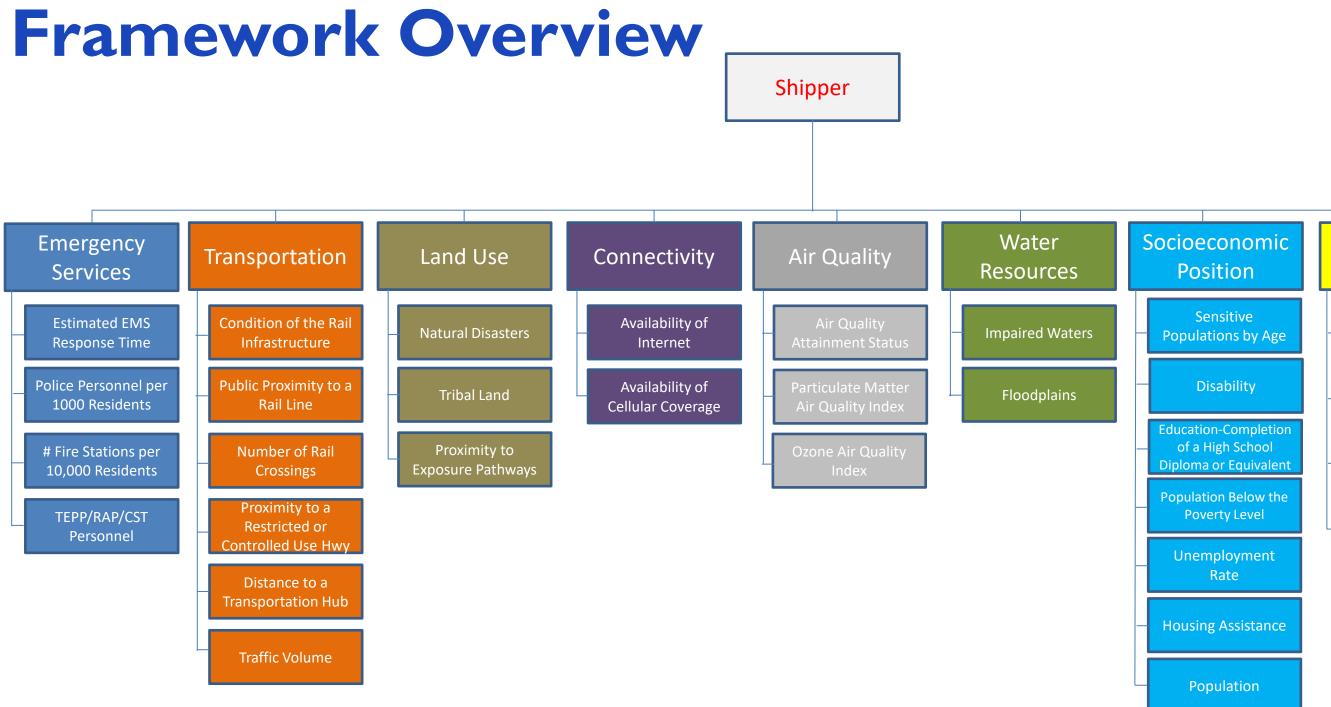
Preparedness (e.g., Emergency Services)

ADVANCED SCIENCE. APPLIED TECHNOLOGY.



Vulnerability

(e.g., Proximity to Exposure Pathways)



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

Minority Status and Languages

Minority Population

Racial Diversity Index

English Proficiency

Percentage of Households that Speak Spanish

Category	Indicator	Question	Clear All Answer	Grade	Veight			
w	Estimated EMS Response Time	Time analysis based on population? # of Police Officers per How many police officers are there per 1,000 residents?		2	4	1.5		
ervice	# of Police Officers per 1,000 Residents			5	3	4.5		
Emergency Services	# of Fire Stations per 10,000 Residents	According to the Homeland Infrastructure Foundation- Level Data (HIFLD) Fire Station Database, how many fire stations per 10,000 residents are within the area of	0.8 - 2	2	3	1.7		
Emen	Transportation Emergency Preparedness Program (TEPP), DOE Radiological Assistance Program (RAP)	Are there Transportation Emergency Preparedness Programs (TEPP) or DOE Radiological Assistance Programs (RAP) in the county?	No	1	3	Indicator ight Indicator 4 1.5 3 4.5 3 1.1 3 0.0 1 1.1 5 0.0 2 3.0 2 3.0 3 4.5 0.1 1.1 5 0.0 2 3.0 2 3.0 1 0.4 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 2 3.0 3 3.0 3 3.0 3 3.0 3		
	Condition of Rail Infrastructure	What grade has the ASCE's Infrastructure Report Card given the state's rail infrastructure?	в	4	1	1.1		
	Public Proximity to a Rail Line	At the nearest point, how far is the public to the SNF transportation route?	≤ 12 ft	1	5	0.0		
tation	Proximity to Restricted or Controlled Use Highway	At the nearest point, how far is the SNF transportation route from restricted or controlled use highways?	> 5 miles	5	2	3.0		
Transportation	# of Rail Crossings	How many at-grade rail crossings (i.e., where the rail crosses a road at the same elevation) does the SNF transportation route have in the area of analysis?	≥5	1	2	0.0		
-	Distance to Transportation Hub	How far is the population center of the area of analysis from a transportation hub?	> 0.25 miles	5	3	4.5		
	Traffic Volume	What is the highest average annual daily traffic value for the area of analysis?	AADT≤ 10,000	5	2	3.0		
	Natural Disasters	How many natural disasters have there been in the area of analysis in the last 20 years?	3	2	1	0.4		
Land Use	Tribal Land	How far are Tribal lands from the area of analysis?	Distance > 10 miles	5	2	3.0		
Ĩ	Proximity to Exposure Pathways	How many potential environmental exposure pathways (e.g., Superfund sites, landfills) are located within 3 miles of the area of analysis?	<5	5	2	3.0		
Connectivity	Availability of Internet What percentage of households in the area of analysis 50 - 74%				2	2.2		
Connecting	Availability of Cellular Coverage	What percentage of the area of analysis has cellular network coverage?	75 - 100%	5	2	3.0		
≿	Air Quality Attainment Status	Is the air quality in the area of analysis in attainment or not in attainment?	In Attainment	5	2	3.0		
Air Quality	Particulate Matter Air Quality Index	Compared to other U.S. locations, what is the ambient level for Particulate Matter (PM2.5), presented as a percentile, in the area of analysis?	< 60 %ile	5	2	3.0		
	Ozone Air Quality Index	Compared to other U.S. locations, what is the ambient level for ozone, presented as a percentile, in the area of	80-90 %ile	3	2	1.5		
Water	Impaired Waters	Are there Clean Water Act 303(d) impaired waters within the area of analysis?	303(d) segments present	1	2	0.0		
Resources	Floodplains	Does a 100-year or 500-year floodplain intersect with the SNF transportation route?	Within 100-yr Floodplain	1	3	0.0		

Lowest Contributors



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

Highest Contributors



The Total Framework Score

- Total framework score is the sum of weighted indicator grades
- On a scale of 0 100
- 100 indicates high preparedness/low vulnerability





ADVANCED SCIENCE. APPLIED TECHNOLOGY.

100

High Preparedness/ Low Vulnerability

swri.org

6

CSG-Midwest Benchmarking Purpose

- Provide context and meaning for individual site scores to identify representative variability within a region
- Identify indicators potentially requiring scaling or weighting adjustments to achieve a better representation of community characteristics











Summary of Benchmarking Outcomes

- CSG-Midwest benchmarking work started in January 2023
 - 24 Midwest cities
 - All but 2 cities have Class I rail lines
 - Rural vs urban / near vs away from reactor
- Findings
 - Total scores exhibit S-shaped cumulative distribution
 - Benchmarking identified the importance of individual indicators to the total city scores and city rankings
 - Importance of indicator categories to the total score rankings



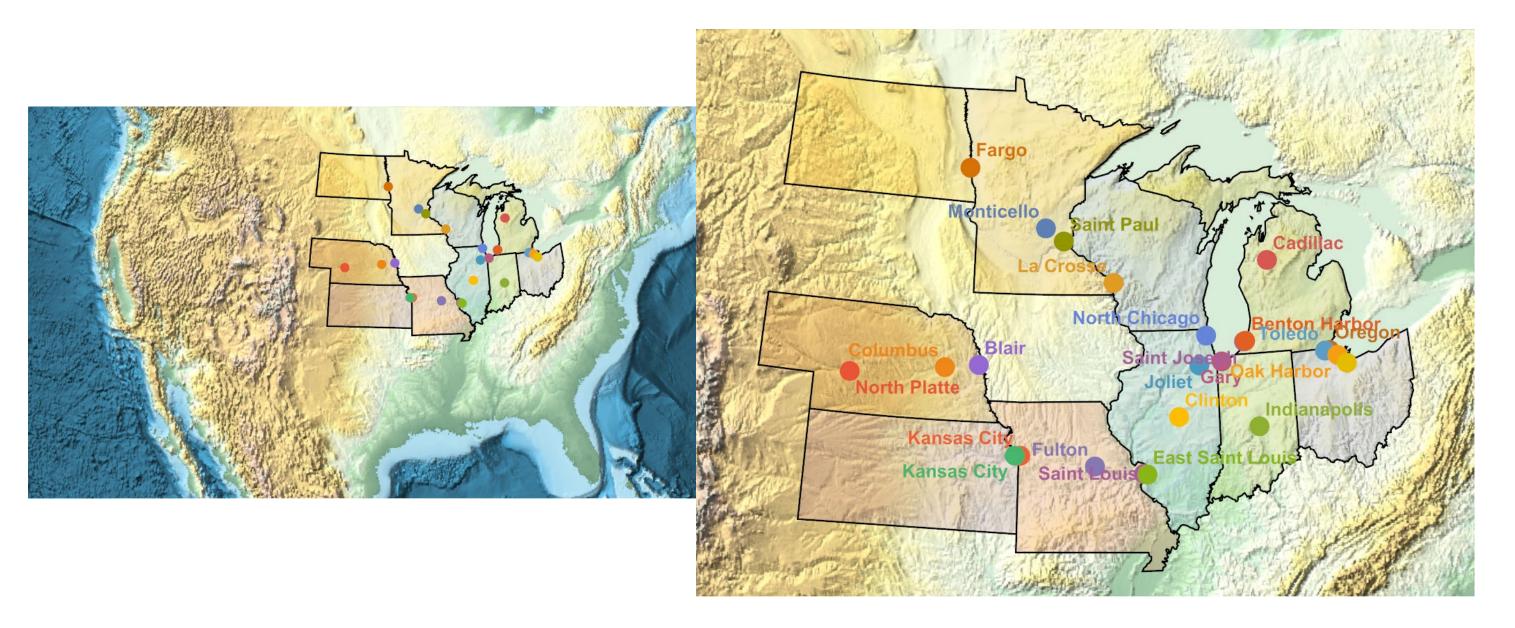
ADVANCED SCIENCE. APPLIED TECHNOLOGY.







Midwest Cities Analyzed

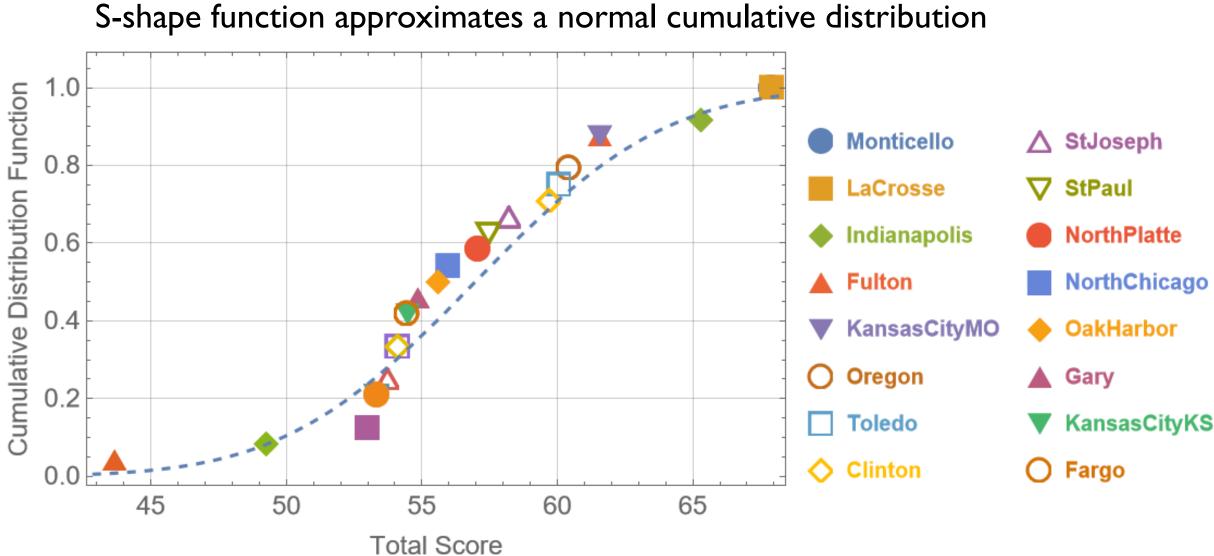




ADVANCED SCIENCE. APPLIED TECHNOLOGY.

©SOUTHWEST RESEARCH INSTITUTE



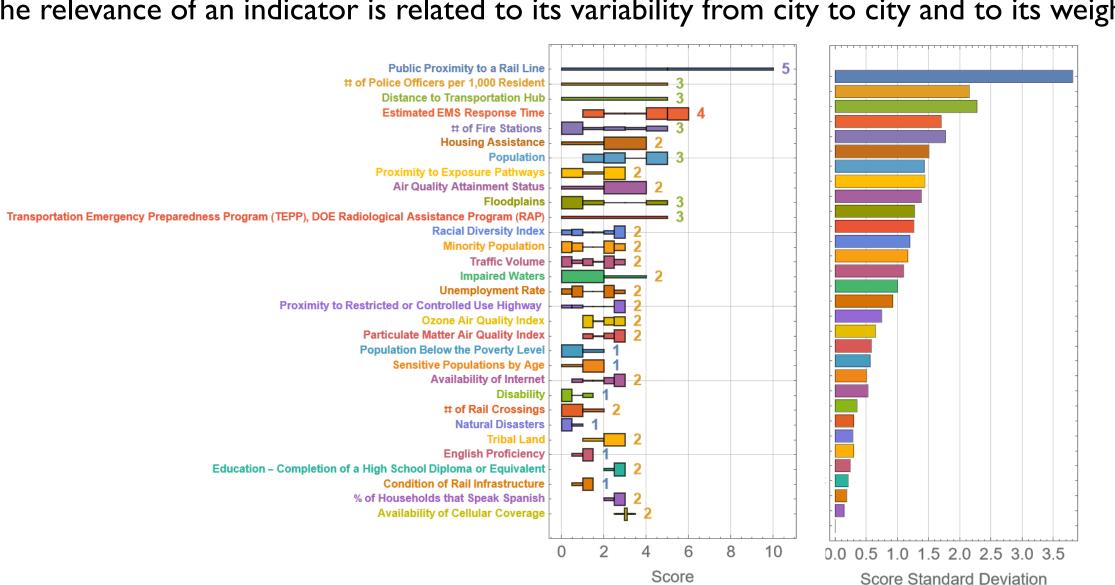


©SOUTHWEST RESEARCH INSTITUTE

ADVANCED SCIENCE. APPLIED TECHNOLOGY.

10

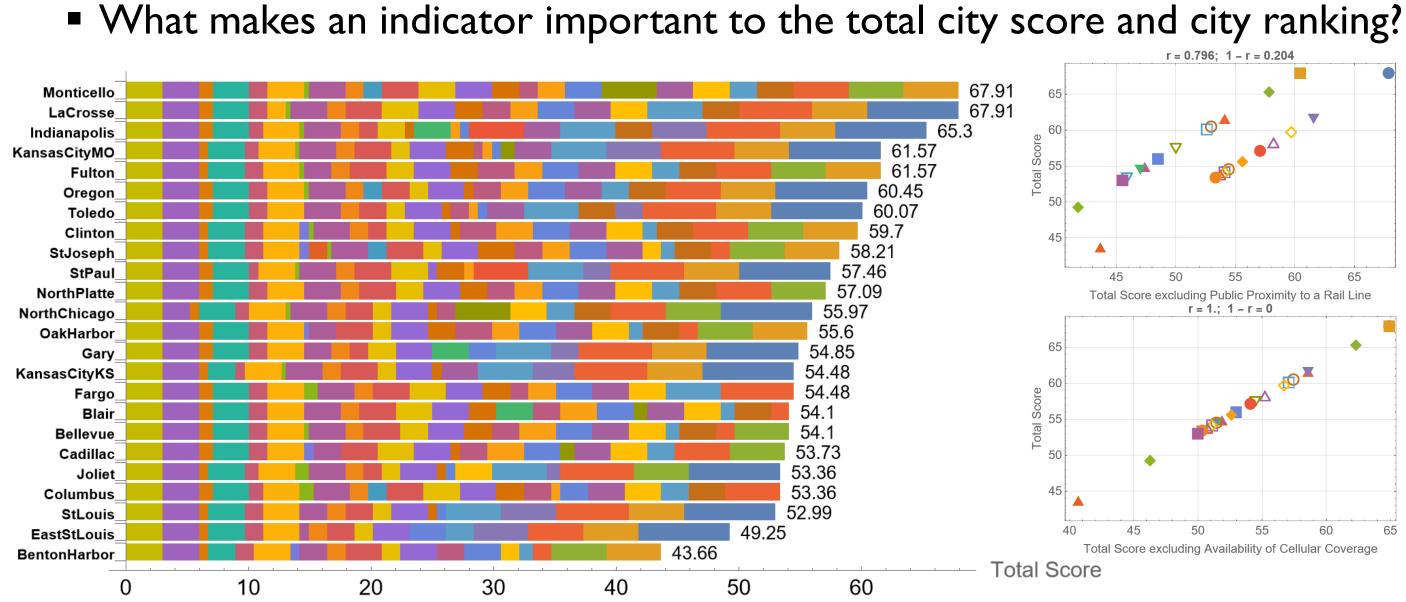
The relevance of an indicator is related to its variability from city to city and to its weight





ADVANCED SCIENCE. APPLIED TECHNOLOGY.

11

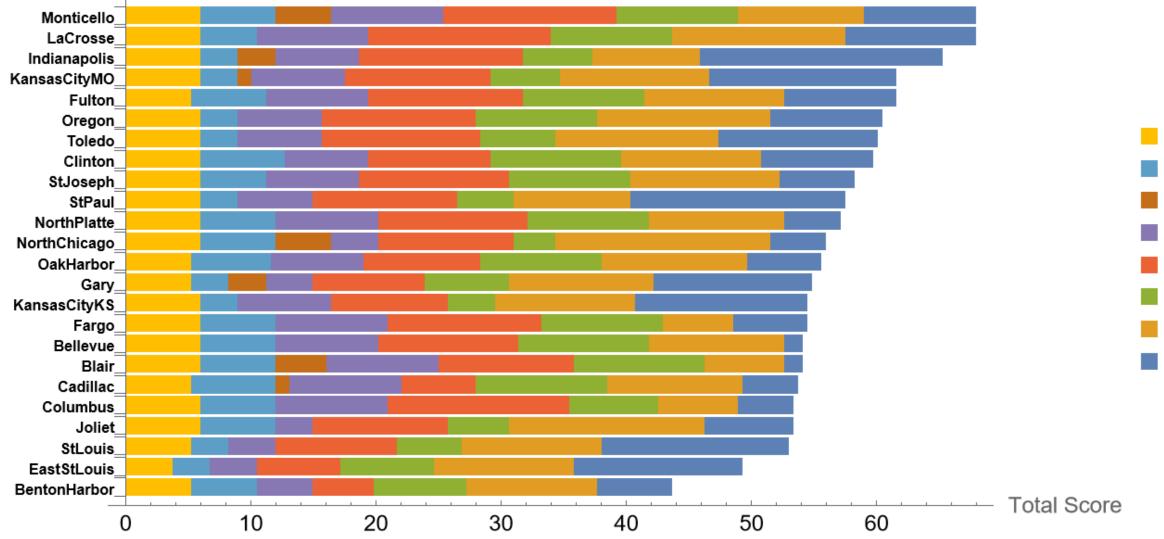




ADVANCED SCIENCE. APPLIED TECHNOLOGY.

12

Initial importance of indicator categories from lowest (left) to highest (right)





ADVANCED SCIENCE. APPLIED TECHNOLOGY.

Connectivity Land Use Water Resources Air Quality Socioeconomic Position Minority Status and Languages Transportation Emergency Services

13

Recent Framework Adjustments

- Revised executable Excel tool to display each indicator score that sums to the total city score
- Clarified terminology (e.g., using "grade" instead of "scale")
- Normalized # of Fire Stations per10,000 residents
- Changed the sources for 2 air quality indicators to provide more consistent data and to better discretize the results
- Revised the grading for Traffic Volume and English Proficiency indicators to better discretize the results





14

Next Phase

- Conduct and gather results from a small group meeting and roundtable discussion with community leaders
 - Ground-truth the framework and gain confidence in the framework characterization of the location
 - Discuss whether adjustments to the framework tool would be warranted
 - Discuss regional specificity or city specificity of adjustments
 - Revise framework tool and re-run the results
 - Develop final report



swri.org

15





 \bullet

 \bullet

- Miriam Juckett
- Kristin Ulmer

Contacts Amy Minor Aminor@swri.org 210.522.5750

Osvaldo Pensado Opensado@swri.org 210.522.6084



CSG Midwest with special thanks to Mitch Arvidson





Backup Slides



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

©SOUTHWEST RESEARCH INSTITUTE



17

Example Framework Run

	A	В	c	D	E	F	н
1	Category	Indicator	Question	Answer	Grade	Veight	Score
		Estimated EMS Response	What is the estimated EMS response time in the area of	Pop. > 50,000 (< 8	5	4	20
4	Time # of Police Officers per 1,000		analusis based on population?	min)			
5	a vici	Resident	How many police officers are there per 1,000 residents?	≥ 1.8	5	3	15
6	Emergency Services	# of Fire Stations	According to the Homeland Infrastructure Foundation-Level Data (HIFLD) Fire Station Database, how many fire stations are within the area of analysis?	≥ 26	5	3	15
7	Energ	Transportation Emergency Preparedness Program (TEPP), DOE Radiological Assistance Program (RAP)	Are there Transportation Emergency Preparedness Programs (TEPP) or DOE Radiological Assistance Programs (RAP) in the county?	No	1	3	3
		Condition of Rail	What grade has the ASCE's Infrastructure Report Card given	с	3	1	3
\$		Infrastructure	the state's rail infrastructure?	-			-
		Public Proximity to a Rail	At the nearest point, how far is the public to the SNF	> 12 ft	5	5	25
9	_	Line	transportation route?	=	-	-	
	ţi	Proximity to Restricted or	At the nearest point, how far is the SNF transportation route	> 5 miles	5	2	10
10	uta I	Controlled Use Highway	from restricted or controlled use highways?				
11	[ransportation	# of Rail Crossings	How many at-grade rail crossings (i.e., where the rail crosses a road at the same elevation) does the SNF transportation route have in the area of analysis?	≥5	1	2	2
12		Distance to Transportation Hub	How far is the population center of the area of analysis from a transportation hub?	≤ 0.25 miles	1	3	3
13		Traffic Volume	What is the highest average annual daily traffic value for the area of analysis?	AADT > 75,000	1	2	2
14		Natural Disasters	How many natural disasters have there been in the area of analysis in the last 20 years?	≥ 4	1	1	1
15	and Use	Tribal Land	How far are Tribal lands from the area of analysis?	Distance > 10 miles	5	2	10
16	Ĩ	Proximity to Exposure Pathways	How many potential environmental exposure pathways (e.g., Superfund sites, landfills) are located within 3 miles of the area of analysis?	> 50	1	2	2
17	Connectivity	Availability of Internet	What percentage of households in the area of analysis have broadband internet?	50 - 74%	4	2	8
18	- San Country	Availability of Cellular Coverage	What percentage of the area of analysis has cellular network coverage?	75 - 100%	5	2	10

St. Louis, Missouri (Urban Away)

		Air Quality Attainment	Is the air quality in the area of analysis in attainment or not in	Non-Attainment	1	2	2
19	>	Status	attainment?	Toon-Presentiene		-	-
	Ë	Particulate Matter Air	Compared to other U.S. locations, what is the ambient level				
	ā		for Particulate Matter (PM2.5), presented as a percentile, in	60-80 %ile	4	2	8
20	Air Quality	Quality Index	the area of analysis?				
	~	Ozone Air Quality Index	Compared to other U.S. locations, what is the ambient level	80-90 %ile	3	2	e
21		Ozone Ali Quality index	for ozone, presented as a percentile, in the area of analysis?	00-30 /vile	3	2	0
		Impaired Waters	Are there Clean Water Act 303(d) impaired waters within the	303(d) segments	1	2	2
22	Water	impaired waters	area of analysis?	present	1	2	2
	Resources	Floodplains	Does a 100-year or 500-year floodplain intersect with the SNF	Within 100-yr		2	2
23		Piooopiains	transportation route?	Floodplain		3	3
		Sensitive Populations by	What percentage of the population in the area of analysis are	≤ 30%	5	1	Б
24		Age	under the age of 5 or over 65?	\$ 30%	9	'	5
		Disabilitu	What percentage of the population in the area of analysis are	> 15%	1	1	1
25	E		disabled?	2.1025		· ·	
	Socioeconomic Position	Education - Completion of a	What percentage of the population age 18 and over in the				
	õ	High School Diploma or	area of analysis have at least a high school diploma or	> 80%	5	2	10
26	.9	Equivalent					
	E	Population Below the	What percentage of the population in the area of analysis live	> 10%	1	1	1
27	ĕ	Poverty Level	in povertų?	/ 10/1		· ·	
	8	Unemployment Rate	What percentage of the population in the area of analysis are	5.1 - 10%	2	2	A
28	-8-	onemplogment hate	unemployed?	0.141024	2	-	Ŧ
	S	Housing Assistance	Does the area of analysis qualify for low-income housing tax	Yes	1	2	2
29		r lodsing Assistance	credit (LIHTC)?	165		-	-
		Population	What is the population in the area of analysis?	> 50,000	5	3	15
30		r opdiation					
	2	Minority Population	What percentage of the population in the area of analysis are	> 50%	1	2	2
31		· ·····	racial minorities?				
	a tri	Racial Diversity Index	What is the Census Bureau's Racial Diversity Index for the	55.0 - 64.9%	2	2	4
32	E Sa		area of analysis?				
	Minority Status and Languages	English Proficiency	What percentage of the population in the area of analysis	95-100%	5	1	5
33	15 2	· ·	over age 5 speak English very well (i.e., are proficient in				Ť
	Ξ	% of Households that Speak	What percentage of the population in the area of analysis	≤ 25%	5	2	10
34	~	Spanish	over the age of 5 speak Spanish?	2 C VI	Ů	-	
35			Overall Framework Score				53



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

18

Indicator Grades

a for Point Confinement Programs (DAP) Hew many point configers are there per 1,000 residences 2 1.8 Provide Configuration Provided Prov		А	В	С	L	М	N	0	
Image: Model of the section Description Section Section <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>Grade</td><td></td><td></td></th<>							Grade		
2 0 <th></th> <th></th> <th>Indicator</th> <th>Question</th> <th></th> <th></th> <th>Crute</th> <th></th> <th></th>			Indicator	Question			Crute		
2 0 <th>1</th> <th></th> <th></th> <th></th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th></th>	1				5	4	3	2	
2 8 9		<u>}</u>				Pop. 10.000-50.000 (8 -		Pop. 2.500-10.000 (15.1	-
2 1 <td>2</td> <td>ences</td> <td>Estimated EMS Response Time</td> <td>What is the estimated EMS response time?</td> <td>Pop. > 50,000 (< 8 mins)</td> <td></td> <td></td> <td></td> <td>Pop <</td>	2	ences	Estimated EMS Response Time	What is the estimated EMS response time?	Pop. > 50,000 (< 8 mins)				Pop <
2 1 <td></td> <td>erv</td> <td># of Police Officers per 1,000</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		erv	# of Police Officers per 1,000						
4 a a b	з	Fo	Resident	How many police officers are there per 1,000 residents?	≥ 1.8				< 1.8
grad Transportation Emergency Are there Transportation Emergency Preparedness Radiological Assistance Program, (TEPP) or DOE Radiological Assistance No 5 S Condition of Rail Infrastructure Report Card Are there Transportation Emergency Prepared Ress No No 6 Condition of Rail Infrastructure Report Card B C D E 7 Public Proximity to a Rail Une Proximity to Restricted or Controlled Use Highway The neerest point, how far is the SNF transportation route from restricted or controlled use highways? > 12 ft		u a		According to the Homeland Infrastructure Foundation-					
grad Transportation Emergency Are there Transportation Emergency Preparedness Radiological Assistance Program, (TEPP) or DOE Radiological Assistance No 5 S Condition of Rail Infrastructure Report Card Are there Transportation Emergency Prepared Ress No No 6 Condition of Rail Infrastructure Report Card B C D E 7 Public Proximity to a Rail Une Proximity to Restricted or Controlled Use Highway The neerest point, how far is the SNF transportation route from restricted or controlled use highways? > 12 ft		- Š		Level Data (HIFLD) Fire Station Database, how many fire					
grad Transportation Emergency Are there Transportation Emergency Preparedness Radiological Assistance Program, (TEPP) or DOE Radiological Assistance No 5 S Condition of Rail Infrastructure Report Card Are there Transportation Emergency Prepared Ress No No 6 Condition of Rail Infrastructure Report Card B C D E 7 Public Proximity to a Rail Une Proximity to Restricted or Controlled Use Highway The neerest point, how far is the SNF transportation route from restricted or controlled use highways? > 12 ft	4	Ser	# of Fire Stations Within 25 miles	stations are within the area of analysis?	2 26	20-25	14 - 19	8-13	≤7
$\frac{1}{2} = 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0$		5	Transportation Emergency						
$\frac{1}{2} = 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0$		50	Preparedness Program, DOE	Are there Transportation Emergency Preparedness					
$\frac{1}{2} = 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0$		ner	Radiological Assistance Program,	Programs (TEPP) or DOE Radiological Assistance					
6 Vertice Condition of Rail Infrastructure given the state's rail infrastructure? A B C D E 7 Atthe nearest point, how far is the public to the SNF Image: Simple Sim	5	ш	or Civil Support Team Personnel	Programs (RAP) in the county?	Yes				No
7 Atthe nearest point, how far is the public to the SNF > 12 ft </td <td></td> <td></td> <td></td> <td>What grade has the ASCE's Infrastructure Report Card</td> <td></td> <td></td> <td></td> <td></td> <td></td>				What grade has the ASCE's Infrastructure Report Card					
7 B Public Proximity to Ratil Line transportation route? > 12 ft	6		Condition of Rail Infrastructure	given the state's rail infrastructure?	A	В	С	D	E
8 Proximity to Restricted or crute from restricted or controlled use highway? >5 miles <				At the nearest point, how far is the public to the SNF					
10 How far is the population center of the area of analysis from a transportation hub? >0.25 miles <	7		Public Proximity to a Rail Line	transportation route?	> 12 ft				<12 f
10 How far is the population center of the area of analysis from a transportation hub? >0.25 miles <		6	Proximity to Restricted or	At the nearest point, how far is the SNF transportation					
10 How far is the population center of the area of analysis from a transportation hub? >0.25 miles <	8	E .	Controlled Use Highway	route from restricted or controlled use highways?	> 5 miles			≤5 miles	Inters
10 How far is the population center of the area of analysis from a transportation hub? >0.25 miles <		201		How many at-grade rail crossings (i.e., where the rail					
10 How far is the population center of the area of analysis from a transportation hub? >0.25 miles <		ls le		crosses a road at the same elevation) does the SNF					
10 Ustance to Transportation Hub from a transportation hub? >0.25 miles Image: Comparison of Comparison of Comparison of Comparison of Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient >0.25 miles Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient Image: Compared to other U.S. locations, what is the ambient	9	Ĕ	# of Rail Crossings	transportation route have in the area of analysis?	0		<5		≥5
Image: Natural Disasters What is the highest average annual daily traffic value for the area of analysis? AADT \$ 10,000 < AADT \$ 25,000 < AADT \$ 50,000 < AADT \$ 50,000 < AADT \$ 75,000 AADT \$ 10,000 < AADT \$ 25,000 < AADT \$ 50,000 < AADT \$ 75,000 AADT \$ 10,000 < AADT \$ 25,000 < AADT \$ 50,000 < AADT \$ 75,000 AADT \$ 10,000 < AADT \$ 25,000 < AADT \$ 50,000 < AADT \$ 75,000 AADT \$ 10,000 < AADT \$ 25,000 AADT \$ 10,000 < AADT \$ 25,000 AADT \$ 10,000 < AADT \$ 50,000 < AADT \$ 75,000 AADT \$ 10,000 < AADT \$ 25,000 AADT \$ 10,000 < AADT \$ 25,000 AADT \$ 10,000 < AADT \$ 50,000 AADT \$ 10,000 AADT \$ 10,000 <th< td=""><td></td><td></td><td></td><td>How far is the population center of the area of analysis</td><td></td><td></td><td></td><td></td><td></td></th<>				How far is the population center of the area of analysis					
11 Image: Connectivity of Cellular Coverage: network cov	10		Distance to Transportation Hub	from a transportation hub?	> 0.25 miles				≤ 0.25
12 Natural Disasters How many natural disasters have there been in the area of analysis in the last 20 years? 0 1 2 3 24 13 Natural Disasters of analysis in the last 20 years? 0 1 2 3 24 14 How far are Tribal lands from the area of analysis? Distance >10 miles Distance >3 miles 0 miles 14 Proximity to Exposure Pathways miles of the area of analysis? <5				What is the highest average annual daily traffic value for	•				
12 Natural Disasters of analysis in the last 20 years? 0 1 2 3 24 13 Tribal Land How far are Tribal lands from the area of analysis? Distance >10 miles Distance ≤3 miles 0 miles 14 How many potential environmental exposure pathways (e.g., Superfund sites, landfills) are located within 3 S 5 15 15 - 30 30 - 50 > 50 14 Proximity to Exposure Pathways miles of the area of analysis? <5	11		Traffic Volume		AADT ≤ 10,000	10,000 < AADT ≤ 25,000	25,000 < AADT ≤ 50,000	50,000 < AADT ≤ 75,000	AADT
13 13 13 14 How far are Tribal lands from the area of analysis? Distance > 10 miles Distance < 3 miles On 14 How many potential environmental exposure pathways (e.g., Superfund sites, landfills) are located within 3 5 5 - 15 15 - 30 30 - 50 > 50 15 Connectivity Availability of Internet have broadband internet? 75 - 100% 50 - 74% 25 - 49% <25				How many natural disasters have there been in the area	ſ				
Image: Proximity to Exposure Pathways How many potential environmental exposure pathways < 5 5 - 15 15 - 30 30 - 50 > 50 14 Proximity to Exposure Pathways miles of the area of analysis? < 5	12	8	Natural Disasters	of analysis in the last 20 years?	0	1	2	3	≥ 4
14 Proximity to Exposure Pathways miles of the area of analysis? <5 5-15 15-30 30-50 >50 15 Connectivity Availability of Internet have broadband internet? 75 - 100% 50 - 74% 25 - 49% <25	13	Ď,	Tribal Land	How far are Tribal lands from the area of analysis?	Distance > 10 miles		Distance ≤3 miles		On Tr
14 Proximity to Exposure Pathways miles of the area of analysis? <5 5-15 15-30 30-50 >50 15 Connectivity Availability of Internet have broadband internet? 75 - 100% 50 - 74% 25 - 49% <25		u de							
15 Connectivity Availability of Internet What percentage of households in the area of analysis have broadband internet? 75 - 100% 50 - 74% 25 - 49% <25 16 Availability of Cellular Coverage What percentage of the area of analysis has cellular network coverage? 75 - 100% 50 - 74% 25 - 49% <25		_							
15 Availability of Internet have broadband internet? 75 - 100% 50 - 74% 25 - 49% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40% 26 - 40%	14		Proximity to Exposure Pathways		< 5	5 - 15	15 - 30	30 - 50	> 50
Connectivity What percentage of the area of analysis has cellular network coverage? 75 - 100% 50 - 74% 25 - 49% <25 16 Availability of Cellular Coverage Is the air quality in the area of analysis in attainment or not in attainment? In Attainment In Attainment 25 - 49% <25									
16 Availability of Cellular Coverage What percentage of the area of analysis has cellular network coverage? 75 - 100% 50 - 74% 25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <25 - 49% <26 - 40% <26 - 40% In Attainment of in attainment	15	Connectivity	Availability of Internet		75 - 100%	50-74%		25 - 49%	< 25%
17 Air Quality Attainment Status Is the air quality in the area of analysis in attainment or not in attainment? In Attainment In Attainment Non 18 Image: State Sta		,							
17 Air Quality Attainment Status not in attainment? In Attainment In Attainment Nor 18 18 12 Air Quality Attainment Status not in attainment? In Attainment 60 - 80 %ile 80 - 90 %ile 90 - 95 %ile 90 - 95 %ile 95 - 95 %ile 18 18 10 Compared to other U.S. locations, what is the ambient level for Particulate Matter (PM2.5), presented as a percentile, in the area of analysis? <60 %ile	16		Availability of Cellular Coverage		75 - 100%	50 - 74%		25 - 49%	< 259
18 Compared to other U.S. locations, what is the ambient level for Particulate Matter (PM2.5), presented as a percentile, in the area of analysis? 60 % ile 60 - 80 % ile 80 - 90 % ile 90 - 95 % ile 95 - 95 % ile									
18 Index percentile, in the area of analysis? < 60 %ile 60 - 80 %ile 80 - 90 %ile 90 - 95 %ile 95 - Compared to other U.S. locations, what is the ambient Compared to other U.S. locations, what is the ambien	17	~	Air Quality Attainment Status		In Attainment				Non-/
18 Index percentile, in the area of analysis? < 60 %ile 60 - 80 %ile 80 - 90 %ile 90 - 95 %ile 95 - Compared to other U.S. locations, what is the ambient Compared to other U.S. locations, what is the ambien		alit							
18 Index percentile, in the area of analysis? < 60 % ile 60 - 80 % ile 80 - 90 % ile 90 - 95 % ile 95 - Compared to other U.S. locations, what is the ambient <		ð							
	18	Air	Index		< 60 %ile	60 - 80 %ile	80 - 90 %ile	90 - 95 %ile	95 - 1
19 Ozone Air Quality Index level for ozone, presented as a percentile, in the area of < 60 %ile 60 - 80 %ile 80 - 90 %ile 90 - 95 %ile 95 -									
	19		Ozone Air Quality Index	level for ozone, presented as a percentile, in the area of	< 60 %ile	60 - 80 %ile	80 - 90 %ile	90 - 95 %ile	95 - 1



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

Р
1
< 2,5000 (> 60 mins)
В
? ft
rsects
25 miles
T > 75,000
Tribal Land
)
;%
596
Attainment
100 %ile
100 %ile

19

Indicator Grades

	А	В	С	L	М	N	0	P
1		Indicator	Question	5	4	Grade 3	2	1
20	Water	Impaired Waters	Are there impaired waters within the area of analysis?	No 303(d) segments				303(d) segments present
21	Resources	Floodplains	Does a 100-year or 500-year floodplain intersect with the SNF transportation route?	No Floodplain			500-yr Floodplain	100-yr Floodplain
22		Sensitive Populations by Age	What percentage of the population in the area of analysis are under the age of 5 and over 65?	≤30%				>30%
23	Lo Lo	Disability	What percentage of the population in the area of analysis are disabled?	< 5%	5 - 10.9%		11-14.9%	>15%
24	mic Position	Education - Completion of a High School Diploma or Equivalent	What percentage of the population age 18 and over in the area of analysis have at least a high school diploma or equivalent?	>80%	60 - 80%		40 - 59%	< 40%
25	ouo	Population Below the Poverty Level	What percentage of the population in the area of analysis live in poverty?	≤10%				>10%
26	ō	Unemployment Rate	What percentage of the population in the area of analysis are unemployed?	≤3%	3.1-5%		5.1-10%	>10%
27		Housing Assistance	Does the area of analysis qualify for low-income housing tax credit (LIHTC)?	No				Yes
28 29	and	Population Minority Population	What is the population in the area of analysis? What percentage of the population in the area of analysis are racial minorities?	> 50,000 ≤ 10%	30,000 - 50,000	10,000 - 30,000	2,500 - 10,000 20.1 - 50%	<2,500 >50%
30		Racial Diversity Index	What is the Census Bureau's Racial Diversity Index of the area of analysis?	< 35.0%	35.0 - 44.9%	45.0-54.9%	55.0-64.9%	≥ 65.0 %
	Minority Status Languages		What percentage of the population in the area of analysis over age 5 speak English very well (i.e., are					
31	i și	English Proficiency	proficient in English)?	95 - 100%	85 - 95%	75-85%	50-75%	< 50%
32	2	% of Households that Speak Spanish	What percentage of the population in the area of analysis over the age of 5 speak Spanish?	≤25%	25.1-50%		50.1-75%	>75%



ADVANCED SCIENCE. APPLIED TECHNOLOGY.

20

Indicator Sources

Indicator	Data Source
Estimated EMS Response Time	Census Bureau population Table B01001
	Federal Bureau of Investigation Crime Data Explorer
# <u>of</u> Police Officers per 1,000 Residents	website https://crime-data-
	explorer.app.cloud.gov/pages/le/pe
	Homeland Infrastructure Foundation-Level Data (HIFLD)
# of Fire Stations per 10,000 Residents	Fire Station Database
	https://www.epa.gov/enviroatlas/enviroatlas-
	interactive-map
Transportation Emergency Preparedness	TEPP: https://teppinfo.com/24-hour-emergency-
Program (TEPP), DOE Radiological	contacts
Assistance Program (RAP)	DOE RAP: <u>https://remm.hhs.gov/RAP.htm</u>
	CTS: manual online search
	American Society of Civil Engineer's (ASCE's)
Condition of Rail Infrastructure	Infrastructure Report Card
	https://infrastructurereportcard.org/state-by-state-
	infrastructure/
	requirements for Type B packaging are addressed in 49
Public Proximity to a Rail Line	Code of Federal Regulation (CFR) 173.411, 49 CFR
	173.413, and 10 CFR Part 71
	National Hazardous Materials Route Registry
Proximity to Restricted or Controlled Use	https://www.fmcsa.dot.gov/regulations/hazardous-
Highway	materials/national-hazardous-materials-route-registry-
	state
# <u>of</u> Rail Crossings	EnviroAtlas FRA Highway Rail Grade Crossing" layer
Distance to Transportation Hub	Manual map search
Traffic Volume	general search of the AADT values in your area of
	analysis
Natural Disasters	https://www.fema.gov/data-visualization/disaster-
	declarations-states-and-counties
Tribal Land	EnviroAtlas "Federal American Indian Reservations"
	layer



ADVANCED SCIENCE. APPLIED TECHNOLOGY.



21

Indicator Sources

Indicator	Data Source
Proximity to Exposure Pathways	 EnviroAtlas FAC - ACRES Brownfields (EPA) EPA Facility Registry Service – RCRA Hazardous Waste Treatment, Storage, and Disposal (RCRA_TSD) Superfund National Priorities List (NPL) Sites with Status Information
Availability of Internet	Census Table DP02
Availability of Cellular Coverage	EnviroAtlas "FCC Form 477 4G LTE Dead Zones" layer
Air Quality Attainment Status	EPA Criteria Pollutant Nonattainment Summary https://www3.epa.gov/airquality/greenbook/ancl3.html
Particulate Matter Air Quality Index	https://ejscreen.epa.gov/mapper/ (Source: EPA Office of Air and Radiation
Ozone Air Quality Index	https://ejscreen.epa.gov/mapper/ (Source: EPA Office of Air and Radiation
Impaired Waters	EPA How's My Waterway https://mywaterway.epa.gov/
Floodplains	FEMA's website https://msc.fema.gov/portal/home
Sensitive Populations by Age	Census Table S0101
Disability	Census Table DP02
Education - Completion of a High School Diploma or Equivalent	Census Table S1501
Population Below the Poverty Level	Census Table DP03
Unemployment Rate	Census Table DP03
Housing Assistance	Department of Housing and Urban Development (HUD). https://hudgis- hud.opendata.arcgis.com/datasets/HUD::qualified- census-tracts/about
Population	Census Table B01001
Minority Population	Census Table B03002
Racial Diversity Index	Census Table B03002
English Proficiency	Census Table DP02
% of Households that Speak Spanish	Census Table DP02



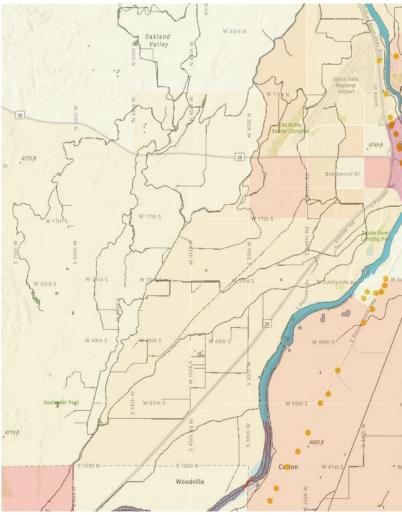
ADVANCED SCIENCE. APPLIED TECHNOLOGY.



22

Future Development Opportunities

- Aggregate data versus communityspecific information
 - Example: capture additional minority populations
- Utilizing the processing power and mapping capabilities of GIS programs
 - Improve readability and visualization of the decision framework
 - Ability to grade indicators over a gradient
 - Incorporation of climate change considerations





23

Future Development Opportunities

- Could be further customized as a complement to already existing decision frameworks or tools used by both Federal and State agencies
- Tool concept could be adapted for other purposes such as other hazardous materials
- Framework indicators could be adjusted for road transport instead of rail





ADVANCED SCIENCE. APPLIED TECHNOLOGY.

24